PREPARED FOR THE CITIZENS OF COLORADO AND ITS VISITORS
BY COLORADO PARKS AND WILDLIFE

# State Wildlife Action Plan

A STRATEGY FOR CONSERVING WILDLIFE IN COLORADO





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# Foreword

United States laws and policies place primary responsibility for wildlife management in the hands of the states. The states have a lengthy record of success in conserving species, including those that are hunted or fished and those that are not. In Colorado, these successes have been paid for by a variety of sources, including lottery proceeds distributed by Great Outdoors Colorado, the Species Conservation Trust Fund, and federal dollars. Development of partnerships has added to the efficiency of conservation success. It is no surprise that the task of conserving **all** species will take more than traditional funding sources and single agency action.

The State Wildlife Grants program (*Title IX, Public Law 106-553 and Title 1, Public Law 107-63*), created through federal legislation, is meant to help close the funding gap by providing federal aid to states to secure the status of Species of Greatest Conservation Need. This State Wildlife Action Plan (SWAP) has been prepared in fulfillment of the requirements of that legislation.

Beyond those requirements is a more fundamental goal for this strategy, held by Colorado Parks and Wildlife and the state as a whole: to secure wildlife populations so that they do not require protection via federal or state listing regulations. This requires collaboration among a diverse set of agencies, interests, and citizens. CPW's Species Conservation Program works in conjunction with our stakeholders, using the best available science to conserve Colorado's at-risk species and habitats. The SWAP is the roadmap for this collaboration.

Colorado's revised SWAP serves as a blueprint for conservation and provides a catalog on the status of our knowledge about native wildlife and plants (most of which are not commonly hunted or fished), threats to the habitats upon which they depend, and strategies to lessen, mitigate, or manage those threats. Thus, **Colorado's SWAP is comprehensive in scope and strategic in nature**. This SWAP reflects the data that currently exist for Colorado species and their habitats and the collective judgment of many of Colorado's scientists, as well as the interests and concerns of citizens with a stake in Colorado wildlife conservation.

Again, implementation of this plan is beyond the scope of a single agency. The issues addressed and the actions outlined in this plan cross political, jurisdictional, and ecological boundaries. Commitment, coordination and communication among the diverse and interested parties involved are critical to the collaborative success that the SWAP describes and aims to achieve. Developing the plan to achieve those goals is the first step, and this has been accomplished. Implementation is the next step and we look forward to this important and collaborative effort.

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# Chapter 1: Introduction

## Purpose of the SWAP

Historically, all fish and wildlife conservation in Colorado, and in the nation, was funded largely by sportsmen and women. Recently, funding for conservation of non-hunted species has been undertaken using non-traditional sources of funding to establish a reliable base. This funding comes from sources such as lottery proceeds distributed by Great Outdoors Colorado, the Species Conservation Trust Fund, federal aid dollars, and other sources. Species identified as federally threatened or endangered under the Endangered Species Act receive additional attention, but not necessarily adequate funding.

Recognizing that there has not been enough revenue at a national level available for conservation of all wildlife species, leaders in the conservation community sought to provide a new source of funding. Teaming with Wildlife, a diverse national coalition of conservationists, hunters, anglers, and conservation-minded agencies, organizations, and businesses lobbied for passage of the necessary national legislation for this new source of funding. The Commerce, Justice and State Appropriations Act of Fiscal Year 2001, Title IX, Public Law 106-553 created the Wildlife Conservation and Restoration Program (WCRP), designed to provide funding for the conservation needs of wildlife, as well as for education and wildlife-related recreation. The WCRP was only funded for one year. A second act, the Department of the Interior and Related Agencies Appropriations Act of 2002, Public Law 107-63, Title 1, created a State Wildlife Grants program (SWG), which provides annual funding for conservation of wildlife and wildlife habitats. The SWG requires that each state prepare and adopt a State Wildlife Action Plan (SWAP) to remain eligible for SWG funding. This SWAP meets Colorado's obligation under this law.

## Philosophy and Guiding Principles

Although development of Colorado's SWAP was coordinated by Colorado Parks and Wildlife (CPW), it is not simply a plan for that agency. Rather, it is a plan for all of Colorado. The task of conserving and managing Colorado's wildlife is too big for any one group or agency to achieve alone. This document identifies conservation priorities that can be used by everyone in Colorado as a guide for planning, partnership building, and project design.

The SWAP articulates a set of conservation priorities that considers an expansive array of wildlife from a statewide perspective. The purpose of this SWAP is to foster greater coordination between the conservation actions of CPW and other members of Colorado's wildlife

conservation community, thus enabling all partners to collectively meet the state's wildlife conservation needs. As such, this SWAP is designed to complement the substantial planning and active management programs that already exist in Colorado, and to support cooperation with adjacent states when such cooperation will result in range-wide conservation of species of greatest conservation need.

Colorado's SWAP is not a legal document, a regulatory document, a Recovery Plan under the Endangered Species Act (ESA), or a National Environmental Policy Act (NEPA) decision document. All parties should consider this guidance, along with other information, as they follow established public participation protocols and legal requirements when preparing decision documents and project proposals.

The guiding principles of this strategy are to:

1. Encourage and support conservation actions that meet the needs of Species of Greatest Conservation Need;
2. Manage for healthy habitats and ecosystems so that all species will benefit;
3. Create a strategy that will be flexible enough to incorporate new research findings and successful management innovations into conservation actions;
4. Acknowledge the pivotal role that private landowners and local stakeholders play in conservation;
5. Enhance, not replace, other planning efforts; and
6. Maintain an atmosphere of cooperation, participation, and commitment among wildlife managers, landowners, private and public land managers, and other stakeholders in development and implementation of conservation actions.

# Federal SWAP Requirements: The Eight Elements

Colorado's SWAP meets the requirements of guiding federal legislation. It is based on the best available information and identifies data gaps where they exist. It is, and will continue to be, the result of involving virtually all of Colorado's conservation agencies, organizations, and affected stakeholders.

The enabling legislation and regulations governing the SWG and related programs stipulate that a state's SWAP contain the following eight elements (referred to throughout the SWAP as "Element 1, Element 2, and so on):

1. **Information on the distribution and abundance of species of wildlife**, including low population and declining species that are indicative of the diversity and health of the state's wildlife;

2. Descriptions of **locations and relative condition of key habitats** and community types essential to conservation of species identified in (1);
3. **Descriptions of issues** that may adversely affect species identified in (1) or their habitats, **and priority research and survey efforts needed** to identify factors which may assist in restoration and improved conservation of these species and habitats;
4. Descriptions of **conservation actions** proposed to conserve the identified species and habitats and **priorities for implementing such actions**;
5. Proposed **strategies for monitoring species** identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions;
6. Descriptions of **procedures to review** the Wildlife Action Plan at intervals not to exceed 10 years;
7. Strategies for **coordinating** the development, implementation, review, and revision of the Wildlife Action Plan with federal, state, and local agencies and Native American tribes that manage significant land and water areas within Colorado or administer programs that significantly affect the conservation of identified species and habitats; and
8. Provisions to ensure **public participation** in the development, revision, and implementation of the Wildlife Action Plan, and associated projects and programs.

# Roadmap to the Eight Required Elements

The SWAP addresses the eight required elements using both species and habitat approaches. Table 1 lists the locations within the SWAP where information pertaining to each of the eight required elements may be found. Tables 7 and 8 identify cross-relationships between species and their habitats. Information pertaining to plants and invertebrate animals (with the exception of mollusks) can be found in Appendices A and B, respectively.

**Table 1. Locations of Required Elements in the SWAP.**

| Required Element | Location(s) |
|---|---|
| ***1 – Distribution and abundance of wildlife species*** | |
| a. sources of information | Chapter 2 |
| b. abundance and distribution | Chapter 2; Table 7 |
| c. low and declining populations | Chapter 2; Tables 3 & 7 |
| d. consideration of all major wildlife groups | Chapter 2; Appendices A & B |
| e. process for selecting SGCNs | Chapter 2; Table 2 |
| ***2 – Locations and conditions of key habitats*** | |
| a. level of detail | Chapter 3 |
| b. location, relative condition, and conservation actions needed | Chapter 3, Table 8; Chapter 8, Figures 17 - 19 |
| ***3 – Problems that may adversely affect species and habitats*** | |
| a. sources of information | Chapters 1, 5, and 6 |
| b. detailed threats | Chapter 4; Chapter 5, Table 7; Chapter 6, Table 8; Appendix F |
| c. threats relevant to species and habitats | Chapter 5, Table 7; Chapter 6, Table 8; Appendix F |
| d. research and survey efforts needed | Chapter 5, Table 7; Chapter 6, Table 8 |
| ***4 – Conservation actions that may conserve species and habitats, and priorities for implementing actions*** | |
| a. how conservation actions address threats | Chapter 4; Chapter 5, Table 7; Chapter 6, Table 8 |
| b. descriptions of conservation actions | Chapter 4; Appendix D |
| c. linking actions to objectives and indicators | Chapter 5, Table 7; Chapter 6, Table 8 |
| d. actions for partners | Chapter 5, Table 7; Chapter 6, Table 8 |
| e. research and survey efforts needed | Chapter 5, Table 7; Chapter 6, Table 8 |
| ***5 – Proposed plans for monitoring species and habitats*** | |
| a. plans for monitoring SGCN and habitats | Chapter 7; Appendices A & B |
| b. monitoring outcomes of conservation actions | Chapter 7; Appendices A & B |
| c. species not monitored | Chapter 7; Appendices A & B |
| d. monitoring at multiple levels | Chapter 7; Appendices A, B, & G |
| e. relationship to existing monitoring/survey systems and determining effectiveness of conservation actions | Chapter 7; Appendices A, B, & G |
| f. geographic scale | Chapter 7; Appendices A, B, & G |
| g. adaptive management | Chapter 7; Appendices A, B, & G |
| ***6 – Procedures to review the SWAP*** | |
| a. review process | Chapter 9 |
| ***7 – Coordination with other land management agencies*** | |
| a. involvement of federal, state, and local agencies and Indian tribes in development of SWAP | Chapter 9; Appendices H & I |
| b. continued involvement of agencies and tribes in implementation, review, and revision | Chapter 9 |
| ***8 – Public participation*** | |
| a. public involvement in development of SWAP | Chapter 1; Chapter 9; Appendices H & I |
| b. continued public involvement in implementation and revision | Chapter 9 |

# SWAP Development Process

Maximizing the quality, effectiveness, and efficiency of stakeholder participation was a primary consideration in establishing the methods used to prepare Colorado's 2015 SWAP. To this end, CPW created an online participation platform consisting of a web page[1] and a dedicated email. The process for revising each of the required elements with scientific content (the first five elements) in Colorado's 2006 SWAP involved the following steps:

1. Review of 2006 SWAP content by CPW and Colorado Natural Heritage Program (CNHP) biologists, and drafting of proposed revisions based on the most current information available;
2. Stakeholder review of draft revised chapter using dedicated online resources (webpage and email);
3. Final draft chapter prepared;
4. All stakeholder comments compiled along with CPW responses; and
5. All materials posted on CPW's SWAP webpage for public access.

Over 100 CPW staff were involved in the revision process, including Species Conservation Coordinators, Habitat Coordinators, GIS analysts, CPW Terrestrial and Aquatic biologists, and regional staff and representatives from CPW's Research, Real Estate, and Leadership Teams. Please refer to Chapter 9 of this document for a more detailed description of the agency coordination and the public participation process.

# Management and Legal Authorities

A diversity of state, federal, and county regulations offer protection to Colorado's species of greatest conservation need, and there are many management programs that support population and habitat conservation actions. More broadly, there is a diversity of entities that directly or indirectly manage or affect wildlife through their actions. The job of coordinating this diversity of managers is an important institutional determinant of success for Colorado's SWAP. That job falls to CPW. The following statutory authorities and policies provide necessary guidance for CPW in its role as the state's SWAP coordinator.

Colorado Parks and Wildlife, a branch of the Colorado Department of Natural Resources, has the statutory charge for managing and conserving wildlife resources within state borders, for hunted, fished, and non-game wildlife, including state-listed threatened and endangered species[2]. The

[1] http://cpw.state.co.us/aboutus/Pages/StateWildlifeActionPlan.aspx

[2] Colorado Revised Statutes, Title 33 Article 1-101 states: "It is the policy of the state of Colorado that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors. It is further declared to be the policy of this state that there shall be provided a comprehensive program designed to offer the greatest possible variety of wildlife-related recreational

U.S. Fish and Wildlife Service (USFWS) has management for the species that are protected under the federal Endangered Species Act.

The Colorado Parks and Wildlife Commission is embarking on a strategic planning process to guide CPW's efforts into the future. This new strategic plan will set a high level vision, overarching goals, and strategies for Colorado's state parks, wildlife and outdoor recreation resources. Following completion of the Commission's 2015 Strategic Plan, CPW will develop finer scale implementation plans to outline how agency goals will be achieved. The SWAP will help to guide the implementation of plans to achieve conservation goals for Colorado's Species of Greatest Conservation Need.

# Overview of Colorado Wildlife Species

Colorado's native species occur across our state's 103,000 square miles, including 480 square miles of waters. There are over 960 native species for which CPW has statutory authority, including mammals, birds, fish, reptiles, amphibians, mollusks, and crustaceans. Colorado is also home to many hundreds of plant and invertebrate animal species that fall outside of CPW's authority. Colorado manages wildlife at the species, subspecies, and population level, depending on various factors such as legal requirements, interagency coordination needs, stakeholder concerns, funding eligibility, national or international reporting conventions, and/or taxonomic determinations through scientific documentation. Colorado also manages assemblages of species and the array of habitats important to them (i.e., ecosystem management).

opportunity to the people of this state and its visitors and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities." Title 33 Article 2-102 states, "The general assembly finds and declares that it is the policy of this state to manage all nongame wildlife, recognizing the private property rights of individual property owners, for human enjoyment and welfare, for scientific purposes, and to insure their perpetuation as members of ecosystems; that species or subspecies of wildlife indigenous to this state which may be found to be endangered or threatened within the state should be accorded protection in order to maintain and enhance their numbers to the extent possible; that this state should assist in the protection of species or subspecies of wildlife which are deemed to be endangered or threatened elsewhere; and that adequate funding be made available to the division annually by appropriations from the general fund."

# Chapter 2: Species of Greatest Conservation Need

This chapter presents updated information on wildlife species that are in need of conservation attention in Colorado, with a focus on native species. Colorado's first SWAP, completed in 2006, identified 210 Species of Greatest Conservation Need (SGCN). Those species were grouped into Tier 1 and Tier 2 categories, reflecting a relative degree of conservation priority. Conservation attention is still warranted for the species on the original SGCN list. However, the utility of such a long Tier 1 species list for prioritizing conservation work over the intervening years has been somewhat confounding. Thus, a primary focus of the SGCN component in this SWAP revision has been to improve the SWAP's usefulness for conservation prioritization, while continuing to recognize the broader interests and capacity of Colorado's conservation community overall. To that end, we have re-defined how we are characterizing Tier 1 and Tier 2 SGCN, and modified the criteria used to determine Tier 1 and Tier 2 status.

Also, in the interest of improving the SWAP's applicability across Colorado's conservation community, we have added a rare plant component to the plan, and retained and expanded the insect component of the SGCN list. Though CPW does not have statutory authority over plant and insect species, we recognize the crucial role these taxa play in the ecosystems and wildlife communities of the State. SWAP elements for plants and non-mollusk invertebrates are presented in Appendices A and B, respectively.

## Revised Interpretation of Tier 1 and Tier 2

Although the 2015 revision of Colorado's SWAP retains the original two-tier SGCN structure, **we have re-interpreted the Tier 1 list to represent the species which are truly of highest conservation priority in the state,** and to which CPW will likely focus resources over the life of this plan. Though the agency will certainly maintain flexibility in responding to evolving conservation needs and scientific knowledge, our best current estimate of how our work will probably be focused over the coming decade is reflected in the new Tier 1 list of 55 species. All other previously Tier 1 SGCN have been moved to the Tier 2 list, with one exception. Recent genetic studies indicate that the subspecies designation for northern pocket gopher (*Thomomys talpoides macrotis*) is not valid. Thus, this subspecies has been removed from the SGCN list. Tier 2 species remain important in light of forestalling population trends or habitat conditions that may lead to a threatened or endangered listing status, but the urgency of such action has been judged to be less. When planning future conservation work, these tier rankings should be considered along with other important factors, including potential funding and partnership

opportunities, and responsiveness to "one-time-only" opportunities. It is our hope and expectation that our conservation partners and stakeholders will work together toward conservation of all SGCN, including those on the Tier 2 list. As an agency, we remain committed to improving the status of all SGCN, and welcome collaborative efforts to do so.

## Revised SGCN Criteria

For this iteration of our SWAP, we have expanded the criteria that were used to develop the original SGCN list[3], which were primarily focused on species' conservation status. Those criteria were retained and augmented by further consideration of the species' role in Colorado wildlife communities, as well as our ability to make a measurable contribution to conservation of species populations, according to the criteria listed in Table 2. In distinguishing Tier 1 and Tier 2 species in the original SWAP, we developed an additional set of sub-criteria that placed more emphasis on economic considerations[4]. Due to the revised interpretation of Tier 1 status, some of these criteria were deemed to be of less importance in the revised SWAP. The remaining criteria have been absorbed into the updated criteria in Table 2.

[3] Listed as federal candidate, threatened or endangered species under the ESA; Classified as state endangered or threatened species, or species of special concern; Global ranking scores of G1, G2 or G3 by the Colorado Natural Heritage Program; Identified as conservation priorities through a range-wide status assessment or assessment of large taxonomic divisions; Assigned state ranking scores of S1 or S2 AND a global ranking score of G4 by the Colorado Natural Heritage Program. Species were removed from the list if they: occur peripherally in Colorado but are common elsewhere AND for which management actions in Colorado are likely to have no population-level effect; are very common but were placed on lists due to economic considerations (e.g., Mallard).

[4] Knowledge of management techniques needed for recovery; Impact on federal recovery; Cost of recovery or management action implementation; Direct cost of recovery action to others; Public appeal or interest in the species; Economic impacts of listing (cost incurred by listing); Importance to state biological diversity; Multiple species benefits from management of target species.

**Table 2. Criteria used to revise the list of Tier 1 Species of Greatest Conservation Need.**

| |
|---|
| **1) Federal and State Status** |
| a) Listed or proposed as endangered at federal or state level |
| b) Listed or proposed as threatened at federal or state level |
| c) Other indication of special concern at federal or state level |
| **2) Colorado's contribution to the species overall conservation (portion of overall range that occurs in Colorado)** |
| a) The health of the population in Colorado compared to other portions of its range (better = higher) |
| b) Population status and level of conservation activity in surrounding states and other portions of the species range |
| c) Level of conservation activity in Colorado relative to its status in the state |
| **3) Urgency of conservation action:** |
| a) New threats to the species |
| b) Lack of Scientific Knowledge |
| c) Increases in severity of existing threats or new data that show a significant, persistent decline in population status |
| d) Likelihood and immediacy of potential ESA listing |
| e) Funding or partnership opportunities that are time limited |
| **4) Ability to Implement Effective Conservation Actions:** |
| a) Few regulatory issues present to impede conservation success |
| b) Limitations in mitigating population and/or habitat threats are minimal (i.e., conservation success is highly likely) |
| c) Cost to implement effective conservation |
| d) Socio-political factors (general willingness to support conservation of the species) |
| **5) Ecological Value of the species:** |
| a) Species is a good indicator to the overall health of the habitat it occupies |
| b) Keystone species – plays a significant role in defining the habitat in which it lives |
| c) Umbrella species – protecting these species indirectly protects the many other species that make up the ecological community used by the species |

# Updated SGCN List

The 2015 SGCN list of vertebrate animals and mollusks– the groups for which CPW has statutory authority – contains 159 species (Table 3). Fifty-five species have been identified as Tier 1 SGCN, including 2 amphibians, 13 birds, 25 fish, 13 mammals, and 2 reptiles (Table 3). Of these, all were on the Tier 1 SGCN list in 2006 with the following exceptions: White-tailed ptarmigan[5] and wolverine were previously Tier 2; plains topminnow, little brown bat, New Mexico meadow jumping mouse, and American pika were not SGCN in 2006. Conservation opportunity, Colorado's contribution to conservation, and changes in conservation status are all partially explanatory in these changes.

[5] The 2006 SWAP listed white-tailed ptarmigan as a SGCN at the species level. This 2015 SWAP lists the subspecies Southern white-tailed ptarmigan, based on the USFWS recognition of the Colorado population of white-tailed ptarmigan as a separate subspecies.

The revised Tier 2 SGCN list of vertebrates and mollusks contains 104 species, including 8 amphibians, 48 birds, 2 fish, 23 mammals, 14 reptiles, and 9 mollusks. Of the Tier 2 species, 10 vertebrates and one mollusk were not identified as SGCN in 2006. The pygmy rabbit was not a SGCN in 2006 because at that time the species had not been reported in Colorado. Recent evidence suggests that this species may be present in northwestern Colorado. The following species were not SGCN in 2006, but have been added to the 2015 Tier 2 list due to designation as a Sensitive Species by the Bureau of Land Management and/or the U.S. Forest Service: Great Basin spadefoot, black tern, grasshopper sparrow, Rocky Mountain capshell, American marten, big free-tailed bat, hoary bat, pygmy shrew, desert spiny lizard, and milksnake. Thirty bird species have been removed from the SGCN list. This change is not a result of change in species status, but rather is due to the revisions of the criteria used to define SGCN.

There are four species on the SGCN list that no longer occur as wild populations in Colorado: bison, gray wolf, grizzly bear, and wolverine. These species were historically part of Colorado's native animal community, and would meet the criteria for SGCN if they were to re-colonize or be re-introduced to the state during the time period covered by this plan. There are no plans to re-introduce wolves or grizzly bears to the state, but it is possible that wolverine and/or genetically pure, wild bison could be re-introduced if social and political concerns can be satisfactorily addressed and such efforts are biologically justified.

## Status and Trend

The status of each vertebrate and mollusk SGCN is summarized in Table 3. The lists generated by the U.S. Fish and Wildlife Service, U.S. Forest Service, Bureau of Land Management, State of Colorado, Colorado Natural Heritage Program, and NatureServe all use species status in some form to develop their respective lists. We did not develop a new metric that specifically evaluated species status within Colorado, but rather used the lists generated by these other organizations to inform our evaluation of species status.

A species' population trend is also used by other organizations in the development of their lists, but we do consider it as a separate factor here (Table 3, Declining Trend column). Both data from studies as well as best professional judgments were used to determine declining trend. Data were found in recovery plans, status assessments, and both published and unpublished reports. For landbirds we relied heavily upon the Partners in Flight Species Assessment Database (PIF Science Committee 2012) to evaluate trends on a continental scale.

**Table 3. Vertebrate and Mollusk Species of Greatest Conservation Need.**

Species are grouped by Tier and taxonomic group, and then sorted alphabetically by common name. Legend: Federal Listing: LE – listed Endangered; LT – listed Threatened; LT* - listed Threatened status applies to Distinct Population Segment only; C – Candidate; P – Petitioned; N - Not Warranted. State Listing: SE – state endangered; ST – state threatened; SC – Special Concern. Agency Sensitive: BLM – Bureau of Land Management; USFS – U.S. Forest Service; USFWS - U.S. Fish and Wildlife Service Birds of Conservation Concern for Bird Conservation Regions 16 and 18. NatureServe Global/State Status: 1 – critically imperiled; 2 – imperiled; 3 – vulnerable; 4 – apparently secure, but with cause for long-term concern; 5 – demonstrably secure; T – subspecies status; Q – taxonomic uncertainty; B – breeding; N – non-breeding; NR – not ranked; X - extirpated. Species mark with a double-asterisk (**) were added as habitat indicator species.

| *Species* | Common Name | Priority Tier | Federal Status | State Status | USFS Sensitive Species | BLM Sensitive Species | USFWS Birds of Conservation Concern | PIF US-Canada Watch List | CO's Contribution to Conservation | Urgency of Conservation Action | Ability to Implement Effective Conservation Actions | Ecological Value of the Species | NatureServe Global Status Rank | CNHP/NatureServe State Status Rank | Declining Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AMPHIBIANS** | | | | | | | | | | | | | | | |
| *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain population) | Tier 1 | P | SE | x | x | | | x | x | | x | G4T1 | S1 | |
| *Lithobates pipiens* | Northern leopard frog | Tier 1 | | SC | x | x | | | | | | x | G5 | S3 | ? |
| **BIRDS** | | | | | | | | | | | | | | | |
| *Leucosticte australis* | Brown-capped rosy-finch | Tier 1 | | | | | x | x | | | | x | G4 | S3B,S4N | |
| *Athene cunicularia* | Burrowing owl | Tier 1 | | ST | x | x | x | | | | | x | G4 | S4B | |
| *Tympanuchus phasianellus columbianus* | Columbian sharp-tailed grouse | Tier 1 | | SC | x | x | | | | x | x | x | G4T3 | S2 | |
| *Aquila chrysaetos* | Golden eagle | Tier 1 | | | | | x | | | x | | x | G5 | S3S4B, S4N | |
| *Centrocercus urophasianus* | Greater sage-grouse | Tier 1 | C | SC | x | x | | x | | x | x | x | G3G4 | S4 | |
| *Grus canadensis tabida* | Greater sandhill crane | Tier 1 | | SC | | | | | | | | | G5T4 | S2B,S4N | x |
| *Centrocercus minimus* | Gunnison sage-grouse | Tier 1 | LT | SC | | x | x | x | x | x | x | x | G1 | S1 | |
| *Tympanuchus pallidicinctus* | Lesser prairie-chicken | Tier 1 | LT | ST | | x | x | x | | | x | x | G3 | S2 | |

| *Species* | Common Name | Priority Tier | Federal Status | State Status | USFS Sensitive Species | BLM Sensitive Species | USFWS Birds of Conservation Concern | PIF US-Canada Watch List | CO's Contribution to Conservation | Urgency of Conservation Action | Ability to Implement Effective Conservation Actions | Ecological Value of the Species | NatureServe Global Status Rank | CNHP/NatureServe State Status Rank | Declining Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Charadrius montanus* | Mountain plover | Tier 1 | | SC | x | x | x | | | | | | G3 | S2B | |
| *Tympanuchus phasianellus jamesii* | Plains sharp-tailed grouse | Tier 1 | | SE | | | | | | | | | G4T4 | S1 | |
| *Lagopus leucura altipetens* | Southern white-tailed ptarmigan | Tier 1 | P | | x | | | | | | | x | G5 | S4 | |
| *Empidonax traillii extimus* | Southwestern willow flycatcher | Tier 1 | LE | SE | | | x | | | | | | G5T1T2 | SNA | |
| *Coccyzus americanus occidentalis* | Western yellow-billed cuckoo | Tier 1 | LT* | SC | x | x | x | | | x | | | G5T3Q | S1B | |
| **FISH** | | | | | | | | | | | | | | | |
| *Etheostoma cragini* | Arkansas darter | Tier 1 | C | ST | | x | | | | | | | G3G4 | S2 | |
| *Catostomus discobolus* | Bluehead sucker | Tier 1 | | | x | x | | | x | x | | x | G4 | S4 | |
| *Gila elegans* | Bonytail chub | Tier 1 | LE | SE | | | | | x | x | | | G1 | SX | |
| *Hybognathus hankinsoni* | Brassy minnow | Tier 1 | | ST | | | | | | | | x | G5 | S3 | |
| *Ptychocheilus lucius* | Colorado pikeminnow | Tier 1 | LE | ST | | | | | x | x | | x | G1 | S1 | x |
| *Oncorhynchus clarkii pleuriticus* | Colorado River cutthroat trout | Tier 1 | | SC | x | x | | | | | | x | G4T3 | S3 | |
| *Luxilus cornutus* | Common shiner | Tier 1 | | ST | | | | | | | | | G5 | S2 | |
| *Catostomus latipinnis* | Flannelmouth sucker | Tier 1 | | | x | x | | | x | x | | x | G3G4 | S3 | |
| *Platygobio gracilus* | Flathead chub | Tier 1 | | SC | x | | | | | | | | G5 | S3 | |
| *Oncorhynchus clarkii stomias* | Greenback cutthroat trout | Tier 1 | LT | ST | | | | | x | | | x | G4T2T3 | S2 | |
| *Gila cypha* | Humpback chub | Tier 1 | LE | ST | | | | | | x | | | G1 | S1 | x |
| *Catostomus playtrhynchus* | Mountain sucker | Tier 1 | | SC | x | x | | | | | | | G5 | S2 | |
| *Phoxinus eos* | Northern redbelly dace | Tier 1 | | SE | x | | | | | | x | | G5 | S1 | |
| *Lepomis humilis* | Orangespotted sunfish | Tier 1 | | | | | | | | | x | | G5 | S5 | x |

| *Species* | Common Name | Priority Tier | Federal Status | State Status | USFS Sensitive Species | BLM Sensitive Species | USFWS Birds of Conservation Concern | PIF US-Canada Watch List | CO's Contribution to Conservation | Urgency of Conservation Action | Ability to Implement Effective Conservation Actions | Ecological Value of the Species | NatureServe Global Status Rank | CNHP/NatureServe State Status Rank | Declining Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Etheostoma spectabile* | Orangethroat darter | Tier 1 | | SC | | | | | | | | | G5 | S3 | x |
| *Hybognathus placitus* | Plains minnow | Tier 1 | | SE | x | | | | | | | x | G4 | SH | |
| *Fundulus sciadicus* | Plains topminnow | Tier 1 | | | x | | | | | | | | G4 | S4 | |
| *Xyrauchen texanus* | Razorback sucker | Tier 1 | LE | SE | | | | | x | x | | x | G1 | S1 | |
| *Gila Pandora* | Rio Grande chub | Tier 1 | | SC | x | x | | | | | | | G3 | S1 | |
| *Oncorhynchus clarkii virginalis* | Rio Grande cutthroat trout | Tier 1 | N | SC | x | x | | | x | | | x | G4T3 | S3 | |
| *Catostomus plebeius* | Rio Grande sucker | Tier 1 | | SE | x | x | | | | | | | G3G4 | S1 | |
| *Gila robusta* | Roundtail chub | Tier 1 | | SC | x | x | | | x | x | | x | G3 | S2 | x |
| *Phoxinus erythrogaster* | Southern redbelly dace | Tier 1 | | SE | x | | | | | | x | | G5 | S1 | |
| *Noturus flavus* | Stonecat | Tier 1 | | SC | | | | | | x | | | G5 | S1 | |
| *Phenacobius mirabilis* | Suckermouth minnow | Tier 1 | | SE | | | | | | | | x | G5 | S2 | |
| **MAMMALS** | | | | | | | | | | | | | | | |
| *Ochotona princeps* | American pika** | Tier 1 | N | | | | | | | | | | G5 | S5 | |
| *Mustela nigripes* | Black-footed ferret | Tier 1 | LE | SE | | | | | | x | | x | G1 | S1 | |
| *Myotis thysanodes* | Fringed myotis | Tier 1 | | | x | x | | | | | | x | G4 | S3 | |
| *Cynomys gunnisoni* | Gunnison's prairie dog | Tier 1 | N | | x | x | | | x | | | x | G5 | S5 | |
| *Myotis lucifigus* | Little brown myotis | Tier 1 | P | | | | | | | | | x | G3 | S5 | |
| *Lynx Canadensis* | Lynx | Tier 1 | LT | SE | | | | | | | | x | G5 | S1 | |
| *Zapus hudsonius luteus* | New Mexico meadow jumping mouse | Tier 1 | LE | | x | x | | | x | | | x | G5T2 | S1 | |
| *Perognathus fasciatus* | Olive-backed pocket mouse | Tier 1 | | | | | | | | | | x | G5 | S3 | x |
| *Zapus hudsonius preblei* | Prebles meadow jumping mouse | Tier 1 | LT | ST | | | | | x | | | x | G5T2 | S1 | x |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Euderma maculatum* | Spotted bat | Tier 1 | | | x | x | | | | | | x | G4 | S2 | |
| *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | Tier 1 | | SC | x | x | | | | | x | x | G3G4T3T4 | S2 | |
| *Cynomys leucurus* | White-tailed prairie dog | Tier 1 | | | x | x | | | | | | x | G4 | S4 | |
| *Gulo gulo* | Wolverine | Tier 1 | N | SE | | | | | | | | x | G4 | S1 | |
| **REPTILES** | | | | | | | | | | | | | | | |
| *Aspidoscelis neotesselata* | Colorado checkered whiptail | Tier 1 | N | SC | | | | | x | x | | x | G2G3 | S2 | |
| *Sistrurus catenatus* | Massasauga | Tier 1 | P | SC | x | x | | | | | | x | G3G4 | S2 | |
| **AMPHIBIANS** | | | | | | | | | | | | | | | |
| *Acris blanchardi* | Blanchard's cricket frog | Tier 2 | | SC | | x | | | | | | | G5 | SH | |
| *Hyla arenicolor* | Canyon tree frog | Tier 2 | | | | x | | | | | | | G5 | S2 | |
| *Scaphiopus couchii* | Couch's spadefoot | Tier 2 | | SC | | | | | | | | | G5 | S1 | |
| *Spea intermontana* | Great Basin spadefoot | Tier 2 | | | | x | | | | | | | G5 | S3 | |
| *Gastrophryne olivacea* | Great Plains narrowmouth toad | Tier 2 | | SC | | | | | | | | | G5 | S1 | |
| *Anaxyrus debilis* | Green toad | Tier 2 | | | | | | | | | | | G5 | S2 | |
| *Lithobates blairi* | Plains leopard frog | Tier 2 | | SC | x | x | | | | | | | G5 | S3 | |
| *Lithobates sylvatica* | Wood frog | Tier 2 | | SC | x | | | | | | | | G5 | S3 | |
| **BIRDS** | | | | | | | | | | | | | | | |
| *Botaurus lentiginosus* | American bittern | Tier 2 | | | x | | x | | | | | | G4 | S3S4B | |
| *Falco peregrinus anatum* | American peregrine falcon | Tier 2 | | SC | x | x | x | | | | | | G4T4 | S2B | |
| *Pelecanus erythrorhynchos* | American white pelican | Tier 2 | | | | x | | | | | | | G4 | S1B | |
| *Haliaeetus leucocephalus* | Bald eagle | Tier 2 | | SC | x | x | x | | | | | | G5 | S1B,S3N | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Patagioenas fasciata* | Band-tailed pigeon | Tier 2 | | | | | | | | | | | G4 | S4B | x |
| *Bucephala islandica* | Barrow's goldeneye | Tier 2 | | | | | | | | | | | G5 | S2B | |
| *Leucosticte atrata* | Black rosy-finch | Tier 2 | | | | | x | x | | | | | G4 | S4N | |
| *Cypseloides niger* | Black swift | Tier 2 | | | x | x | | x | x | | | | G4 | S3B | x |
| *Chlidonias niger* | Black tern | Tier 2 | | | x | | | | | | | | G4 | S2B | |
| *Dolichonyx oryzivorus* | Bobolink | Tier 2 | | | | | | x | | | | | G5 | S3B | x |
| *Aegolius funereus* | Boreal owl | Tier 2 | | | x | | | | | | | | G5 | S2 | |
| *Spizella breweri* | Brewer's sparrow | Tier 2 | | | x | x | x | | | | | | G5 | S4B | x |
| *Peucaea cassinii* | Cassin's finch | Tier 2 | | | | | x | | | | | | G5 | S5 | x |
| *Aimophila cassinii* | Cassin's sparrow | Tier 2 | | | x | | | | | | | | G5 | S4B | x |
| *Calcarius ornatus* | Chestnut-collared longspur | Tier 2 | | | x | | x | x | | | | | G5 | S1B | x |
| *Buteo regalis* | Ferruginous hawk | Tier 2 | | SC | x | x | x | | | | | x | G4 | S3B,S4N | |
| *Otus flammeolus* | Flammulated owl | Tier 2 | | | x | | x | x | | | | | G4 | S4 | |
| *Setophaga graciae* | Grace's warbler | Tier 2 | | | | | x | | | | | | G5 | S3B | |
| *Ammodramus savannarum* | Grasshopper sparrow | Tier 2 | | | x | | x | | | | | | G5 | S3S4B | x |
| *Vireo vicinior* | Gray vireo | Tier 2 | | | | | x | x | | | | | G4 | S2B | |
| *Tympanuchus cupido* | Greater prairie-chicken | Tier 2 | | | x | | | x | | | | | G4 | S3 | x |
| *Baeolophus ridgwayi* | Juniper titmouse | Tier 2 | | | | | x | | | | | | G5 | S4 | x |
| *Calamospiza melanocorys* | Lark bunting | Tier 2 | | | | | x | | | | | | G5 | S4 | x |
| *Passerina amoena* | Lazuli bunting | Tier 2 | | | | | | | | | | | G5 | S5B | x |
| *Sterna antillarum* | Least tern | Tier 2 | LE | SE | | | | | | | | | G4 | S1B | |
| *Melanerpes lewis* | Lewis's woodpecker | Tier 2 | | | x | | x | | | | | | G4 | S4 | x |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lanius ludovicianus* | Loggerhead shrike | Tier 2 | | | x | | | | | | | | G4 | S3S4B | x |
| *Numenius americanus* | Long-billed curlew | Tier 2 | | SC | x | x | x | | | | | | G5 | S2B | |
| *Rhynchophanes mccownii* | McCown's longspur | Tier 2 | | | x | | x | | | | | | G4 | S2B | |
| *Strix occidentalis lucida* | Mexican spotted owl | Tier 2 | LT | ST | | | | | | | | | G3T3 | S1B,SUN | |
| *Colinus virginianus* | Northern bobwhite | Tier 2 | | | | | | | | | | | G5 | S4 | x |
| *Accipiter gentilis* | Northern goshawk | Tier 2 | | | x | x | | | | | | | G5 | S3B | |
| *Circus cyaneus* | Northern harrier | Tier 2 | | | x | | | | | | | | G5 | S3B | |
| *Contopus cooperi* | Olive-sided flycatcher | Tier 2 | | | x | | | x | | | | | G4 | S3S4B | x |
| *Gymnorhinus cyanocephalus* | Pinyon jay | Tier 2 | | | | | x | x | | | | | G5 | S5 | x |
| *Charadrius melodus* | Piping plover | Tier 2 | LT | ST | | | | | | | | | G3 | S1B | |
| *Falco mexicanus* | Prairie falcon | Tier 2 | | | | | x | | | | | | G5 | S4B,S4N | |
| *Progne subis* | Purple martin | Tier 2 | | | x | | | | | | | | G5 | S3B | |
| *Selasphorus rufus* | Rufous hummingbird | Tier 2 | | | | | | x | | | | | G5 | SNA | x |
| *Amphispiza belli* | Sage sparrow | Tier 2 | | | x | | | | | | | | G5 | S3B | x |
| *Asio flammeus* | Short-eared owl | Tier 2 | | | x | | | | | | | | G5 | S2B | x |
| *Buteo swainsoni* | Swainson's hawk | Tier 2 | | | | | | | | | | | G5 | S5B | x |
| *Bartramia longicauda* | Upland sandpiper | Tier 2 | | | | | x | | | | | x | G5 | S3B | |
| *Catharus fuscescens* | Veery | Tier 2 | | | | | x | | | | | | G5 | S3B | |
| *Oreothlypis virginiae* | Virginia's warbler | Tier 2 | | | | | | x | | | | | G5 | S5 | |
| *Charadrius alexandrinus nivosus* | Western snowy plover | Tier 2 | | SC | | x | x | | | | | | G3T3 | S1B | |
| *Plegadis chihi* | White-faced ibis | Tier 2 | | | | x | | | | | | | G5 | S2B | |
| *Grus Americana* | Whooping crane | Tier 2 | LE | SE | | | | | | | | x | G1 | SNA | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FISH** | | | | | | | | | | | | | | | |
| *Etheostoma exile* | Iowa darter | Tier 2 | | SC | | | | | | | | | G5 | S3 | |
| *Couesius plumbeus* | Lake chub | Tier 2 | | SE | x | | | | | | x | | G5 | S1 | |
| **MAMMALS** | | | | | | | | | | | | | | | |
| *Sciurus aberti* | Abert's squirrel** | Tier 2 | | | | | | | | | | | G5 | S5 | |
| *Idionycteris phyllotis* | Allen's big-eared bat | Tier 2 | | | | x | | | | | | | G4 | SNR | |
| *Martes Americana* | American marten | Tier 2 | | | x | | | | | | | | G4G5 | S4 | |
| *Nyctinomops macrotis* | Big free-tailed bat | Tier 2 | | | | x | | | | | | | G5 | S1 | |
| *Ovis Canadensis* | Bighorn sheep | Tier 2 | | | x | x | | | | | | | G4 | S4 | |
| *Bison bison* | Bison | Tier 2 | | | | | | | | | | | G4 | SX | |
| *Cynomys ludovicianus* | Black-tailed prairie dog | Tier 2 | N | SC | x | x | | | | | | x | G4 | S3 | |
| *Thomomys bottae rubidus* | Botta's pocket gopher (*rubidus* ssp.) | Tier 2 | | SC | | | | | | | | | G5T1 | S1 | |
| *Conepatus leuconotus* | Common hog-nosed skunk | Tier 2 | | | x | | | | | | | | G4 | S1 | |
| *Sorex nanus* | Dwarf shrew | Tier 2 | | | | | | | | | | | G4 | S2 | |
| *Canis lupus* | Gray wolf | Tier 2 | LE | SE | x | | | | | | | x | G4G5 | SX | |
| *Ursus arctos* | Grizzly bear | Tier 2 | | SE | | | | | | | | | G4 | SX | |
| *Lasiurus cinereus* | Hoary bat | Tier 2 | | | x | | | | | | | | G5 | S5B | |
| *Vulpes macrotis* | Kit fox | Tier 2 | | SE | x | x | | | | | | | G4 | S1 | x |
| *Sorex preblei* | Preble's shrew | Tier 2 | | | | | | | | | | | G4 | S1 | |
| *Brachylagus idahoensis* | Pygmy rabbit | Tier 2 | | | | | | | | | | | G4 | SNR | |
| *Sorex hoyi montanus* | Pygmy shrew | Tier 2 | | | x | | | | | | | | G5T3T4 | S2 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Clethrionomys gapperi* | Red-backed vole** | Tier 2 | | | | | | | | | | | G5 | S5 | |
| *Lontra Canadensis* | River otter | Tier 2 | | ST | x | | | | | | x | x | G5 | S3S4 | |
| *Lemmiscus curtatus* | Sagebrush vole | Tier 2 | | | | | | | | | | | G5 | S1 | |
| *Lepus americanus* | Snowshoe hare** | Tier 2 | | | | | | | | | | | G5 | S5 | |
| *Vulpes velox* | Swift fox | Tier 2 | | SC | x | x | | | | | | x | G3 | S3 | |
| *Lepus townsendii* | White-tailed jackrabbit | Tier 2 | | | | | | | | | | | G5 | S4 | |
| **MOLLUSKS** | | | | | | | | | | | | | | | |
| *Ferrissia walker* | Cloche ancylid | Tier 2 | | | | | | | | | | | G4G5Q | S3 | |
| *Promenetus umbillicatellus* | Cockerell | Tier 2 | | | | | | | | | | | G4 | S3 | |
| *Anodontoides ferussacianus* | Cylindrical papershell | Tier 2 | | SC | | | | | | | | | G5 | S2 | |
| *Ferrissia fragilis* | Fragil ancylid | Tier 2 | | | | | | | | | | | G5Q | S1 | |
| *Physa cupreonitens* | Hot springs physa | Tier 2 | | | | | | | | | | | G5Q | S2 | |
| *Uniomerus tetralasmus* | Pondhorn | Tier 2 | | | | | | | | | | | G5 | S1 | |
| *Acroloxus coloradensis* | Rocky Mountain capshell | Tier 2 | | SC | x | | | | | | | | G3 | S1 | |
| *Promenetus exacuous* | Sharp sprite | Tier 2 | | | | | | | | | | | G5 | S2 | |
| *Physa gyrina utahensis* | Utah physa | Tier 2 | | | | | | | | | | | G5T2 | S1 | |
| **REPTILES** | | | | | | | | | | | | | | | |
| *Thamnophis cyrtopsis* | Black-necked gartersnake | Tier 2 | | | | | | | | | | | G5 | S2? | |
| *Lampropeltis californiae* | California kingsnake | Tier 2 | | SC | | x | | | | | | | G5 | S1 | |
| *Thamnophis sirtalis* | Common gartersnake | Tier 2 | | SC | | | | | | | | | G5 | S3 | x |
| *Sceloporus magister* | Desert spiny lizard | Tier 2 | | | | x | | | | | | | G5 | S2 | |
| *Gambelia wislizenii* | Long-nosed leopard lizard | Tier 2 | | SC | | x | | | | | | | G5 | S1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rhinocheilus lecontei* | Long-nosed snake | Tier 2 | | | | | | | | | | | G5 | S1? | |
| *Crotalus oreganus concolor* | Midget faded rattlesnake | Tier 2 | | SC | | x | | | | | | | G5T4 | S3? | |
| *Lampropeltis triangulum* | Milksnake | Tier 2 | | | | x | | | | | | | G5 | S2? | |
| *Rena dissectus* | New Mexico threadsnake | Tier 2 | | SC | | | | | | | | | G4G5 | S1 | |
| *Hypsiglena chlorophaea* | Desert nightsnake | Tier 2 | | | | | | | | | | | G5 | S3 | |
| *Phrynosoma modestum* | Round-tailed horned lizard | Tier 2 | | SC | | | | | | | | | G5 | S1 | |
| *Tantilla horbartsmithi* | Smith's black-headed snake | Tier 2 | | | | | | | | | | | G5 | S2? | |
| *Phrynosoma cornutum* | Texas horned lizard | Tier 2 | | SC | | | | | | | | | G4G5 | S3 | |
| *Kinosternon flavescens* | Yellow mud turtle | Tier 2 | | SC | | | | | | | | | G5 | S1 | |

# Chapter 3: Habitats

This chapter presents updated information on the distribution and condition of key habitats in Colorado. The habitat component of Colorado's 2006 SWAP considered 41 land cover types from the Colorado GAP Analysis (Schrupp et al. 2000). Since then, the Southwest Regional GAP project (SWReGAP, USGS 2004) has produced updated land cover mapping using the U.S. National Vegetation Classification (NVC) names for terrestrial ecological systems. In the strictest sense, ecological systems are not equivalent to habitat types for wildlife. Ecological systems as defined in the NVC include both dynamic ecological processes and biogeophysical characteristics, in addition to the component species. However, the ecological systems as currently classified and mapped are closely aligned with the ways in which Colorado's wildlife managers and conservation professionals think of, and manage for, habitats. Thus, for the purposes of the SWAP, references to the NVC systems should be interpreted as wildlife habitat in the general sense.

Fifty-seven terrestrial ecological systems or altered land cover types mapped for SWReGAP have been categorized into 20 habitat types, and an additional nine aquatic habitats and seven "Other" habitat categories have been defined. SWAP habitat categories are listed in Table 4 (see Appendix C for the crosswalk of SWAP habitats with SWReGAP mapping units). Though nomenclature is slightly different in some cases, the revised habitat categories presented in this document are consistent with those defined in the 2006 SWAP with the following exceptions:

- Douglas Fir and White Fir, formerly stand-alone habitat categories, have been included in the Mixed Conifer category;
- Limber Pine and Bristlecone Pine have been combined into Subalpine Limber and Bristlecone Pine;
- Tallgrass Prairie and Midgrass Prairie have been combined into Mixed-grass and Tallgrass Prairies;
- Sand Dune Complex (Grassland) and Sand Dune Complex (Shrubland) have been combined into the Sandsage category, and a separate Sand Dunes category has been added to distinguish sandy prairie habitats from true sand dune habitats;
- Meadow Tundra and Shrub Tundra, formerly stand-alone categories, have been combined under Alpine;
- Exposed Rock has been split into Alpine (high elevation bedrock, screen, ice fields and fellfields) and Cliffs & Canyons (cliffs, canyons, outcrops, and tablelands of Rocky Mountains, Western Great Plains, and Intermountain Basins)
- A Riparian Woodlands and Shrublands category has been added to better distinguish terrestrial stream-side habitats from aquatic habitats.

A widely-accepted, broad-scale classification comparable to the NVC does not currently exist for aquatic habitats. For the 2006 SWAP, we defined aquatic habitat categories that had meaning for wildlife managers and stakeholders. For this iteration of the SWAP, we have revised the original aquatic habitat categories to more explicitly relate aquatic habitats to associated physiographic regions. Watershed characteristics such as elevation, vegetation and geology strongly influence key aspects of aquatic habitat such as gradient, temperature, and turbidity, which in turn shape aquatic species distributions within the state. Changes to aquatic habitat categories are:

- West Slope Rivers and West Slope Streams have been re-categorized as Colorado Plateau – Wyoming Basins Rivers and Streams;
- Rio Grande Valley Rivers and Streams have been added as unique habitat categories;
- Lakes and Open Water categories have been revised to distinguish natural lakes (still the Lakes category) from other types of open water and associated habitats (now split into the Reservoirs & Shorelines and Hot Springs categories).

**Table 4. Wildlife habitats in Colorado.**

| Habitat Type | Habitat Community |
|---|---|
| Forest | Aspen |
| Forest | Lodgepole Pine |
| Forest | Mixed Conifer |
| Forest | Pinyon-Juniper |
| Forest | Ponderosa Pine |
| Forest | Spruce-Fir |
| Forest | Subalpine Limber-Bristlecone Pine |
| Shrub | Desert Shrub |
| Shrub | Greasewood |
| Shrub | Oak and Mixed Mountain Shrublands |
| Shrub | Sagebrush |
| Shrub | Saltbush |
| Shrub | Sandsage |
| Shrub | Upland Shrub |
| Grassland | Foothill and Mountain Grasslands |
| Grassland | Mixed and Tallgrass Prairies |
| Grassland | Shortgrass Prairie |
| Riparian and Wetland | Playas |
| Riparian and Wetland | Riparian Woodlands and Shrublands |
| Riparian and Wetland | Wetlands |
| Aquatic | Colorado Plateau - Wyoming Basins Rivers |
| Aquatic | Colorado Plateau - Wyoming Basins Streams |
| Aquatic | Eastern Plains Rivers |
| Aquatic | Eastern Plains Streams |

| Habitat Type | Habitat Community |
|---|---|
| Aquatic | Lakes |
| Aquatic | Mountain Streams |
| Aquatic | Rio Grande Valley Rivers |
| Aquatic | Rio Grande Valley Streams |
| Aquatic | Transition Zone Streams |
| Other | Agriculture |
| Other | Alpine |
| Other | Cliffs and Canyons |
| Other | Conservation Reserve Program (CRP) |
| Other | Hot Springs |
| Other | Reservoirs and Shorelines |
| Other | Sand Dunes |

# Distribution and Condition of Habitats

Figure 1 shows the distribution of terrestrial habitats dominated by native vegetation. Figure 2 shows the distribution of aquatic habitats. Some habitats that occur in small patches are not detectable when displayed on a letter-size statewide map. These include many lakes, wetlands, playas, and hot springs, as well as some riparian areas. Where data were available for these small-patch habitats, habitat features have been enhanced for readability in Figure 1. Finer scale mapping of wetlands in Colorado has been developed through a partnership between the U.S. Fish and Wildlife's National Wetland Inventory Program, U.S. Environmental Protection Program, the Colorado Natural Heritage Program, and Colorado Parks and Wildlife. Playas have been mapped by Playa Lakes Joint Venture and Rocky Mountain Bird Observatory[6]. Three types of agricultural land uses provide wildlife habitat in Colorado: rangeland, cropland, and Conservation Reserve Program (CRP) lands. Rangeland is included under the grassland habitat types. Cropland and CRP are treated as separate habitat types, but current spatial data at a statewide scale are not available; thus, these two habitats do not appear on Figure 1.

Brief descriptions of each habitat follow. Portions of habitat summaries have been excerpted, with permission, from Rondeau et al. 2011, CNHP 2005-2007, and NatureServe 2014, with modifications where necessary to accurately reflect revised SWAP habitat categories. Information related to general habitat condition has been summarized from these and other sources (e.g., Colorado's 2013 Forest Health Report), and from ecosystem experts at the Colorado Natural Heritage Program.

Tables 7 and 8 list the SGCN that are associated with each habitat type, by species and by habitat, respectively. SGCN for which the habitat is a primary habitat are marked. For the purposes of this SWAP, "primary habitat" refers to the habitat(s) in which a species is most typically found,

[6] For the most recent data available, contact the Colorado Natural Heritage Program, www.cnhp.colostate.edu for wetlands and Bird Conservancy of the Rockies, www.birdconservancy.org, for playas.

or that is crucial to the completion of one or more phases of the species' life cycle. Simplifying the complex factors that constitute "habitat" into broad categories that can be mapped at a statewide scale is always going to be an imperfect process. The species/habitats relationships in Tables 7 and 8 do not always recognize small-scale nuances. For example, grouse are known to use wet meadows interspersed within shrubland communities for brood rearing. However, these features are often not mappable at a statewide scale. Furthermore, these wet meadows are distinct from the statewide habitat category for "wetlands." So even though grouse require moist habitats, including the wetland habitat category, as defined for this SWAP, would be inappropriate. Local scale conservation work should always be based on site-specific conditions.

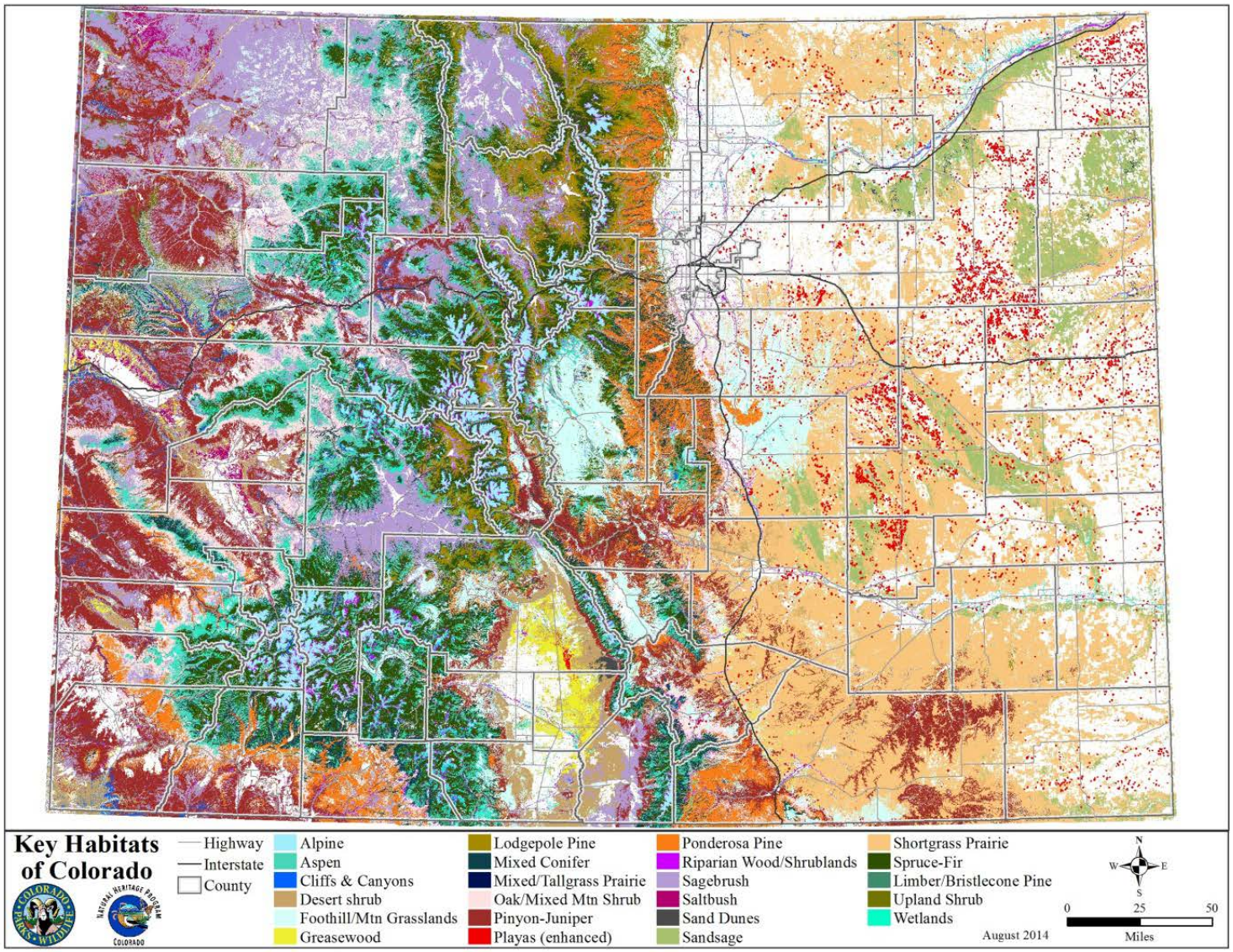



**Figure 1. Distribution of key terrestrial habitats in Colorado.**

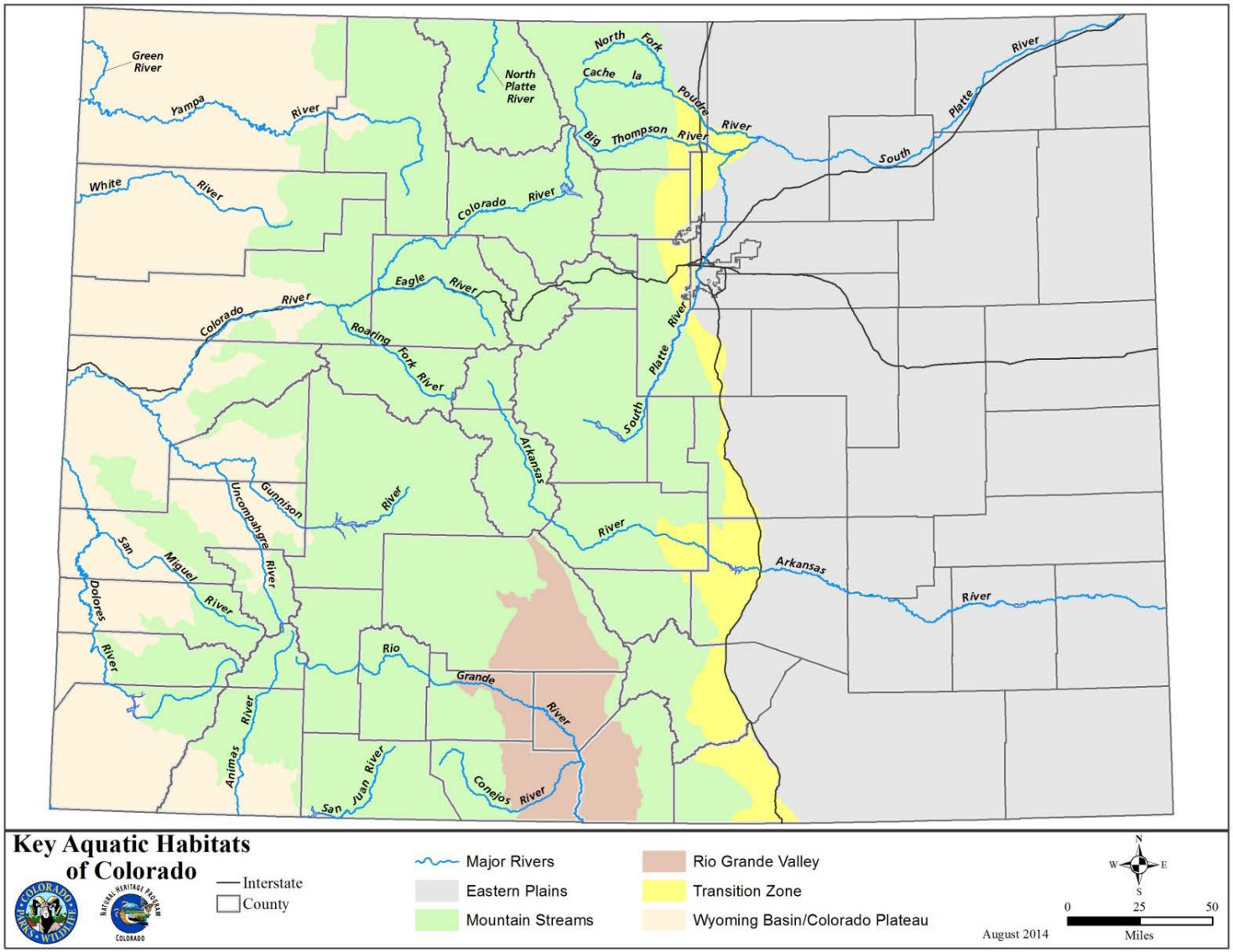



**Figure 2. Distribution of key aquatic habitats.**

# FOREST AND WOODLAND HABITATS

## Aspen

Aspen supports 29 SGCN (Table 8). In Colorado, aspen forests are quite common on the western slope, with smaller stands represented on the east slope. These forests cover more than three and a half million acres in Colorado, including one patch of more than a half million acres on the edges of the White River Plateau and Flat Tops. These are upland forests and woodlands dominated by quaking aspen (*Populus tremuloides*), ranging in elevation from about 7,500 to 10,500 feet. Aspen forests and woodlands usually contain a mosaic of many plant associations and may be surrounded by a diverse array of other ecological systems, including grasslands, wetlands, and coniferous forests.

Primary threats to aspen forests in Colorado include fire suppression, excessive browsing (especially by elk), and Sudden Aspen Decline (SAD), which is especially troublesome in the southwestern portion of the state (CSFS 2010). The cause(s) of SAD are unclear and research to identify stressors is on-going. Currently, SAD is not widely distributed across the state, but there is potential for this condition to pose a more significant threat to our aspen forests in the future if the underlying causes are exacerbated by changing climatic conditions. Aspens have increased susceptibility to episodic decline at lower elevations under warm and dry conditions (Worrall et al. 2008). SAD appears to be related to drought stress, and is typically greatest on the hotter and drier slopes, which are usually at the lowest elevations of a stand (Rehfeldt et al. 2009). Stands may undergo thinning, but then recover. Increasing drought with climate change is believed to be the primary vulnerability of this ecosystem (Worrall et al. 2013), and substantial loss of aspen can potentially be expected. However, from a statewide perspective, aspen forests are currently in generally good condition overall and threats are comparatively low.

## Lodgepole

Lodgepole forests, which cover more than two million acres in Colorado, support 21 SGCN (Table 8). In Colorado, lodgepole is widespread between 8,000-10,000 feet in elevation, on gentle to steep slopes of the Rocky Mountains in the northern part of the state. Stands may be pure lodgepole pine (*Pinus contorta*), or mixed with other conifer species. Following stand-replacing fires, lodgepole pine rapidly colonizes and develops into dense, even-aged stands (sometimes referred to as "dog hair" stands). Lodgepole pine forests typically have shrub, grass, or barren understories, sometimes intermingled with aspen. Shrub and groundcover layers are often sparse in lodgepole pine forests. Diversity of plant species is also low, perhaps as a result of the uniform age and dense canopy of many stands.

Although these forests are common across Colorado, most have experienced widespread damage from a severe outbreak of mountain pine beetle (*Dendroctonus ponderosae*). The pine beetle is a native species, and periodic outbreaks of this insect are part of the natural cycle that maintains our mountain forests. After killing approximately 3.4 million acres of lodgepole forests over the past decade, this recent outbreak is finally beginning to subside, primarily due to the fact that most susceptible host trees have been killed (CSFS 2013). Regeneration has been rapid in beetle-kill areas, and many large vegetation management projects have been completed and are underway on public lands to remove dead trees. Although there has been widespread mortality, and remaining lodgepole forests have been "re-set" to an early seral stage, this situation is part of the natural life cycle of a forest – thus, current condition cannot really be considered "bad."

Preliminary results of our climate change vulnerability assessment suggest that lodgepole may be moderately vulnerable through mid-century. Warming temperatures favor the growth of lodgepole pine, at least under conditions of increased precipitation, which may occur in some portions of the state. Warmer winters with drought are likely to increase mountain pine beetle outbreaks, but mortality is already widespread. Lodgepole habitat may be fairly resilient to climate change, and likely to persist, even if in an altered form.

## Mixed Conifer

Mixed conifer supports 35 SGCN (Table 8). Mixed conifer forests occur at elevations ranging from 4,000 to 10,800 feet, and covers more than 850,000 acres in Colorado. Douglas-fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*) are the most common dominant trees, but as many as seven different conifer species may be present. Douglas-fir stands are characteristic of drier sites, often mixed with ponderosa pine (*Pinus ponderosa*). More mesic stands are found in cool ravines and on north-facing slopes, and are likely to be dominated by white fir with blue spruce (*Picea pungens*) or quaking aspen (*Populus tremuloides*) stands. Natural fire processes in this ecological system are highly variable in both return interval and severity, with fire cycles ranging from 20 to more than 150 years. Stands in the Front Range are vulnerable to the impacts of housing development, and some are in degraded condition (i.e., denser, with more dead fuel) as a result of fire suppression (CSFS 2010). However, many of these habitats are generally in good condition, with minimal threats.

## Pinyon-Juniper

Pinyon-juniper, which covers almost 7 million acres in Colorado, supports 67 SGCN (Table 8). Pinyon-juniper habitat includes juniper (*Juniperus* spp.) savannas and woodlands, woodlands and shrublands co-dominated by pinyon pine (*Pinus edulis*) and juniper, and some stands of juniper mixed with limber pine (*Pinus flexilis*) at lower elevations. Various forms of pinyon-juniper occur on mesas, dry mountains, and foothills across the western slope as well as in south-

central and southeastern Colorado. The understory is highly variable, and may be shrubby, grassy, sparsely vegetated, or rocky. Elevation ranges from 4,900 - 9,000 feet. In the canyons and tablelands of the southern Great Plains, juniper woodlands form extensive cover at some distance from the mountain front, at elevations from 4,100 to 6,200 feet.

For the purpose of analysis under the SWAP, the two major and four minor types of pinyon-juniper habitats classified under ReGAP have been lumped together. There are only two major pinyon-juniper systems – the Colorado Plateau system on the western slope, and the Southern Rockies system on the eastern slope. The Southern Rockies system is restricted to relatively discrete areas in the southeastern part of the state. The other four types can be significant on a local scale, but do not warrant separate treatment in statewide analyses such as the SWAP. Although localized threats exist, the size, juxtaposition, and broad distribution of this plant community affords a resiliency lacking in most other vegetation communities across Colorado.

Pinyon-juniper is influenced by climate, grazing, fires, and insect-pathogen outbreaks. Since the late 1800s, many of these woodlands have been significantly altered by changes in fire frequency, grazing patterns, habitat treatments, and climate cycles.

Recent studies (Eisenhart 2004; Romme et al. 2009) indicate that pinyon-juniper stands on the western slope are shaped predominantly by large, stand replacing fires that occur in 300-500 year intervals. Such fires would be followed by long recovery periods where the site is dominated by forbs and grasses, then shrubs, followed eventually by the re-establishment of a pinyon-juniper climax community. This scenario yields a very large range in historic variability and makes modeling past or future distribution of pinyon-juniper forests across the state difficult at best. In this habitat, fire acts to open stands, increase diversity and productivity in understory species, and create a mosaic of stands of different sizes and ages across the landscape while maintaining the boundary between woodlands and adjacent shrubs or grasslands. Altered fire regimes, drought, overgrazing, and tree cutting can affect stand quality and the potential encroachment of trees into adjacent habitats.

Pinyon-juniper habitat quality has declined compared to historic norms, as significant acreage has been chained and burned in an effort to increase forage for livestock and big game on productive sites. Other threats include urban development, recreation (especially motorized recreation), invasive species (most notably an increase in cheatgrass (*Bromus tectorum*) in the understory, which has led to increasing fire ignitions), and energy development. In comparison with pinyon-juniper stands, Colorado's juniper-only woodlands have been much less impacted by human activities. However, the extent of juniper woodlands has historically been limited by fire, which kills juniper trees. Fire suppression and drought may have caused an expansion of juniper woodlands in some areas of southeast Colorado, where most of the junipers not associated with rimrock are young trees (<100 years old).

Pinyon-juniper habitats across Colorado are in generally fair to good condition, and are excellent in more remote, untreated or administratively protected areas. Some patches can be in poor condition in areas where incompatible grazing has reduced native bunch grasses and invasive species such as cheatgrass have become established. Overgrazing can also result in a complete lack of understory in mature pinyon-juniper stands. Oil and gas development, and chaining to improve livestock forage, have degraded the condition of some stands. Climate change may result in additional degradation of this habitat type, especially via an increase in frequency and/or severity of wildfire. In some previously burned areas, pinyon-juniper is not regenerating. For example, roughly 50% of Mesa Verde National Park burned in the early 1990s. At this time, there is still no sign of pinyon-juniper regeneration. Instead, burned areas have been invaded by cheatgrass and smooth brome (*Bromus inermis*). Preliminary results of our climate change vulnerability assessment suggest that pinyon-juniper may be moderately vulnerable to climate change through mid-century. The pinyon-juniper habitat has large ecological amplitude; warmer conditions may allow expansion, as has already occurred in the past centuries, as long as there are periodic cooler, wetter years for recruitment. Increased drought may drive fires and insect outbreaks, from which these woodlands would be slow to recover.

Although a large number of animal species in Colorado use pinyon-juniper habitats, few are wholly dependent upon them, with the exception of birds. It may be that the cyclic nature of these plant communities has forced many animals using them to remain adaptable. The primary mast crops produced in a pinyon-juniper community can vary widely from year to year, largely in response to precipitation and frost patterns. The best strategy may be to take advantage of this food source when available, but not to depend upon it for long term survival. This makes the pinyon-juniper forests of Colorado significant to wildlife, but more in a generalist, and not an obligate fashion. For birds, however, pinyon-juniper supports one of the highest proportions of obligate or semi-obligate bird species among forest types (Paulin et al. 1999). Thirty-nine percent of bird species found in pinyon-juniper are obligate or semi-obligate, second only to riparian forested communities (Paulin et al. 1999); 20% of bird species that use pinyon-juniper (roughly one-quarter of Colorado's native birds) are obligates (Kingery 1998).

## Ponderosa Pine

Ponderosa pine supports 34 SGCN (Table 8). In Colorado, ponderosa pine (*Pinus ponderosa*) woodlands cover about 3.2 million acres in Colorado. They occur between about 6,000 and 9,000 feet, often at the lower treeline transition between grassland or shrubland and the more mesic coniferous forests above. These woodlands are especially prevalent along the eastern edge of the Rocky Mountains, and on the southern flank of the San Juan Mountains. Healthy ponderosa pine forests often consist of open and park-like stands of mature trees, with an understory of predominantly fire-tolerant grasses and forbs. Fire is the most significant ecological process

maintaining this ecological system; frequent, low-intensity ground fires are typical. Older trees drop their lower branches and develop thick, insulating bark as they age, which protects them from ground fires. In stands where the natural fire regime occurs, shrubs, understory trees and downed logs are uncommon. When fires are not allowed to burn, young trees continue to grow, and places that were once open savannas and woodlands become dense forests. Increased density of trees allows fires to reach the forest canopy, spread rapidly, and burn large areas.

In southwestern Colorado, the overall condition of ponderosa pine is generally good, except where exurban development has fragmented larger stands. On the Front Range, many stands have been lost to urban development, and some of the remaining stands are in degraded condition. The likelihood of future threats (primarily development and fire suppression) is high. Preliminary results from our climate change vulnerability assessment suggest that ponderosa pine may be moderately vulnerable through mid-century. Increased drought may drive fires and insect outbreaks, and relative proportions of component species in ponderosa stands may change. This habitat is well adapted to warm, dry conditions if precipitation is not reduced too much, and may be able to expand into higher elevations.

## Spruce-Fir

Spruce-fir forests support 23 SGCN (Table 8). Spruce-fir forests cover about 5% of Colorado's landscape, forming the matrix vegetation of the sub-alpine zone at elevations of 9,500 to 11,500 feet. They are characterized by dense stands of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). This is one of the few Colorado forest types that is not fire-adapted – the typical fire return frequency is around 400 years. Areas with spruce-fir forest typically receive precipitation in the form of snowfall and frequent summer showers. When periods of drought occur, however, the stressed trees become susceptible to spruce-bud worm (*Choristoneura freemani*) and spruce beetle (*Dendroctonus rufipennis*) outbreaks, which can kill entire hillsides of trees in one summer. In the early 20th century, much of Colorado's old-growth spruce fir was cut for timber. Although much spruce-fir is now made up of younger trees, it is still possible to find very old, widely-spaced trees with yellow bark, as well as snags and downed trees that create perfect habitat for cavity-nesting birds and pine martens.

In 2013, spruce beetle infestations were identified on 398,000 acres, the majority of which are in the southwestern mountain ranges (CSFS 2013). However, from a statewide perspective, spruce-fir forests are generally healthy and intact, except that small stand size detracts from the overall quality of the habitat in some areas. Although this habitat is heavily used for recreation and other human activities, overall threats are relatively low at this time. Global climate change may have significant impacts on spruce-fir in the future. Preliminary results of our climate change vulnerability assessment suggest that spruce-fir is moderately vulnerable until mid-century. Under warmer conditions, spruce-fir is likely to expand into alpine areas, but the response would

be slow. The lower distributional limit of this habitat is likely to move higher under warmer, drier conditions. Change in species composition may occur in some areas. The vulnerability of this habitat might be higher if the analysis timeframe were further out than mid-century.

## Subalpine Limber and Bristlecone Pine

Limber and bristlecone pine forests and woodlands support 12 SGCN (Table 8). This habitat occurs throughout the Rocky Mountains on dry, rocky ridges and slopes. Although it can be found near upper treeline above spruce-fir forests, it also occurs at lower elevations. These are typically woodlands of xeric, high elevation sites, but they may also extend down to the lower montane, particularly along the Front Range. Limber pine (*Pinus flexilis*) and bristlecone pine (*Pinus aristata*) do not necessarily occur together, but the two species occupy a similar ecological niche. Where the two co-occur, limber pine is often confined to the lower portion of its potential habitat. Bristlecone pine is more-or-less endemic to the Southern Rocky Mountian ecoregion, reaching its northernmost station in Gilpin County, Colorado. Limber pine is more widely distributed and also occurs in mixed conifer systems. It largely replaces bristlecone pine north of I-70, and extends onto the plains in small but important habitat patches on the Pawnee National Grasslands.

This habitat occurs in harsh sites that are exposed to desiccating winds with rocky substrates and a short growing season that limit plant growth. Higher elevation occurrences are found well into the subalpine – alpine transition on wind-blasted, mostly south to west-facing slopes and exposed ridges. Bristlecone forests are typically found on steep, south-facing slopes from 8,850 to 12,140 feet. Limber pine woodlands occupy similar habitats, but may occur at lower elevations than bristlecone. Both bristlecone and limber pine are slow-growing, long-lived species in which individuals may live for 1,000 or more years. Fire is an important source of disturbance that facilitates stand regeneration in this system. Older woodlands are often broadly even-aged stands where seedlings are nearly absent, while areas that have recently burned may have abundant seedlings. Bristlecone is somewhat more tolerant of fire than is limber pine, but both species appear to depend on fire for regeneration. Regeneration of limber pine on burned areas is largely due to the germination of seeds cached by Clark's nutcrackers (*Nucifraga columbiana*). The slow growth and recruitment of bristlecone and limber pine will make it difficult for these habitats to colonize new areas under changing climate conditions. Furthermore, warmer conditions may increase the vulnerability of these pines to white pine blister rust.

# SHRUBLAND HABITATS

## Desert Shrub

Desert shrub supports 37 SGCN (Table 8). In Colorado, these semi-arid shrubby grasslands, sometimes referred to as shrub steppes, are found between 7,500 and 9,500 feet in elevation, on windswept mesas, valley floors, gentle slopes, and on shoulders of ridges. Our shrub-steppes are grass-dominated areas with an open shrub layer. Typical grass species include blue grama (*Bouteloua gracilis)*, needle-and-thread (*Hesperostipa comata*), galleta (*Pleuraphis jamesii*), saltgrass (*Distichlis spicata*), Indian rice grass (*Acnatherum hymenoides*), and alkali sacaton (*Sporobolus airoides*). Historically, the shrub layer was dominated by winterfat (*Krascheninnikovia lanata*), but this species has decreased under grazing pressure in many areas. Winterfat has been replaced by rabbitbrush (*Ericameria* and *Chrysothamnus*) species and other woody shrubs. In Colorado, this ecological system does not form extensive stands except in the San Luis Valley. Pinyon-juniper woodlands and sagebrush shrublands commonly occur adjacent to this ecological system at the upper elevations. Shrub steppe covers more than 750,000 acres in Colorado. Historically, it probably accounted for well over a million acres, but many areas were converted to agricultural use. Remaining stands are generally in good condition, except for altered species composition in areas where grazing has reduced or eliminated some native bunch grasses. Solar energy development in the San Luis Valley and continued alteration by grazing are the primary potential threats to this ecological system. Thus far, solar energy development has mostly occurred on land that was previously converted to cropland, so this activity does not yet necessarily constitute additional loss.

## Greasewood

Greasewood supports 17 SGCN (Table 8). Shrublands dominated by black greasewood (*Sarcobatus vermiculatus*) account for less than 450,000 acres in Colorado, where they are typically found near drainages on stream terraces and flats, on alluvial fans along streams or arroyos, or as rings around playas. In eastern Colorado, greasewood stands are primarily in the southwestern portion of the plains. Large acreages are also found in the lower elevations of Colorado's western valleys and throughout much of the San Luis Valley. Greasewood flats usually have saline soils, a shallow water table and flood intermittently, but remain dry for most of the growing season. Because greasewood flats are tightly associated with saline soils and groundwater that is near the surface, groundwater recharge rather than surface water flow is critical for maintaining these shrublands. Elevations range from about 4,000 to 7,700 feet. These open to moderately dense shrublands are dominated by black greasewood, often with rabbitbrush (*Ericameria* and *Chrysothamnus* spp.), four-wing saltbush (*Atripelx canescens*), and alkali sacaton grass (*Sporobolus airoides*). Threats to greasewood include groundwater pumping,

conversion to cropland, and energy development. However, the condition of greasewood habitats in Colorado remains generally good.

## Oak and Mixed Mountain Shrub

Oak and mixed mountain shrublands, which account for about 2.7 million acres in Colorado, support 30 SGCN (Table 8). Oak and mixed mountain shrublands generally occur at elevations from approximately 6,500 to 9,500 feet, where they are often adjacent to lower elevation pinyon-juniper woodlands. Gambel's oak (*Quercus gambelii*) is typically dominant, but very often mixed with other montane shrubs such as serviceberry (*Amelanchier* spp.), mountain mahogany (*Cercocarpus montanus*), antelope bitterbrush (*Purshia tridentata*), big sagebrush (*Artemisia tridentata*), chokecherry (*Prunus virginiana*), and snowberry (*Symphoricarpos* spp.). These shrublands intergrade with foothills shrublands (roughly equivalent to the Upland Shrub habitat category) because both types are often found on poor, dry soils. In Colorado, oak and mixed mountain shrublands are most common on the western slope, where they form extensive bands on the lower mountain slopes, plateaus, and dry foothills. In eastern Colorado, these shrublands are also found at the mountain front as far north as the Palmer Divide. They may form dense thickets, or occur as open shrublands with an herbaceous understory. Although this is a shrub-dominated ecological system, some trees may be present.

Fire typically plays an important role in oak and mixed mountain shrublands, causing shrub die-back in some areas, promoting re-sprouting from stumps or underground tubers and rhizomes in other areas, and controlling the invasion of trees into the shrublands. Healthy examples of this habitat contain shrubs of varying heights, a robust understory of native bunchgrasses and forbs, and relatively little bare ground (COPiF 2000). Shrubs that produce acorns and berries provide valuable food and cover resources for a variety of wildlife species.

Where oak and mixed mountain shrublands occur near the wildland-urban interface, they are often in degraded condition due to effects from fire suppression. Ongoing impacts include housing development and oil and gas development. However, oak and mixed mountain shrublands are in generally good condition from a statewide perspective. Preliminary results from our climate change vulnerability assessment suggest that oak and mixed mountain shrub habitats have low vulnerability in Colorado. Warmer temperatures may increase seedling survival.

## Sagebrush

Sagebrush supports 65 SGCN (Table 8). Sagebrush in Colorado includes the three subspecies of big sagebrush (basin big sagebrush, *Artemisia tridentata* ssp. *tridentata*; mountain big sagebrush, *A. tridentata* ssp. *vaseyana*; and Wyoming big sagebrush, *A. tridentata* ssp. *wyomingensis*) that

occur as shrublands and montane sagebrush steppe. These shrublands occur throughout much of the western United States. Although they can be found on Colorado's east slope, the largest occurrences are on the western slope. North Park, Middle Park, and the upper Gunnison Basin have extensive stands of sagebrush shrublands, as do Moffat and northwest Rio Blanco counties. Big sagebrush shrublands are characterized by dense stands of taller sagebrush species with a significant herbaceous understory, and are generally found at elevations from 5,000 to 7,500 feet. Big sagebrush shrublands are typically found in broad basins between mountain ranges, on plains and foothills. Montane sagebrush steppe shrublands are dominated by the shorter sagebrush *Artemisia tridentata* ssp. *vaseyana*, and are usually found at elevations from 7,000 to 10,000 feet. Montane sagebrush steppe primarily occurs on ridges, near flat ridgetops, and mountain slopes.

Many of Colorado's sagebrush shrublands are vulnerable to changes induced by domestic livestock grazing. Prolonged use can cause a decrease in the abundance of native grasses and forbs in the understory, and an increase in shrubs and non-native grasses such as Kentucky bluegrass (*Poa pratensis*). Trampling from livestock grazing significantly decreases the survival of sagebrush and grass seedlings. Over the past century, the condition of much of Colorado's sagebrush shrubland has been degraded due to fire suppression and heavy livestock grazing. Although many livestock operations are now more sensitive in their treatment of sagebrush shrublands than they once were, recovery in these ecological systems is slow. Furthermore, many remaining sagebrush patches are now being fragmented by fast-paced and widespread energy development.

Various climate change vulnerability assessments for sagebrush have produced differing results (e.g., Nydick et al. 2012; Schlaepfer et al. 2012; Pocewicz et al. 2014), with rankings ranging from highly vulnerable to likely to increase, depending on the scale, location, and method of assessment. The Colorado-specific climate change vulnerability assessment conducted for this SWAP suggested that sagebrush is not particularly vulnerable in Colorado. Seasonal timing of precipitation is important for sagebrush habitats. Summer moisture stress may be limiting if winter precipitation is low, and increased drought may increase fire frequency/severity, eliminating sagebrush in some lower elevation areas. However, the habitat is not expected to be limited by lack of cooler habitat, since it can move to adjacent higher elevations. While some stands of sagebrush, especially those dominated by the *wyomingensis* subspecies, may be vulnerable, overall, sagebrush has numerous life history strategies that may help it adapt (e.g., it is a relatively short-lived shrub, it produces numerous seeds, and it can tolerate some droughts). Note that while the sagebrush habitat within Colorado does not appear to be particularly vulnerable to climate change, some sagebrush obligate species – most notably the Gunnison sage-grouse – are thought to be extremely vulnerable (Neely et al. 2011).

# Saltbush

Saltbush supports 33 SGCN (Table 8). Saltbush includes salt desert scrub, mat saltbush shrublands, and shale badlands. All of these ecological system types are typically dominated by saltbush (*Atriplex*) species or other shrubs tolerant of saline or alkaline soils. These sparse to moderately dense low-growing shrublands are widespread at lower elevations (generally from 4,500 to 7,000 feet) in Colorado's western valleys, and are also found in more limited distribution in the southern part of the eastern plains. In mixed salt desert scrub, the shrub layer may include winterfat (*Krascheninnikovia lanata*), wolfberry (*Lycium*), horsebrush (*Tetradymia canescens*), and various sagebrush (*Artemisia*) species. Grasses and forbs are generally sparse, and dominated by species tolerant of the harsh soils. Some areas are essentially barren, or very sparsely vegetated. Saltbush covers more than 750,000 acres in Colorado. Perhaps a quarter of the historic acreage of saltbush shrublands has been converted to agricultural use, especially in valley bottoms where irrigation is available. Remaining occurrences appear to be in good condition. Impacts and fragmentation from energy development are the most current threats to this habitat.

# Sandsage

Sandsage supports 21 SGCN (Table 8). Sandsage shrublands dominate sandy areas on Colorado's eastern plains, where they often intermingle with shortgrass prairie to form a locally patchy sandsage-shortgrass matrix. Sandsage is characterized by sand sagebrush (*Artemisia filifolia*) with an understory of tall, mid- and short grasses and scattered forbs. Yucca (*Yucca glauca*) and snakeweed (*Gutierrezia sarothrae*) are common in some areas, which may be indicative of mismanagement. Fire and grazing are the most important dynamic processes for sandsage, although drought stress can impact this ecological system significantly in some areas. Sandsage covers nearly two million acres in Colorado. These sandy-soiled habitats have frequently been passed over while neighboring grasslands are converted to agriculture, but about 20% of historic acreage has been lost, and sandsage areas continue to be converted to row crop production. Although remaining sandsage tracts generally have good landscape context and connectivity, species composition in these areas is highly altered by long-term mismanaged grazing. Understory grasses have been converted to short grass or annual species, and historic mixed and tall grass components are lacking, with consequent detrimental effect on habitat quality for several SGCN. Sandsage is vulnerable to adverse impacts from energy development (including wind, oil, and gas).

Preliminary results from our climate change vulnerability assessment suggest that sandsage is moderately vulnerable through mid-century. This habitat is not vulnerable on sandy soils, and may be able to expand into adjacent areas under warmer, drier conditions. However, overall condition and composition of these shrublands may change.

## Upland Shrub

Upland shrub habitats, which cover less than 400,000 acres in Colorado, support 27 SGCN (Table 8). Upland shrub habitats are found in dry, upland areas where oak is not present. This habitat is found in the Rocky Mountain foothills, ridges, canyons and lower mountain slopes, and on outcrops, mesas, and canyon slopes of the eastern plains. In general, mixed shrublands without oak are most common in the northern Front Range, as well as on drier foothills and prairie hills. Upland shrub occurs at elevations between 4,900-9,500 feet. Scattered trees may be present, but the vegetation is dominated by shrubs such as mountain mahogany (*Cercocarpus montanus*), antelope bitterbrush (*Purshia tridentata*), skunkbush sumac (*Rhus trilobata*), or currant species (*Ribes* spp.). The dominant shrub species are generally well adapted to poor soils, dry sites, and disturbance by fire. Fire suppression may have allowed an invasion of trees into some of these shrublands, but in many cases sites are too xeric for tree growth. Threats to upland shrub include fragmentation by roads and development. These disturbances provide an unnatural fire break as well as a conduit for weed invasion.

Condition of upland shrub habitats is generally good across Colorado, with fair patches in some areas. The shrub layer is good to excellent, but the understory layer is generally fair to poor. This habitat is vulnerable to weed invasions. Where invasive species such as leafy spurge (*Euphorbia esula*) and cheatgrass (*Bromus tectorum*) have established, understories are highly altered.

# GRASSLAND HABITATS

## Foothill and Mountain Grasslands

Foothill and mountain grasslands support 48 SGCN (Table 8). This habitat type includes three non-shortgrass prairie grassland types: Western Great Plains Foothill and Piedmont Grassland, Southern Rocky Mountain Montane-Subalpine Grassland, and Inter-Mountain Basins Semi-Desert Grassland. Together these grasslands cover about three million acres in Colorado.

Foothill and piedmont grasslands are found at the extreme western edge of the Great Plains, where increasing elevation and precipitation facilitate the development of mixed to tallgrass associations on certain soils. These grasslands typically occur at elevations between 5,250 and 7,200 feet. Typical species include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), needle-and-thread (*Hesperostipa comata*), and prairie sandreed (*Calamovilfa longifolia*).

Montane-subalpine grasslands in the Colorado Rockies are found at elevations of 7,200-10,000 feet, intermixed with stands of spruce-fir (*Picea engelmannii-Abies lasiocarpa*), lodgepole pine

(*Pinus contorta*), ponderosa pine (*Pinus ponderosa*), and aspen (*Populus tremuloides*), or as the matrix community (e.g., in the large intermountain basin of South Park). Typical dominant grass species include fescue (*Festuca* spp.), muhly (*Muhlenbergia* spp.), oatgrass (*Danthonia* spp.), and others. Lower elevation montane grasslands are more xeric, while upper montane or subalpine grasslands are more mesic. Grasses of the foothills and piedmont may be included in lower elevation occurrences. Trees and shrubs are generally sparse or absent, but occasional individuals from the surrounding communities may occur.

Colorado's semi-desert grasslands are found primarily on dry plains and mesas of the western slope at elevations of 4,750-7,600 feet. These grasslands are typically dominated by drought-resistant perennial bunch grasses such as bluebunch wheatgrass (*Pseudoroegneria spicata*), blue grama (*Bouteloua gracilis*), galleta grass (*Pleuraphis jamesii*), and needle-and-thread (*Hesperostipa comata*), and may include scattered shrubs.

A significant portion of historic occurrences of lower elevation foothill and piedmont grasslands on the eastern slope have been lost through conversion to cropland and commercial and residential development. Some remaining patches are in fair condition, but others – especially along Colorado's Front Range – are highly fragmented and invaded by cheatgrass (*Bromus tectorum*), leafy spurge (*Euphorbia esula*), Dalmatian toadflax (*Linaria dalmatica*), Canada thistle (*Cirsium arvense*), and other exotic species. Current impacts from human activity other than domestic livestock grazing are low in the montane grasslands; condition of these grasslands is generally good to excellent. Low elevation grasslands on the western slope are generally fair, but are poor in some areas where native grasses have been replaced by invasive species such as cheatgrass.

## Mixed and Tallgrass Prairies

Mixed-grass and tallgrass prairies support 37 SGCN (Table 8). Mixed-grass habitats are characterized by mid-height or tall native grasses including sideoats grama (*Bouteloua curtipendula*), little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), needle-and-thread (*Hesperostipa comata*). Tallgrass is characterized by the dominance of big bluestem. Due to its position on the periphery of the range of the mixed-grass prairie, Colorado has probably never supported extensive tracts of these types. Habitats characterized by mid- to tall-grass species are limited in Colorado, and most commonly occur as small patches interspersed among shortgrass prairie and sandsage, or in mesic areas near the foothills. The eastern plains mixed-grass remnants are generally in degraded condition, lacking the diversity and extent of mid- to tallgrass species that would have historically been present. Historically, foothills valleys and swales (now frequently filled with reservoirs or houses) would have supported tallgrass communities in Colorado. Now tallgrass prairie only occurs in small, scattered patches where moist soils are present, such as upland terraces above floodplains. Fire,

grazing, and drought are the primary ecological processes. The diversity within this habitat likely reflects both the short- and long-term responses of the vegetation to these often concurrent disturbance regimes. Fire suppression and overgrazing can lead to the invasion by woody species such as juniper and ponderosa pine. Conversion to agriculture likewise has probably decreased the range of these habitats within the state. Ongoing wind energy development may have some impact.

## Shortgrass Prairie

Shortgrass prairie supports 52 SGCN (Table 8). Shortgrass prairie, characterized by blue grama (*Bouteloua gracilis*), buffalo grass (*Bouteloua dactyloides*), and other short to mid-height species, once covered most of Colorado east of the mountain front, at elevations below 6,000 feet. Today, nearly 50% of our historic shortgrass prairie has been converted to row crop agriculture or other uses – the largest loss of any of Colorado's habitats. Remaining tracts have often been managed for domination of blue grama and exclusion of other grasses, with a consequent loss of native forb diversity. In the early 1800s, the shortgrass prairie was home to massive herds of free-ranging bison and pronghorn, as well as huge prairie dog colonies, deer, elk, and top predators such as the gray wolf and grizzly bear. Pronghorn and prairie dogs still inhabit Colorado's prairies in reduced numbers, and the former top predators have been replaced by coyotes.

Large-scale ecological processes such as drought, fire, and grazing by large animals exert strong influences on shortgrass. The short grass species that dominate this ecological system are tolerant of drought and grazing. Ongoing impacts include renewable and non-renewable energy production (wind, solar, geothermal, oil and gas, and biofuels) and continuing expansion of urban and exurban communities, especially along the Front Range. The continued presence of shortgrass prairie in our state may also be threatened by changing climate. Preliminary results from our climate change vulnerability assessment indicate that shortgrass prairie is highly vulnerable. Soil moisture is a key driver for this habitat; change in precipitation seasonality, amount, or pattern will affect soil moisture. Although these grasslands are adapted to warm, dry conditions, increasing warmer and drier conditions are likely to favor increasing growth of shrubby species (e.g., cholla [*Cylindropuntia imbricata*], snakeweed [*Gutierrezia sarothrae*]), especially in areas that are disturbed.

# RIPARIAN AND WETLAND HABITATS

## Playas

Playas support 16 SGCN (Table 8). Playas are shallow, temporary wetlands that occur throughout the shortgrass prairie on Colorado's eastern plains, as well as in limited distribution

on the western slope. They are ephemeral in nature, filling with water only after heavy rainfall. As would be expected of wet habitats in a dry environment, playas are very important habitat components for many species that inhabit or migrate through Colorado. Playas are threatened by conversion of surrounding native habitat to urban and/or agricultural uses, as well as indirect effects of such development (for example, road construction, sedimentation, pollution and runoff, deliberate filling). The current condition of playas is variable, but is generally fair to poor.

## Riparian Woodlands and Shrublands

Riparian woodlands and shrublands support 26 SGCN (Table 8). Riparian woodlands and shrublands occur throughout Colorado. At montane to subalpine elevations, riparian shrublands may occur as narrow bands of shrubs lining streambanks and alluvial terraces, or as extensive willow carrs in broad floodplains and subalpine valleys. They can also be found around seeps, fens, and isolated springs on hillslopes away from valley bottoms. Dominant shrubs within this elevation zone include alder (*Alnus tenuifolia*), birch (*Betula occidentalis*), dogwood (*Cornus sericea*), and willow (*Salix*) species. Generally the upland communities surrounding these riparian systems are either conifer or aspen forests. Many higher elevation riparian shrublands are associated with beaver (*Castor canadensis*) activity, which can be important for maintaining the health of the riparian ecosystem (historically this would have been true for lower elevation streams as well). Beaver dams abate channel down cutting, bank erosion, and downstream movement of sediment. They also raise the water table across the floodplain and provide year-round saturated soils. Plant establishment and sediment build-up behind beaver dams raises the channel bed and creates a wetland environment.

Montane to subalpine riparian woodlands are comprised of seasonally flooded forests and woodlands throughout the Rocky Mountains. They include the conifer and aspen woodlands that line montane streams. They are most often confined to specific riparian environments, occurring on floodplains or terraces of rivers and streams or in V-shaped, narrow valleys and canyons (where there is cold-air drainage). Less frequently, high elevation riparian woodlands are found in moderate to wide valley bottoms, on large floodplains along broad, meandering rivers, and on pond or lake margins. Riparian woodlands are tolerant of periodic flooding and high water tables. Snowmelt moisture in this system may create shallow water tables or seeps for a portion of the growing season.

At lower elevations on the western slope, riparian woodlands and shrublands are found within the flood zone of rivers, on islands, sand or cobble bars, and immediate streambanks. They often occur as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. Forests are typically dominated by cottonwood (*Populus angustifolia*, *P. deltoides*) and willow (*Salix* spp.), but may include maple (*Acer glabrum*), Douglas fir (*Pseudotsuga*

*menziesii*), spruce (*Picea* spp.), and juniper (*Juniperus* spp.). Shrublands are primarily dominated by willow, alder, and birch. Lower elevation riparian woodlands and shrublands are dependent on a natural hydrologic regime, especially annual to episodic flooding. These woodlands and shrublands grow within a continually changing alluvial environment due to the ebb and flow of the river, and riparian vegetation is constantly being "re-set" by flooding disturbance. In some areas, Russian olive (*Elaeagnus angustifolia*), tamarisk (*Tamarix* spp.), and other exotic species are common.

On the eastern plains, riparian woodlands and shrublands are generally dominated by plains cottonwood (*Populus deltoides*) and willow species, but also occur as a mosaic of multiple communities interspersed with herbaceous patches. They are found along small, medium and large streams on the plains, including the wide floodplains of the South Platte and Arkansas Rivers. Hydrologically, smaller rivers tend to have greater seasonal variation in water levels with less developed floodplain than the larger rivers, and can dry down completely for some portion of the year. Plains riparian areas are often subjected to heavy grazing and/or agriculture and can be heavily degraded. Tamarisk and less desirable grasses and forbs have invaded degraded examples throughout eastern Colorado. Groundwater depletion and lack of fire have created additional species changes.

Riparian woodlands and shrublands at higher elevations are in good to excellent condition. At lower elevations, however, conditions are only fair overall and can be poor in areas subjected to intense grazing, agricultural use, urban development, and/or hydrological alteration. Many of these communities have degraded understories, with weedy herbaceous layers and Russian olive and tamarisk invading the shrub layers. Cottonwood die-offs related to prolonged, intense drought and hydrological alterations have affected some stands.

## Wetlands

Non-riparian wetlands support 53 SGCN (Table 8). In Colorado, non-riparian wetland habitats include moist to wet meadows, emergent marshes, fens, and seeps and springs.

Meadows occur throughout Colorado, but most natural wet meadows are found within the montane to subalpine zone. Natural wet meadows are tightly associated with snowmelt or subsurface groundwater discharge, and are typically not subjected to high disturbance events such as flooding. Within mountain valleys and at lower elevations, extensive acres of wet meadows are also linked to irrigation practices, including flood irrigation and seepage from irrigation ditches. Natural wet meadows are dominated by native sedges and grasses, while those influenced by irrigation may be dominated by non-native pasture grasses.

Emergent marshes are wetlands that experience frequent or prolonged ponding. Marshes occur in depressions and kettle ponds, as fringes around lakes, along streams and rivers, and behind many types of impoundments. They can be found at all elevations, but are more common at mid to lower elevations. Standing water restricts the dominant species to robust wetland plants, such as cattail (*Typha*), bulrush (*Scirpus* and *Schoenoplectus* spp.), and large sedges (*Carex* spp.). At lower elevations, marshes can become densely vegetated if they are not periodically flushed by floodwater or mechanical thinning.

Fens are wetlands with thick organic soils that are supported by stable groundwater discharge. Fens are typically found within the montane to subalpine zone, generally above 7,000 feet, and can form along the edges of valley bottoms, at breaks in slope, around hillslope seeps, in shallow basins or anywhere where sufficient ground water emerges to perennially saturate soils. Fens are considered "old growth" wetlands, as the accumulation of thick organic soils can take thousands of years. Fen vegetation is generally characterized by a dense cover of sedges and moss, often intermixed with forbs and short to dwarf shrubs such as willow and bog birch (*Betula nana*).

Seeps and springs include small wetlands that are hydrologically supported by groundwater discharge. They are found throughout Colorado and can be a component of the previously described wetland types, but are most notable within the cliff and canyon country of the Colorado Plateau and the Lower Arkansas River basin.

Montane to subalpine wetlands are generally in good condition, though many acres are impacted by water diversions, groundwater pumping, and grazing of both domestic and wild animals. The condition of lower elevation wetlands, however, is far worse. Non-native species, including noxious weeds, are prevalent and may dominant many wetlands. Intensive water management and human development have greatly altered the timing and magnitude of flooding. In some locations, water has been diverted from natural wetlands. In others, storm water runoff and irrigation return flows have created or expanded wetland acres, but these systems experience flashy hydroperiods and degraded water quality.

# AQUATIC HABITATS

## Colorado Plateau - Wyoming Basins Rivers

Colorado Plateau – Wyoming Basins rivers support 31 SGCN (Table 8). This habitat includes the big rivers within the Colorado Plateau and Wyoming Basin ecoregions of Colorado's western slope: the Colorado, Gunnison, Green, Yampa, White, Dolores, San Juan and Animas Rivers. Larger-order rivers contain habitat features that are unavailable in smaller streams, particularly deep pools and runs, and large backwaters and inundated floodplain areas during high water. As

a result, they comprise the core habitat for several big-river fish species, though these species are also occasionally found in smaller streams. Condition of this habitat type varies, but is moderately or highly impacted for most of these rivers. Dams and diversions have altered the natural hydrograph to varying degrees. In most of these rivers, snowmelt-driven peak flows are greatly reduced, as are base flows in many cases. Peak flow timing may be altered such that these flows no longer coincide with the life-history requirements of big river fish species. Extensive flow management efforts are being made to redress that situation in some rivers. Additionally, dams and diversion structures function as barriers preventing upstream movement of fishes (though fish passage structures have been constructed at some). A number of these species are highly migratory and require many miles of unfragmented habitat in order to move between spawning and rearing, foraging, and overwintering areas. These changes, combined with channelization and bank hardening, impacts from energy development, bank stabilization by non-native vegetation (tamarisk, Russian olive), and other anthropogenic stressors, have degraded the condition of associated riparian habitats as well.

## Colorado Plateau – Wyoming Basins Streams

Colorado Plateau – Wyoming Basins streams support 27 SGCN (Table 8). This habitat includes tributaries to the big river systems within the Colorado Plateau and Wyoming Basins ecoregions of Colorado's western slope. Condition varies widely, with some streams in excellent condition, but the majority of streams are moderately or severely impacted. Dams and, especially, diversions have altered the natural hydrograph and fragmented habitat, to the extent of entirely dewatering some stream reaches. Other anthropogenic impacts include gravel mining and grazing within the riparian corridor, channelization and bank hardening, impacts from energy development, and encroachment of non-native vegetation (tamarisk, Russian olive), all of which have the potential to degrade water quality and the condition of associated riparian habitats.

## Eastern Plains Rivers

Eastern Plains rivers support 33 SGCN (Table 8). This habitat includes the mainstems of the South Platte and Arkansas Rivers, and the lower portions of major tributaries such as the Cache la Poudre River and St. Vrain Creek. These larger-order rivers contain habitat features generally not found in smaller plains streams, including occasional deep pools, secondary channels and backwaters, and inundated floodplain areas during high water. As a result, they comprise the core habitat for several plains fishes, though these species are also sometimes found in smaller tributaries. Condition is heavily impacted in terms of both water quality and water quantity. Dams and numerous large diversions have greatly altered the timing and magnitude of both peak and base flows, as well as other components of the natural hydrograph. In many reaches, treated municipal waste water and/or irrigation return flows maintain base flows at higher levels than

pre-alteration. A plethora of stressors from extensive urban and exurban development, and from agriculture, degrade both water quality and the condition of associated riparian habitats.

## Eastern Plains Streams

Eastern Plains streams provide primary habitat for 44 SGCN (Table 8). This habitat includes the tributaries to the big rivers of Colorado's eastern plains, and the Republican River and its tributaries. Most of these streams rise on the plains and thus have a hydrograph and temperature regime distinct from streams originating in the mountains. Streams in this region are of a diverse character. Many rise from springs and flow consistently in headwaters areas but subside into intermittency further downstream, only becoming more perennial again when they reach the alluvium of the mainstem. The more intermittent portions of these systems only fully connect during flood events, and at other times consist partly or entirely of isolated pools within a dry channel. Some plains fishes appear to be specifically adapted to this hydrologic regime, preferring or requiring standing-water, pond-like habitat, and utilizing periods of connectivity to redistribute and re-colonize habitat patches. A number of such naturally-occurring pools have been impounded, enlarged or otherwise made into more permanent ponds or small lakes, for stock watering or other human uses. These areas, though modified, comprise some of the most important habitat for several plains fish species, especially northern redbelly dace, and also plains topminnow, southern redbelly dace, and Arkansas darter. Streams in the Republican basin tend to be more historically perennial, as are a few larger tributaries such as the Purgatoire and St. Charles Rivers. Diversions and habitat degradation threaten all these streams to varying degrees. A more pressing threat throughout most of the region is drying and fragmentation due to groundwater irrigation depleting underlying aquifers. This threat is particularly dire in the Republican Basin, but is imminent throughout the Eastern plains.

## Lakes

Lakes support 25 SGCN (Table 8). This habitat type includes only natural lakes, the majority of which occur in the subalpine and montane zones. Very few lower-elevation natural lakes exist within Colorado; most of these are oxbow lakes, former river channels that became isolated, and are quite small. Because this habitat type occurs mostly at high elevations where human impacts and natural disturbances are limited, its condition is generally excellent.

## Mountain Streams

Mountain streams support 30 SGCN (Table 8). Mountain stream habitat includes high elevation streams on both sides of the Continental Divide. These streams are characterized by high gradient, cold temperatures, and a snowmelt-dominated hydrograph. Though few waterways in

Colorado have escaped some level of disturbance, mountain streams remain in good condition overall.

## Rio Grande Valley Rivers

Rio Grande Valley rivers are primary habitat for two Tier 1 SGCN (Table 8). This habitat consists of the mainstem Rio Grande and the Conejos River. The high elevation and distinct climate of this watershed differentiate it from other east slope drainages. Within the watershed, these larger-order rivers contain habitat features infrequently found in the tributaries, particularly deep pools and runs. Historically the Rio Grande and Conejos are known or believed to have been primary habitat for several endemic species. Native fish populations have been lost because of water diversions for irrigation, stream drying, and habitat degradation. Additionally, competition, predation, and hybridization by nonnative fish have contributed to extirpation of native fish populations in the Rio Grande and Conejos.

## Rio Grande Valley Streams

Rio Grande Valley streams are primary habitat for two Tier 1 SGCN (Table 8). This habitat includes the tributaries to the Rio Grande, the Conejos River, and the closed-basin streams of Saguache Creek and San Luis Creek. Condition of these streams varies, but most have low to moderate levels of impact. Diversions, mainly for agricultural use, have altered the natural hydrograph and fragmented streams to varying degrees, in some cases entirely dewatering stream reaches. The closed-basin streams remain less disturbed, although some are threatened by drying of the aquifer.

## Transition Zone Streams

Transition zone streams support 33 SGCN (Table 8). The abrupt transition from mountains to plains along the Front Range and east slope give rise to this habitat. At this juncture streams rapidly lose gradient, increase in sinuosity and acquire other characteristics of plains streams, but continue to have a snowmelt-driven hydrograph, colder temperatures and coarser cobble-gravel substrate, reflective of their origin in the mountains, for some distance downstream. These relatively short reaches of intermediate character comprise the sole habitat within Colorado for several "glacial relict" SGCN—species adapted to lower-gradient waters that are cooler than most Colorado plains streams—which are believed to have been "stranded" in this zone as glaciers receded. Because most Front Range cities were established along rivers at the base of the mountains, the transition zone is heavily impacted by many effects of urban development, and is among the most imperiled of aquatic habitats in Colorado. Additionally, it is likely especially vulnerable to climate change, with the prospect of species being "pinched" between warmer water downstream and unfavorable gradient upstream.

# OTHER HABITATS

## Alpine

Alpine habitats, which cover over 1.5 million acres in Colorado, support 32 SGCN (Table 8). Alpine includes high-elevation dry tundra, fellfield, wet-meadow, and rock and scree communities. Alpine tundra is found at the highest elevations in our state, usually above 11,000 feet. Here the long winters, abundant snowfall, high winds, and short summers create an environment too harsh for permanent human habitation. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season.

Old privately-owned mining claims are scattered throughout, but there are very few active mines operating today. In general, alpine tundra in Colorado is currently in excellent condition. The primary threat to this ecological system is global climate change, which could have significant impacts in the future. Preliminary results from our climate change vulnerability assessment suggest that alpine habitats are moderately vulnerable through mid-century. Snowpack patterns are important for this habitat. Thus, if Colorado experiences an increase in winter precipitation, alpine areas may be able to withstand some increase in temperature, at least in the short term, and especially in areas where it is difficult for trees to advance. At a longer time frame, however, alpine is likely to largely disappear from Colorado.

## Cliffs and Canyons

Cliffs and canyons support 34 SGCN (Table 8). Mountain cliffs and canyons habitats are found from foothill to subalpine elevations. They include barren and sparsely vegetated landscapes comprised of steep cliff faces, narrow canyons, and open tablelands, as well as the unstable scree and talus slopes that typically occur below cliff faces. Widely scattered trees and shrubs may be present. These highly erodible areas are generally too steep to allow any significant soil development. Erosion by wind, water, and the force of gravity is the primary natural disturbance process in the cliff environment. Cliffs and canyons have a naturally high rate of erosion; infiltration rates are low and runoff high. At cliff faces there is less hydraulic pressure retaining water within the rock, so liquid water is more consistently found than in the surrounding habitat types (Larson et al. 2000). Within the larger cliff habitat, steep slopes, small terraces ledges, overhangs, cracks and crevices often form a mosaic of microhabitat types that appears to be the primary factor contributing to cliff biodiversity (Graham and Knight 2004). Cliffs and bedrock outcrops are relatively free of anthropogenic disturbance, but the canyons where these often occur are rarely without roads. Human disturbance to this system may include road construction and maintenance, recreation (especially climbing), and the effects of mining.

On the eastern plains, this habitat type includes cliffs, outcrops, breaks and barrens, rimrock and erosional remnants of the High Plains escarpment, as well as other isolated buttes and outcrops to the south. Drought and wind erosion are the most common natural dynamics affecting this prairie system. Wind energy development is increasing on prairie cliff/canyon habitats, but in general, condition of cliff and canyon habitats is good. Many cliff and canyon habitats are virtually inaccessible and in excellent condition.

## Hot Springs

Hot Springs are the primary habitat for one Tier 2 SGCN (Table 8). These habitats are limited to physical settings that allow groundwater heated by geothermal processes to rise to the surface. Many of Colorado's hot springs have been developed for human recreation. Presumably this has had deleterious effects on habitat quality, but detailed condition of Colorado's hot springs has not been evaluated.

## Reservoirs and Shorelines

This habitat, though man-made, is significant for 10 of Colorado's Tier 2 SGCN (Table 8), most notably the federally listed Least tern and Piping plover. Reservoir and shoreline habitat is distributed across Colorado. The largest and most important from a habitat perspective include John Martin and other reservoirs in southeastern Colorado. The future of reservoir and shoreline habitats in Colorado is difficult to predict. It seems reasonable to assume that under a warming and drying climate scenario (the likeliest future for the eastern plains), water resources will become scarcer. This situation could potentially change the management of dams and reservoirs. If water levels recede, the amount of plover or tern nesting habitat varies with the topographic contours of the reservoir. Some might gain more isolated islands with lower water, while the opposite may also be true (more dry areas connected to shoreline). Depending on how and when such changes were made, impacts to SGCN are possible but currently unknown.

## Sand Dunes

Sand dunes are a primary habitat for four SGCN (Table 8). In Colorado, small sand dunes habitats occur in North Park and Middle Park, but the majority of sand dunes habitat occurs in the San Luis Valley. These environments are comprised of shifting, coarse-textured substrates and patchy or open grasslands or shrublands. Active and stabilized dune areas include a range of sparsely vegetated plant communities as well as barren or near barren (<5% total plant cover) portions of active sand dunes and sandsheet blowouts, where scattered individuals of early seral species such as blowout grass (*Redfieldia flexuosa*) and lemon scurfpea (*Psoralidium lanceolatum*), and (rarely) Indian ricegrass (*Achnatherum hymenoides*), are the only vegetation. The sandsheet may also include limited areas with woodlands of narrowleaf cottonwood or

ponderosa pine on otherwise sandy areas, as well as both shrubby and grassy areas where vegetation is acting to anchor dunes. Shrub dominated plant communities of the sandsheet are shrub steppe or shrublands dominated by rabbitbrush and other shrubs with a typically sparse herbaceous layer dominated by bunchgrasses. In early seral stages, vegetated dunes and sandsheet areas where shrubs are absent may be characterized by an herbaceous layer typically dominated by scurfpea and/or blowout grass, while in late seral stages Indian ricegrass, needle-and-thread or sand muhly (*Muhlenbergia arenicola*) are typical. The condition of most sand dune habitats in Colorado is very good, with the exception of those in North Park, where the dunes are impacted by recreational vehicle use and weeds.

# Agriculture

For the purposes of the SWAP, this habitat type is restricted to no-till and conventional till agriculture in both irrigated and dryland (non-irrigated) situations, including croplands and orchards. Though rangelands are an important component of our state's agricultural system, native rangelands are included under relevant grassland and shrubland habitat types and omitted from this section. Agricultural fields constitute a man-made environment, but they now serve as important habitat for 39 SGCN (Table 8).

The major cropping regimes in Colorado can be broken into three regions: the Eastern Plains, the northwest, and the southwest. Crops on the Eastern Plains include irrigated and dryland situations where the major crops are wheat, corn, millet, milo, and alfalfa. Some of these cropping systems will include a fallow year. Aside from tall grasses, growing wheat provides some of the most available nesting cover on the Eastern Plains for ground nesting birds, including northern bobwhite. Additionally, CPW has recently documented successful nesting of lesser prairie-chickens in growing wheat via GPS transmitters. Corn, millet, and milo provide loafing and foraging cover for a wide suite of wildlife, and can also provide good winter cover if adequate stubble heights are left after harvest. The fallow period in some cropped or the non-cropped portion of the year can provide habitat components for low structure and bare-ground associated species like mountain plover and burrowing owl. CPW research on mountain plover has documented significant use and successful nesting on fallow agricultural fields.

Northwest region crops consist mainly of irrigated grass hay, wheat, and alfalfa. Irrigated grass hay and alfalfa fields can provide a variety of wildlife cover, but are especially important brood-rearing cover for greater sandhill cranes and greater sage grouse. Wheat fields in the northwest provide much of the same cover as those on the Eastern Plains and are especially important for Columbian sharp-tailed grouse. Irrigated hayfields and meadows also mimic native wet meadows and provide substantial benefits to SGCN using that habitat type, particularly in the three significant mountain parks (North Park, Middle Park, and South Park). Again, the fallow

cover that is left as part of the cropping rotations provides nesting, brood-rearing, and foraging cover for wildlife.

Southwest region crops consist primarily of irrigated alfalfa, grown for seed and hay, and barley, with relatively smaller amounts of sunflower, corn and potato. Each of these crops provide some cover for wildlife during the growing season, but generally these crops do not provide much winter cover due to harvesting and other treatments that reduce stubble heights and residual cover. A significant percentage of crops grown within the southwest region are dependent on irrigation; there are not many acres of tilled ground in this region.

## Conservation Reserve Program

The Conservation Reserve Program (CRP) is a federal program executed by the U.S. Department of Agriculture's Farm Service Agency. The program pays landowners to retire cropped lands for 10 to 15 years at a time to address soil erosion, water quality and wildlife habitat concerns. The retired fields are planted to a perennial cover of grasses, forbs and/or shrubs. These lands, which frequently provide critical wildlife cover and are often in areas where production cropland is the primary land use, support 26 SGCN. CRP lands are important for sustaining populations of Gunnison sage grouse, plains and Columbian sharp-tailed grouse, lesser and greater prairie-chickens, and a suite of grassland nesting birds as well as many other species. Currently, Colorado has approximately 1.8 million acres of land enrolled in the CRP, down from a high of 2.2 million. Most CRP lands are in eastern Colorado, east of Interstate 25, but pockets of CRP west of the Continental Divide also support locally and regionally important wildlife populations such as the Dove Creek population of Gunnison sage-grouse, Columbian sharp-tailed grouse in Routt County, and an experimental transplant population of Columbian sharp-tailed grouse in Dolores and Montezuma counties.

Many CRP lands were planted in the late 1980s during the first program sign-up. Because of their age and low diversity seed mixes focusing only on soil erosion during the early sign-up periods, Colorado's CRP fields generally lack plant species and structural diversity, and often may be monotypic stands of smooth brome, sideoats grama, or crested wheatgrass. Thus, most of the state's fields would benefit from management efforts designed to enhance plant diversity and increase wildlife habitat benefits.

# Chapter 4: Threats and Conservation Actions Overview

This chapter presents updated information on the problems affecting Colorado's Species of Greatest Conservation Need (SGCN) and their habitats, as well as conservation actions needed to address problems and improve species' status. Current information on problems that may adversely affect SGCN or their habitats (i.e., "threats") was compiled from a number of different sources, including the 2006 SWAP, agency and partner biologists, and a variety of existing conservation assessments, conservation and management plans, CPW and CNHP databases, and published literature. There are myriad existing resources that present in-depth discussions of threats and/or needed conservation actions for many of the SGCN and their habitats. The purpose of the SWAP is not to re-create these resources. Rather, in this document we will summarize the most crucial aspects of biodiversity conservation in Colorado over the next 10 years. A list of additional resources, including management, conservation, and recovery plans, is presented in Appendix D.

This threat assessment was undertaken strictly from the perspective of wildlife conservation. Some of the identified practices are also necessary and highly valued public services and land uses – for instance, water development, residential development, recreation, mining, and agriculture. These activities provide important values and are legitimate, often vital public pursuits, from which all of society benefits. Nonetheless, aspects of some of these activities are sometimes harmful to wildlife and their habitats, which are also legitimate public values and resources; therefore, these actions pose challenges from the viewpoint of wildlife conservation. These challenges need to be identified in order to determine which are most harmful, and importantly, where opportunities for investments in remedial or preventive actions would be most effective and efficient.

## Updated Lexicon for Describing Threats & Actions

As noted in the 2006 SWAP, many sources use different language to describe essentially the same threats and conservation actions. In order to maintain consistency of threats/actions descriptions across species and habitats, "taxonomies" of threats and actions were created for the 2006 SWAP, based on work by The Nature Conservancy. In the interim, a standardized lexicon has been developed by the Conservation Measures Partnership[7] (Salafsky et al. 2008), and is

[7] The Conservation Measures Partnership (CMP) is a joint venture of conservation organizations and collaborators that are committed to improving the practice of conservation. Each organization within CMP has biodiversity conservation as its primary goal, has a focus on field-

recommended in the 2012 Best Practices for State Wildlife Action Plans guidance (AFWA 2012). For the 2015 SWAP, we have adopted the Salafsky lexicon's classification of general threats and conservation actions (Tables 5 & 6, respectively). The database that was developed to house information on SGCN and habitats for the 2006 SWAP has been updated to reflect the new lexicon. Use of the Salafsky lexicon will position the CPW to migrate SGCN information and conservation work planning to the Miradi program, a tool also developed by the Conservation Measures Partnership, in the future if it is determined that we can improve our conservation outcomes by doing so.

The Salafsky lexicon uses a three-level categorization scheme, with each level increasingly specific (Tables 5 & 6). As explained in Salafsky et al. (2008),

> *"An ideal classification for both threats and actions would be **simple** (uses clear language and examples and is understandable by all practitioners); **hierarchical** (creates a logical way of grouping items that are related to one another to facilitate use of the classification and meaningful analyses at different levels); **comprehensive** (contains all possible items, at least at higher levels of the hierarchy; consistent (ensures that entries at a given level of the classification are of the same type); **expandable** (enables new items to be added to the classification if they are discovered); **exclusive** (allows any given item to only be placed in one cell within the hierarchy); and **scalable** (permits the same terms to be used at all geographic scales)…The classifications are designed to be comprehensive, consistent, and exclusive for the first and second levels. The third level, by contrast, is at a much finer scale and thus only contains some illustrative examples rather than comprehensive listings of threats and actions at this level."*

An example of the three-level classification is:

Level 1 – Human Intrusions and Disturbance
  Level 2 – Recreational Activities
    Level 3 – hiking

Using this lexicon will allow for large-scale analyses (e.g., allowing federal agencies and national non-governmental organizations to assess threats across states), but it must also provide enough specificity to direct meaningful conservation action in Colorado. Thus, we have modified it to include additional Level 1 and Level 2 categories that were deemed necessary to adequately describe the situation in Colorado, and added more detailed entries in Level 3.

As with any classification method, there are various ways to categorize and "lump or split," and all options ultimately force some degree of simplification onto very complex and inter-related issues. The Salafsky lexicon is no exception, and readers may experience a degree of discomfort with some applications of this method. We remind those readers that the SWAP is a statewide, strategic document that is intended to highlight the most significant conservation issues across

based conservation actions, and is working to develop better approaches to project design, management, and assessment. For additional information, visit http://www.conservationmeasures.org/.

our state. As such, it is a first step in conservation planning that is appropriately supported by a series of more in-depth species and habitat conservation plans. Existing and needed species/habitat plans are addressed in the tables and narratives that follow.

**Table 5. Lexicon of threats according to Salafsky et al. 2008.**

Threats marked with an asterisk (*) are not included in Salafsky et al. (2008), but we have determined that they are needed to fully express threats to SGCN in Colorado.

| Level 1 | Level 2 (general threats in Tables 7 & 8) | Level 3 – illustrative examples (specific threats in Tables 7 & 8) |
|---|---|---|
| **1 Residential & Commercial Development** Threats from human settlements or other non-agricultural land uses with a substantial footprint | **1.1 Housing & Urban Areas** Human cities, towns, and settlements including non-housing development typically integrated with housing (e.g., shopping areas, offices, schools, hospitals) | • Housing, urban, and ex-urban development<br>• Hobby livestock – domestic sheep and goats associated with exurban development |
| | **1.2 Commercial & Industrial Areas** Factories and other commercial centers (e.g., manufacturing plants, military bases, power plants, train yards, airports) | |
| | **1.3 Tourism & Recreation Areas** Tourism and recreation sites with a substantial footprint (e.g., ski areas, golf courses, county parks, campgrounds) | • Recreation area developments |
| **2 Incompatible Agriculture**[8] Threats from farming and ranching as a result of agricultural expansion and intensification, including silviculture and aquaculture | **2.1 Annual & Perennial Non-Timber Crops** Crops planted for food, fodder, fiber, fuel, or other uses (e.g., farms, plantations, orchards, vineyards, mixed agroforestry systems) | • Conversion to cropland<br>• Early/often pasture and hayfield cutting (nest destruction)<br>• Intensive agricultural operations<br>• Loss of compatible CRP lands<br>• Poor quality CRP lands |
| | **2.2 Wood & Pulp Plantations** Stands of trees planted for timber or fiber outside of natural forests, often with non-native species (e.g., silviculture, Christmas tree farms) | |

[8] In Salafsky et al. (2008), this threat is "Agriculture and Aquaculture." For the purposes of this SWAP, we have changed this threat to "Incompatible Agriculture," in recognition of the role that some agricultural lands play in providing wildlife habitat.

| Level 1 | Level 2<br>(general threats in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific threats in Tables 7 & 8) |
|---|---|---|
| | **2.3 Livestock Farming & Ranching**<br>Domestic terrestrial animals raised in one location on farmed or non-local resources (farming); also domestic or semi-domesticated animals allowed to roam in the wild and supported by natural habitats (ranching) (e.g., cattle feed lots, dairy farms, cattle ranching, chicken farms) | • Altered native vegetation<br>• Decreased water quality (nutrient load from cattle)<br>• Degradation of alpine habitats from sheep grazing & disturbance by guard dogs<br>• Incompatible timing, intensity, duration of grazing<br>• Range improvement operations<br>• Reduced grass and forb diversity<br>• Transmission of pathogens |
| | **2.4 Marine & Freshwater Aquaculture**<br>Aquatic animals raised in one location on farmed or non-local resources; also hatchery fish allowed to roam in the wild | |
| **3 Energy Production & Mining**<br>Threats from production of non-biological resources | **3.1 Oil & Gas Drilling**<br>Exploring for, developing, and producing petroleum and other liquid hydrocarbons (e.g., oil wells, natural gas drilling) | • Altered native vegetation<br>• Behavioral avoidance of oil/gas development & associated infrastructure<br>• Fragmentation of native habitat due to oil/gas development & associated infrastructure |
| | **3.2 Mining & Quarrying**<br>Exploring for, developing, and producing minerals and rocks (e.g., coal mines, alluvial gold panning, gold mines, rock quarries) | • Mining operations<br>• Rock mining in nesting & winter habitat<br>• Uranium mining |
| | **3.3 Renewable Energy**<br>Exploring, developing, and producing renewable energy (e.g., geothermal power production, solar farms, wind farms, birds flying into windmills) | • Collision with wind turbines<br>• Behavioral avoidance of renewable energy development & associated infrastructure<br>• Fragmentation of native habitat due to renewable energy development & associated infrastructure |
| **4 Transportation & Service Corridors**<br>Threats from long narrow transport corridors and the vehicles that use them, including associated wildlife mortality | **4.1 Roads & Railroads**<br>Surface transport on roadways and dedicated tracks (e.g., highways, secondary roads, logging roads, bridges and causeways, road kill, fencing associated with roads) | • Collision (e.g., auto)<br>• Fragmentation |
| | **4.2 Utility & Service Lines**<br>Transport of energy & resources (e.g., electrical and phone wires, oil and gas pipelines, electrocution of wildlife) | • Collision (e.g., powerlines) |

| Level 1 | Level 2<br>(general threats in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific threats in Tables 7 & 8) |
|---|---|---|
| | **4.3 Shipping Lanes** (*not applicable to Colorado*) | |
| | **4.4 Flight Paths**<br>(e.g., impacting birds) | • Low-flying military jets & helicopters |
| **5 Biological Resource Use**<br>Threats from consumptive use of "wild" biological resources including both deliberate and unintentional harvesting effects; also persecution or control of specific species | **5.1 Control of Nuisance Species or Collecting**[9]<br>Killing or trapping wild animals for commercial, recreation, subsistence, research or cultural purposes, or for control/persecution reasons | • Extermination / evictions in urban settings<br>• Loss of habitat due to prairie dog control<br>• Mortality and prey reduction through rodent control<br>• Poisoning (indirect effect of prairie dog control) |
| | **5.2 Gathering Terrestrial Plants**<br>Harvesting plants, fungi, and other non-timber/non-animal products for commercial, recreation, subsistence, research or cultural purposes, or for control reasons | |
| | **5.3 Logging & Wood Harvesting**<br>Harvesting trees and other woody vegetation for timber, fiber, or fuel (e.g., clear cutting of hardwoods, pulp operations, fuel wood collection) | • Clearcutting<br>• Even-age timber management<br>• Removal of cavity trees<br>• Fragmentation<br>• Replacement of mature/old growth with younger, more even-aged stands |
| | **5.4 Fishing & Harvesting Aquatic Resources**<br>Harvesting aquatic wild animals or plants for commercial, recreation, subsistence, research, or cultural purposes, or for control/persecution | |
| **6 Human Intrusions & Disturbance**<br>Threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources | **6.1 Recreational Activities**<br>People spending time in nature or traveling in vehicles outside of established transport corridors, usually for recreational reasons (e.g., off-road vehicles, snowmobiles, mountain bikes, hikers, skiers, birdwatchers, pets in rec areas, temporary campsites, caving, rock-climbing) | • Campsites and hiking<br>• ORV trail development and use<br>• Motorized and non-motorized recreation<br>• Recreational caving<br>• Rock climbing, hiking near cliffs & crevices<br>• Trails in drainages near nests<br>• Unregulated backcountry winter recreation |

[9] In Salafsky et al. (2008), this threat is "Hunting and Collecting Terrestrial Animals." Salafsky's terminology is intended to address conservation needs at a global scale, including places where hunting is not managed. For the purposes of Colorado's SWAP, the reference to hunting in this context was deemed to be misleading and inappropriate. Thus, we have re-named this threat category.

| Level 1 | Level 2<br>(general threats in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific threats in Tables 7 & 8) |
|---|---|---|
| | **6.2 War, Civil Unrest & Military Exercises**<br>Actions by military forces without a permanent footprint (e.g., tanks and other military vehicles, training exercises and ranges, defoliation, munitions testing) | |
| | **6.3 Work & Other Activities**<br>People spending time in or traveling in natural environments for reasons other than recreation, military activities, or research (e.g., law enforcement, drug smugglers, illegal immigrants, vandalism) | • Proximal non-recreation disturbance |
| **7 Natural System Modifications**<br>Threats from actions that convert or degrade habitat in service of "managing" natural or semi-natural systems, often to improve human welfare | **7.1 Fire & Fire Suppression**<br>Suppression or increase in fire frequency and/or intensity outside of its natural range of variation (e.g., fire suppression to protect homes, inappropriate fire management, escaped agricultural fires, arson, campfires) | • Altered fire regime<br>• Fire suppression leading to high intensity fires<br>• Altered fire regime and juniper encroachment<br>• Wildfires exacerbated by climate change |
| | **7.2 Dams & Water Management/Use**<br>Changing water flow patterns from their natural range of variation either deliberately or as a result of other activities (e.g., dam construction, dam operations, sediment control, change in salt regime, wetland filling, levees and dikes, surface water diversion, groundwater pumping, channelization, artificial lakes) | • Altered hydrological regime – dewatering<br>• Altered hydrological regime – siltation and sedimentation<br>• Altered hydrological regime – wetland drainage<br>• Altered hydrological regime – altered flow and fluctuating water temperatures<br>• Decreased water quality and/or quantity<br>• Natural system modification (hydrological) - dam, diversion, or drop structure construction or modification<br>• Natural system modification (hydrological) – groundwater pumping and surface water diversions<br>• River flow management and riverbank protection<br>• Scouring floods<br>• Water storage<br>• Fragmentation due to diversion structures without fish passage |

| Level 1 | Level 2<br>(general threats in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific threats in Tables 7 & 8) |
|---|---|---|
| | **7.3 Other Ecosystem Modifications**<br>Other actions that convert or degrade habitat in service of "managing" natural systems to improve human welfare (e.g., land reclamation projects, abandonment of managed lands, rip-rap along shorelines, mowing grass, tree thinning in parks, beach construction, removal of snags from streams) | • Altered animal community (change in predator/prey balance)<br>• Altered animal community (loss of beaver)<br>• Altered native vegetation (cottonwood/willow degradation)<br>• Altered native vegetation (loss of older aspen stands)<br>• Altered native vegetation (loss of shoreline nesting, roosting, and perching habitat)<br>• Altered native vegetation (riparian area deforestation, denuding of wetland vegetation)<br>• Altered native vegetation (seral stage imbalance)<br>• Altered native vegetation (streambank cover reduction)<br>• Cave/mine closures and grating<br>• Fragmentation<br>• Natural system modification - wetland filling, eutrophication, siltation |
| **8 Invasive & Other Problematic Species & Genes**<br>Threats from non-native and native plants, animals, pathogens /microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance | **8.1 Invasive Non-Native/Alien Species**<br>Harmful plants, animals, and microbes not originally found within the ecosystem(s) in question and directly or indirectly introduced and spread into it by human activities (e.g., feral cattle, household pets, zebra mussels) | • Invasive animals - bullfrogs<br>• Invasive animals - European starlings<br>• Invasive animals - white sucker<br>• Invasive animals – aquatic predators (e.g., smallmouth bass, northern pike, walleye, burbot)<br>• Invasive plants – tamarisk<br>• Invasive plants – cheatgrass |
| | **8.2 Problematic Native Species**<br>Harmful plants, animals, or microbes that are originally found within the ecosystem(s) in question, but have become "out-of-balance" or "released" directly or indirectly due to human activities (e.g., overabundant native deer) | • Habitat loss / degradation due to beetle kill<br>• Habitat loss due to insect damage and fire<br>• Predation and parasites |
| | **8.3 Introduced Genetic Material**<br>Human altered or transported organisms or genes (e.g., pesticide resistant crops, using nonlocal seed stock, genetically modified insects for biocontrol) | • Invasive animals - hybridization |

| Level 1 | Level 2<br>(general threats in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific threats in Tables 7 & 8) |
|---|---|---|
| | **8.4 Pathogens**[10] | • Loss of prairie dog colonies due to sylvatic plague<br>• Pathogen - canine distemper<br>• Pathogen - chytrid fungus<br>• Pathogen - respiratory disease caused by *Pasteurellacea* and *Mycoplasma* bacteria<br>• Pathogen - sylvatic plague<br>• Potential for white-nose syndrome to be introduced |
| **9 Pollution**<br>Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources | **9.1 Household Sewage & Urban Waste Water**<br>Water-borne sewage and non-point runoff from housing and urban areas that include nutrients, toxic chemicals and/or sediments (e.g., discharge from municipal waste treatment plants, leaking septic systems, fertilizers and pesticides from lawns and golf-courses) | • Water pollution |
| | **9.2 Industrial & Military Effluents**<br>Water-borne pollutants from industrial and military sources including mining, energy production, and other resource extraction industries that include nutrients, toxic chemicals and/or sediments | • Waste or residual materials (excess sediment loads)<br>• Waste or residual materials (mine tailings, excess sediment loads, etc.) |
| | **9.3 Agricultural & Forestry Effluents**<br>Water-borne pollutants from agricultural, silvicultural, and aquaculture systems that include nutrients, toxic chemicals and/or sediments (e.g., nutrient loading from fertilizer runoff, herbicide runoff, manure from feedlots, soil erosion) | • Herbicide/pesticide spraying or runoff (grasshopper control)<br>• Herbicide/pesticide spraying or runoff and nonpoint source pollution<br>• Nutrient loads<br>• Pesticide spraying (prey reduction)<br>• Poisoning (fire ant insecticides)<br>• Reduced water quality due to herbicide/pesticide runoff |
| | **9.4 Garbage & Solid Waste**<br>Rubbish and other solid materials including those that entangle wildlife | |

[10] In Salafsky et al. (2008), pathogens are not split out as a separate threat. However, there are several pathogens causing significant impacts to SGCN, and we found it useful to create an additional category for this threat.

| Level 1 | Level 2<br>(general threats in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific threats in Tables 7 & 8) |
|---|---|---|
| | **9.5 Air-Borne Pollutants**<br>Atmospheric pollutants from point and nonpoint sources (e.g., acid rain, smog from vehicle emissions, excess nitrogen deposition) | • Air pollution (precipitating/concentrating on high elevation snow fields) |
| | **9.6 Excess Energy**<br>Inputs of heat, sound, or light that disturb wildlife or ecosystems (e.g., noise from highways or airplanes, heated water from power plants, lamps attracting insects) | |
| **10 Geological Events**<br>Threats from catastrophic geological events | **10.1 Volcanoes** (*not applicable to Colorado*) | |
| | **10.2 Earthquakes/Tsunamis** (*not likely to be applicable to Colorado*) | |
| | **10.3 Avalanches/Landslides**<br>Avalanches or landslides | |
| **11 Climate Change & Severe Weather**<br>Threats from long-term climatic changes which may be linked to global warming and other severe climatic/weather events that are outside of the natural range of variation | **11.1 Habitat Shifting & Alteration**<br>Major changes in habitat composition and location (e.g., desertification, tundra thawing) | • Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados)<br>• Habitat shifting and alteration due to climate change |
| | **11.2 Droughts**<br>Periods in which rainfall falls below the normal range of variation (e.g., severe lack of rain, loss of surface water sources) | • Lack of water due to drought and exacerbated by climate change |
| | **11.3 Temperature Extremes**<br>Periods in which temperatures exceed or go below the normal range of variation (e.g., heat waves, cold spells, disappearance of glaciers) | |
| | **11.4 Storms & Flooding**<br>Extreme precipitation and/or wind events (e.g., thunderstorms, tornados, hailstorms, ice storms or blizzards, dust storms) | • Climate variability (e.g., prolonged rain or hail events) |
| **12 Organizational Capacity and Management***<br>Inability to implement effective conservation measures due to lack of goal/policy alignment across agencies and stakeholders, lack of dedicated funding sources, institutional barriers to coordination | **12.1 Lack of Coordination** | |

| Level 1 | Level 2 (general threats in Tables 7 & 8) | Level 3 – illustrative examples (specific threats in Tables 7 & 8) |
|---|---|---|
| | **12.2 Lack of Funding** | |
| | **12.3 Lack of Common Goals** | |
| | **12.4 Confused or Gaps in Authorities** | |
| | **12.5 Legislation/Policy Changes** | |
| **13 Lack of Knowledge*** Inability to determine priorities for what/when/where conservation action is needed due to poor understanding of species needs | **13.1 Complete Distribution in Colorado Unknown** | |
| | **13.2 Critical Life History/Habitat Components Unknown** | |
| | **13.3 Genetic Relationship with Other Subspecies Unknown** | |
| | **13.4 Population Status Unknown** | |
| | **13.5 Population Trend Unknown** | |
| | **13.6 Response to Change, Disturbance, & Other Threats Poorly Understood** | |
| **14 Natural Factors*** Life history traits that contribute to species' vulnerability and warrant management attention or influence effectiveness of potential conservation approaches | **14.1 Scarcity (leading to inbreeding depression)** | |
| | **14.2 Low Annual Recruitment** | |
| | **14.3 Low Reproductive Rate** | |
| | **14.4 Nest Predation** | |
| | **14.5 Competition** | |
| | **14.6 Loss of Species from Suitable Habitat** | |

# Overview of Threats to Biodiversity in Colorado

This section provides a very brief overview of the major threats to biodiversity in Colorado. We highlight here the primary issues related to the threats that affect many SGCN and/or are widely distributed across the state. These narratives are far from exhaustive, and are intended only as a simple synopsis to help readers understand the primary ways in which various threats interact with and on species and/or their habitats. As previously noted, many of these issues are closely related to each other, and interact in complex ways. A single threat likely has multiple adverse impacts, and each adverse impact may be coming from multiple threats. Teasing apart the cumulative effects of multiple threats for each SGCN is a dizzying task that exceeds the scope of this SWAP. Our goal here is to illuminate the most crucial conservation and research needs, and to support on-going conservation planning at more localized landscape, species and habitat-

specific scales. We have focused attention on threats that are currently known to be affecting SGCN and their habitats within Colorado, or that are considered likely to impact these resources in the foreseeable future. Many species cross state and international boundaries, especially birds. Conservation activies in other parts of these species' ranges are important, but are beyond the scope of Colorado's SWAP. Past activities that have ceased or are no longer threatening SGCN at the population level, and thus are not likely to drive conservation decisions over the next 10 years, are not considered major threats in this SWAP.

Throughout this document, threats are discussed in the order presented in the Salafsky lexicon. In the following section, threats that are not applicable in Colorado have been omitted.

## 1 Residential & Commercial Development

The most obvious impact of residential and commercial development is complete destruction of native habitat, as woodlands, grasslands, etc. are replaced by buildings and pavement. Other impacts include alteration of the local hydrology. One very significant impact is the damming and diversion of natural waterways to provide increased water availability for larger human populations (see following section on hydrological modification for more on this). Hard surfaces such as pavement prevent infiltration of storm water, which increases the quantity of runoff into surface creeks and streams, and decreases the augmentation of groundwater and moisture availability for plants' root zones. This runoff may be tainted by fertilizers, pesticides, motor oil, pharmaceuticals, and myriad other pollutants. Areas of residential and commercial development also change species dynamics, such as predator/prey relationships and competition among species for food/shelter resources. Examples include introduction of domestic predators (such as house cats and dogs) and increasing numbers of urban-adapted meso-predators (such as raccoons and foxes), as well as proliferation of weeds that out-compete native plant species (thus changing the food and cover resources available for wildlife). Furthermore, species that some consider pests, such as bats, prairie dogs, and predators, may be intentionally exterminated. Residential and commercial development and accompanying roads, utility corridors, and other infrastructure fragment native habitats. This can result in wildlife being confined to patches of habitat that are too small to sustain populations, and too far apart for individuals to move between. Ripple effects of growing urbanization also include increased recreational pressure on surrounding natural areas.

# 2 Incompatible Agriculture

## *2.1 Cropland*

Like residential and commercial development, conversion to cropland replaces native habitats with row crops, hay fields, and so on. Agricultural fields still provide habitat components, such as food and cover, for some wildlife species. This is especially true for crop fields that are retired into the Conservation Reserve Program and seeded with seed mixes appropriate to the local native wildlife. However, activities associated with agricultural production, such as plowing, tilling, and mowing, can be fatal to species that inhabit agricultural fields. Use of herbicides, pesticides, and insecticides may kill native species outright, or have indirect impacts such as reduction in food resources (insects, seeds, etc.) that lower wildlife species' health, reproductive success, and/or ability to survive migration or winter. Perhaps most important of all, much of the water management that adversely affects many species and habitats is driven by the need for irrigation to sustain crop agriculture. Over 80% of the water delivered in Colorado goes to agricultural uses (http://www.coloradowater.org). Some of the same concerns for residential and commercial development relative to water quality and quantity also apply to cropland.

## *2.3 Livestock Farming & Ranching*

Livestock farming and ranching can have positive or negative influences on habitats, depending on how it is conducted and the specific habitat in question. In extensive grasslands, such as those on Colorado's eastern plains, the ecological system has historically been maintained by grazing and browsing animals (such as bison, pronghorn, and prairie dogs), and the plant species that are typical of grasslands have evolved to withstand these pressures. Likewise, the wildlife species that live in grasslands have evolved to inhabit a variety of habitat niches created by native grazers, which historically included a mosaic of bare ground, very short grass, mid-height grass, and shrub patches. In the absence of free-ranging bison, livestock ranching is now the primary tool available to maintain the health of grassland systems. However, ranching practices often reduce the heterogeneity of this landscape matrix, such that many grasslands are now characterized by fences, homogenous structure, and reduced native species. These conditions are less suitable for many grassland species. Other ways that livestock ranching may reduce habitat suitability for wildlife include seeding of non-native pasture grasses; reduction or loss of palatable native grass and forb species; an increased percentage of unpalatable grass and forb species; and potential for degraded riparian zones (soil compaction, increased runoff leading to gullying, downcutting, lowered water table, and loss of riparian vegetation). Predator and prairie dog control is also a common component of grazing management.

Other habitats that have not evolved with grazing as a primary disturbance are more likely to experience changes in plant structure, species composition, increased soil disturbance and erosion, and/or spread of invasive weeds. For example, livestock grazing in pinyon-juniper has greatly reduced the presence and functioning of biological soil crusts, and increased the

incidence of weeds, especially cheatgrass. Proliferation of cheatgrass changes the characteristics of wildfire, with a number of consequences, including altering the density of vegetation and the ability of native plant species to regenerate. Domestic sheep grazing in the alpine can alter species composition of tundra communities.

Although some agricultural activities pose an ongoing threat to wildlife, it should be noted that ranching and farming are also critical to maintaining numerous wildlife populations. Agricultural practices preserve open space and provide sources of concentrated food and cover that would not otherwise exist. Examples include wild ungulate use of croplands and irrigation practices that create wetlands and reservoirs. Without these contributions, it is highly doubtful that Colorado could support current populations of deer, elk, waterfowl and shorebirds or the present number of recreational fishing opportunities that now exist.

# 3 Energy Production & Mining

## *3.1 Oil & Gas Drilling*

Oil and gas development involves a complex series of exploration and production activities, and includes associated infrastructure such as well pads, pipelines, and roads. The footprint of oil and gas development is dependent upon how densely pads are sited (for example, one pad per 640-acre section versus one pad per five acres or multiple pads per acre). Impacts to terrestrial wildlife include habitat conversion and behavioral avoidance of areas where humans and infrastructure are present. In addition, there may be negative impacts associated with the increased noise associated with drilling and operating wells or transfer stations. Aquatic wildlife are affected as well. A significant amount of water is used in drilling, followed by disposal of contaminated water post-drilling. Water polluted with toxic chemicals can have significant effects on a variety of species, including fish and aquatic insects, amphibians, wading birds, and riparian vegetation, among others. For those species where oil and gas is listed as a threat, the use of BMPs is likely appropriate at a site-specific scale. However, to fully mitigate these impacts, the planning, implementation, and mitigation of oil and gas activities need to be carried out at much larger scales, as appropriate to the landscape that these various species inhabit.

## *3.2 Mining & Quarrying*

Mining and quarrying destroy habitat, and have a variety of indirect effects on wildlife. Mining can contaminate streams via leaching of newly exposed rock and chemicals associated with the mining process itself. Past mining of silver, gold, and uranium continue to negatively impact water quality of large rivers and streams. For example, the Upper Arkansas and Las Animas Rivers have elevated levels of heavy metals, which have resulted in an overall decrease in aquatic fauna, including reduced fish productivity and loss of some aquatic insect species. Sand and gravel mining operations are typically near rivers and streams, where they impact hydrologic

flow and patterns, with resultant loss or degradation of riparian vegetation, including the cottonwood galleries and understory shrubs and herbaceous plants that provide cover and food resources for wildlife. Mining for resources such as coal and molybdenum can reduce both air and water quality.

### *3.3 Renewable Energy*

Wind, solar, geothermal, and biofuels energy production continue to grow throughout the state. While these renewable sources of energy are important to pursue for a variety of reasons, they also come with potential for adverse impacts to wildlife. Most of the wind energy development is occurring in the eastern prairie region, with consequent impacts (at least localized) on some species, especially birds and bats. Impacts include behavioral avoidance and collision with turbines. Like traditional means of energy production, all forms of renewable energy production increase habitat fragmentation with associated roads and transmission lines. Many of the same issues associated with crop agriculture also apply to biofuel production.

## 4 Transportation & Service Corridors

### *4.1 Roads & Railroads*

The most significant impact of roads at a landscape scale is fragmentation of habitat. At its most basic, fragmentation refers to the change from large, contiguous areas of suitable habitat to smaller units of suitable habitat, interspersed with areas of, essentially, non-habitat (road surfaces, urban areas, and so on), as well as an overall decrease in the total amount of habitat available. The size of habitat patches, number of patches, and distance between patches that constitute fragmentation is variable, depending on the species. Fragmented habitat is also qualitatively different from non-fragmented habitat, in terms of which species are present, amount of light and moisture, relative temperature, and a host of other factors that influence whether or not a given species can continue to thrive in that place. Fragmentation from roads can be variable, depending not only on the species, but also on the size of the road, speed of traffic, and volume of traffic.

Other impacts of roads are alteration of local hydrology (quantity and flow patterns of runoff), altered rates of erosion and sedimentation in nearby waterbodies, and pollution from motor oil, gasoline, de-icing agents, and other chemicals. A related threat from roads and railroads is the potential for catastrophic spills of toxic materials. Infrastructure related to road crossings (bridges, culverts) can create barriers to fish movement. Construction and use of roads are significant vectors for weeds, and right-of-way maintenance (mowing, application of herbicides) can adversely impact native species, as well as their food and cover resources. Lastly, of course, roads can be a significant source of mortality for animals that cross roads (especially slow animals such as turtles and amphibians) or bask on roads (such as snakes and lizards). Roads can

also be a significant local source of mortality for highly mobile species such as elk, mule deer, and many smaller animal species.

### *4.2 Transmission & Service Lines*

Impacts from transmission lines include electrocution of birds and bats, disturbance from right-of-way maintenance, introduction of vertical structure within habitats that provide perches for raptors, and introduction and spread of noxious weeds. Transmission lines can also contribute to habitat fragmentation, depending upon their density, siting, and design.

## 5 Biological Resource Use

### *5.1 Control of Nuisance Species & Collecting*

Intentional control or persecution of native species that are considered pests by some people is a threat for several SGCN. Chief among these are the three species of prairie dog (black-tailed, white-tailed, and Gunnison's), as well as bats that use human dwellings and other buildings. Prairie dogs are removed for a variety of reasons, including to make way for residential and commercial development, and to improve forage availability for domestic cattle. However, prairie dogs are crucial components of ecosystems that support a myriad of other species, some of whom can not persist without the dens and prey base that prairie dogs provide. Several of the SGCN identified in this document are of conservation concern, at least in part, due to the dramatic reduction in prairie dogs.

### *5.3 Logging & Wood Harvesting*

Like grazing, the harvesting of timber can be used as a tool for enhancing habitats, or it can pose threats to native wildlife species, depending on where, when, and how it is conducted. Use of appropriate silivicultural practices in appropriate forest types is not considered a threat to the forest type or wildlife species that occur in that forest type. Appropriate silivicultural prescriptions would be those that mimic natural disturbances in both size and scale across a given area. Wildlife species that evolved in these forested environments are resilent to disturbances that are caused by natural processes. Logging could be considered a threat when it does not mimic natural ecological disturbances in size and prescription.

## 6 Human Intrusions & Disturbance

### *6.1 Recreational Activities*

Colorado residents and visitors are fortunate in the vast array of recreation opportunities our state has to offer. However, when not managed appropriately, recreationists can have significant impacts on native wildlife. Access roads fragment habitat, construction and use of trails introduce weeds, and the presence of humans and their pets can disturb wildlife, potentially

leading to abandonment of nest sites, feeding or wintering areas, and other important habitats. Hiking and climbing too close to cliff faces and edges disturbs nesting raptors, and caving can cause abandonment of bat maternity roosts and winter hibernacula. Off-road vehicles can damage stream crossings, wetlands, and vegetation; lead to increased erosion and sedimentation; spread noxious weeds; and facilitate poaching. In addition, noise, unpredictable human presence, and disturbance from motorized recreation can lead to wildlife avoiding or abandoning habitat. Any disturbance during winter (skiing, snowmobiling) that causes wildlife to flee could result in an expenditure of energy reserves needed to survive winter.

# 7 Natural Systems Modifications

## *7.1 Fire & Fire Suppression*

Many of Colorado's forests and shrublands have evolved with periodic wildfires. In these ecosystems, fire maintains a heterogenous landscape (and thus a variety of habitat types) by controlling the density of trees and shrubs, creating forest openings, regenerating decadent stands, and supporting reproduction (for example, in species that require fire to germinate seeds). Historic fire regimes are out of balance across much of the American West, due primarily to a century of fire suppression. When natural wildfires are routinely put out, trees become denser and understory fuels (leaf litter, needle duff, downed woody debris, etc.) accumulate. In addition, other natural processes such as insect and disease disturbances may become unbalanced. The ultimate result of these cumulative effects is wildfire that burns hotter and faster, and is more likely to spread into the tree canopy. Wildfires that occur too frequently or burn too intensely can have catastrophic impacts on soil and water resources. Extremely high temperatures can sterilize soil, eliminating its ability to support plant regrowth. Excessive erosion can result in significant reduction in water quality, as well as restructuring of river and stream channels, which alters the types, quality, and amount of suitable habitat for aquatic species. Future threats from wildfire are expected to be exacerbated by climate change.

## *7.2 Dams & Water Management/Use*

Dams and the management and use of water have a multitude of complex effects on wildlife and their habitats. Dams themselves replace habitat outright. The operation of dams directly affects the timing, volume, and temperature of flows, and indirectly affects many closely related habitat characteristics, including transfer of sediments, oxygen levels, support of riparian vegetation, and a host of others. The use of water involves diversions (piping water from one basin to another, irrigation canals, and so on), channelization of rivers and streams, groundwater pumping, and other means of removing water from rivers. Some of the results include, but are not limited to, flattening of the hydrograph, alteration of the quantity, duration, timing, and intensity of high or low flow events (floods, droughts), patterns of erosion & sedimentation that are incompatible with wildlife needs, and barriers to fish movement. Many riparian and wetland plants, the basis

of crucial habitat for many species of wildlife, require specific conditions to germinate, grow, and reproduce. The amount of water in surface and groundwater systems is directly related to whether or not these species can survive. Likewise, the amount of water, temperature of the water, chemical composition and clarity of water determine whether or not fish can successfully spawn, obtain sufficient food, elude predators, survive winter, and so on. Seasonal timing of when specific conditions occur (high flows, low flows, scouring floods, etc.) is also very important for aquatic and riparian species. All these habitat characteristics are either supported or degraded by the ways in which water is managed and used.

### *7.3 Other Ecosystem Modifications*

For the purposes of this SWAP, we have used the term "other ecosystem modification" as a catch-all category when causes of stress are so multi-faceted that teasing out major contributors is uncertain, or when stresses are apparent but causes are unknown.

## 8 Invasives, Problematic Native Species, & Pathogens

### *8.1 Invasive Non-Native Species*

Invasive non-native species are plants or animals that have been introduced into local ecosystems, usually as a result of human activity. Non-native species that become established are often able to out-compete native species for required resources, prey on native species, and/or hybridize with native species. This can lead to reduced abundance, altered distribution, or constricted range of native species. Other impacts could include altered food webs, reduction of reproductive success, health/vigor, and/or overwinter survival, or total elimination of native species from the area. Examples of non-native plants with significant impacts on native wildlife and their habitats include tamarisk, leafy spurge, and cheatgrass, among a host of others. Non-native animals include a variety of introduced sport fish, bullfrogs, zebra mussels, red-eared sliders, and Eurasian collared doves, among others.

### *8.2 Problematic Native Species*

Problematic native species are those that naturally occur in an ecosystem, but have become out of balance. In the absence of native predators, elk have proliferated in some places to the point that they are degrading willow carrs and aspen stands. Species such as coyotes, raccoons, crows and ravens can also become out of balance when there are artificial food sources or a lack of top level predators that would naturally suppress populations. Insects such as mountain pine and spruce beetles are native to Colorado. These insects are a natural disturbance process that helps maintain forest ecosystems. However, a variety of factors, including increased temperature, drought, and – in some cases – fire suppression, have contributed to very severe insect outbreaks and significant tree mortality across the state. The effects of climate change can increase these threats.

### *8.4 Pathogens*

A number of pathogens are having significant impacts on SGCN in Colorado. Sylvatic plague can greatly reduce prairie dog abundance, affecting not only the prairie dogs themselves, but also the myriad of species that use or rely on prairie dogs. Plague and canine distemper are significant problems for recovery of black-footed ferrets, a federally-listed endangered species. Chytrid fungus has been implicated in extreme declines in boreal toads, and may be related to declines in northern leopard frogs as well. Bighorn sheep are being impacted by respiratory disease caused by *Pasteurellacea* and *Mycoplasma* bacteria. Whirling disease has contributed to the collapse of wild trout populations in the western U.S. and is considered a threat to Colorado's native cutthroat trout. White-nose syndrome, a fungal disease in bats first detected in New York in 2006, has decimated some bat populations in the eastern U.S., and is moving westward. Though this disease has not yet been documented in Colorado, as of 2014 it was documented as far west as the Missouri/Kansas border. The potential exists for it to pose significant future threats to some SGCN.

## 9 Pollution

### *9.1 Household Sewage & Urban Waste Water*

Housing and urban areas are a source of pollutants that enter Colorado waters. Developed areas have large coverage of impervious surface (pavement, buildings) and other land with impaired drainage that increase the amount of runoff and carry nutrients, toxic chemicals and/or sediments (e.g., discharge from municipal waste treatment plants, leaking septic systems, fertilizers and pesticides from lawns and golf-courses). These pollutants may be harmful to both aquatic and terrestrial plants and animals. Species near housing and urban areas are most likely to be impacted, but effects can be far-reaching.

### *9.2 Industrial & Military Effluents*

Industrial and military activities can also be a source of water-borne pollutants. Resource extraction and industrial activities including mining, energy production, and manufacturing, especially those that require large amounts of water, can release nutrients, toxic chemicals and/or sediments into the water. Pollution may be incremental with cumulative effects, or accidental spills may introduce large quantities of pollutants during a single episode.

### *9.3 Agricultural & Forestry Effluents*

Runoff of herbicide and pesticide applications in both cropland and forested areas are a primary source of water-borne pollutants from these activies. Increased sedimentation in the local watershed is also likely to result from certain tillage or lumber harvest activities.

### *9.5 Air-Borne Pollutants*

Atmospheric deposition (air pollutants deposited to ecosystems) occurs in both wet deposition through rain, snow, cloud or fog, and as dry deposition via dust and gases. Atmospheric pollutants may come from both point and nonpoint sources (e.g., acid rain, smog from vehicle emissions, excess nitrogen deposition). Atmospheric nitrogen and sulfur deposition can change water chemistry and thereby impact aquatic vegetation, invertebrate communities, amphibians, and fish.

## 11 Climate Change & Severe Weather

Climate projections for Colorado are generally in agreement that the state will experience temperatures that are 2-5 °F warmer than current temperatures by mid-century[11]. Projections for future precipitation are variable, ranging from very dry to approximately 10% wetter than current conditions. Moisture increases are more likely for winter; projections for summer precipitation are highly variable, especially for precipitation associated with monsoonal rains. Elevations below approximately 8,000 feet are likely to experience increasing amounts of annual moisture as rain rather than snow. A potential for changes in El Niño/La Niña effects may lead to extreme wet years followed by extreme dry years, which could have significant impacts to wildlife and their habitats.

As part of the SWAP revision process, we conducted a habitat-based climate change vulnerability assessment. The results of that work are summarized in Appendix F of this document. The full technical report can be obtained from CNHP or accessed online[12].

How climate change will ultimately manifest in Colorado, as well as potential impacts to wildlife species and habitats, is largely unknown at this point. To the best of our ability to estimate, we presume that some potential impacts could include those listed below. This same caveat applies to most of the climate change narrative in the species summaries that follow. Though much of this information is speculative, it represents our best professional judgment given the information available to us, until such time as more focused research results become available.

### *11.1 Habitat Shifting & Alteration*

As temperatures increase and precipitation regimes change, suitable climatic conditions for species and/or habitats may shift in elevation or latitude. There is the potential for this to result

[11] The full range of projected temperature increase across all emissions scenarios at mid-century vary from 1.5 to 6.5 degrees warmer; late-century projections vary from 1.5 to 9.5 degrees warmer. See http://wwa.colorado.edu/climate/co2014report for the complete set of projections.

[12] http://www.cnhp.colostate.edu/download/documents/2014/CO_SWAP_Enhancement_CCVA.pdf

in different tree, shrub, and understory species dominating the landscape. In the future, we may see novel plant communities[13] emerge or significant loss of current communities.

### *11.2 Drought*

Drought is a natural component of the climate in the arid West, with fluctuations between wet years and dry years typical. As temperatures across Colorado warm, we may experience more frequent and intense droughts – periods in which precipitation and soil moisture is below normal – with consequent changes in which plant and animal species can survive, and an overall decrease in plant vigor. Past extreme droughts, such as those experienced in 2002 and 2012, have impacted a number of species (blue grama, spruce, lodgepole, aspen, and pinyon pine). Similar scenarios may become more familiar as climate change progresses.

### *11.3 Temperature Extremes*

Colorado's future climate is expected to include warmer temperatures overall, as well as more frequent and/or extended periods when temperatures go above or below what we have historically considered normal. We are likely to experience more frequent and extended heat waves, and fewer cold spells of the type that control insect populations. Warmer temperatures on average, even without extremes, are likely to produce earlier snowmelt and peak runoff, more precipitation falling as rain instead of snow, increased moisture stress for some wildlife species and their habitats, and potential impacts on seed production/germination and growth of various plant species. These changes will have direct impacts on wildlife habitats, rendering some areas unsuitable for species that currently live there and providing new opportunities for other species to colonize.

### *11.4 Storms & Flooding*

As global climate continues to change, Colorado may experience increased frequency and/or severity of extreme precipitation and/or wind events, thunderstorms, damaging hail, tornados, dust storms, and ice or snow storms. Potential effects include changes in habitats – examples include large areas of windthrow in forests and scouring of rivers and streams.

## 12 Organizational Capacity & Management

To appropriately manage and conserve wildlife and their habitats, it is necessary for agencies, researchers, non-governmental organizations, and others involved in this work to collaborate, share information and resources, and support each other's efforts. Lack of alignment in goals, bureaucratic obstacles to cooperation, and lack of resources are some examples of what we mean by the "threat" of organizational capacity and management. Other examples include lack of guidance or regulatory documents such as recovery plans to direct conservation action. Field

[13] For the purposes of the SWAP, we can interpret plant communities to be roughly equivalent to habitat types.

staff workloads exceed staffing for many conservation agencies, and this forces work strategy to be reactive rather than proactive. Increasing the capacity of agencies by increasing staffing where possible, finding and developing efficiencies, and collaborating to greater extents may alleviate some of this conservation threat.

## 13 Lack of Knowledge

Effective wildlife management and conservation requires sufficient understanding of life history and habitat requirements, distribution, relationships among species, effects of management interventions in habitats, and so on. It is also important to understand responses of non-target species to management and conservation practices (for example, grazing prescriptions, pinyon-juniper removal). Incomplete knowledge inhibits our ability to identify and interpret potential threats and decide on appropriate course(s) of action.

## 14 Natural Factors

For the purposes of the SWAP, this category has been included to address issues related to conservation status or life history characteristics that contribute to vulnerability. These include scarcity, out of balance inter-species relationships such as predation and competition, and reproductive success. In many cases, threats addressed in the SWAP as natural factors are, in fact, products of a variety of interacting human impacts.

# Overview of Conservation Actions

Similar to the threats descriptions in the previous section, the following narratives are intended to give readers a general understanding of the types of conservation and management activities that might be undertaken to improve the status of SGCN and their habitats in Colorado. They are not comprehensive, but they illustrate the types of strategies and actions that are proposed or suggested in the species and habitat narratives that follow, and in Tables 7 and 8. Standards and practices for conservation and habitat management are always evolving. In addition, the specifics of "who," "how," and so on are often highly contingent upon local conditions. Thus we do not consider the statewide SWAP to be the most appropriate venue for prescribing conservation action methods. However, to provide general guidance for project planning, we include examples of the types of activities that might be employed to achieve conservation goals, as appropriate.

**Table 6. Lexicon of conservation actions according to Salafsky et al. 2008.**

Actions marked with an asterisk (*) are not included in Salafsky et al. (2008), but we have determined that they are needed to fully express conservation needs in Colorado.

| Level 1 | Level2<br>(general actions in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific actions in Tables 7 & 8) |
|---|---|---|
| **1 Land/Water Protection**<br>Actions to identify, establish or expand parks and other legally protected areas | **1.1 Site/Area Protection**<br>Establishing or expanding public or private parks, reserves, and other protected (e.g., national parks, wildlife sanctuaries, private reserves) | |
| | **1.2 Resource & Habitat Protection**<br>Establishing protection or easements of some specific aspect of the resource on public or private lands (e.g., easements, development rights, water rights, instream flow rights, wild and scenic river designation) | • Acquire conservation easement for habitat protection<br>• Acquire water rights or instream flow rights |
| **2 Land/Water Management**<br>Actions directed at conserving or restoring sites, habitats and the wider environment | **2.1 Site/Area Management**<br>Management of protected areas and other resource lands for conservation (e.g., site design, demarcating borders, putting up fences, training park staff, control of poachers) | • Coordinate on ecologically sensitive design of recreational facilities<br>• Employ grazing as a tool for compatible vegetation cover, structure, composition<br>• Implement compatible forest management<br>• Implement compatible grazing practices<br>• Implement seasonal closures<br>• Manage public use to be compatible with biodiversity<br>• Manage to limit disturbance, especially to roost sites, maternity colonies, and hibernacula |
| | **2.2 Invasive/Problematic Species Control**<br>Controlling and/or preventing invasive and/or other problematic plants, animals, and pathogens | • Control bullfrogs<br>• Control non-native birds<br>• Control non-native fish<br>• Control non-native plants<br>• Manage research, management, and recreation activities to control the spread of pathogens<br>• Remove tamarisk through biological, chemical, mechanical means and prevent re-establishment<br>• Write and/or implement integrated weed/pest management plan |

| Level 1 | Level2<br>(general actions in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific actions in Tables 7 & 8) |
|---|---|---|
| | **2.3 Habitat & Natural Process Restoration**<br>Enhancing degraded or restoring missing habitats and ecosystem functions (e.g., creating forest corridors, prairie re-creation, riparian tree plantings, prescribed burns, breaching levees, dam removal, fish ladder) | • Adjust operation of dam<br>• Employ grazing as a tool for compatible vegetation cover, structure, composition<br>• Implement streambank or in-stream restoration<br>• Improve erosion and excess sedimentation conditions<br>• Improve status of prairie dogs<br>• Maintain appropriate patch size and habitat mosaic<br>• Maintain connectivity (e.g., wildlife over/under passes, habitat corridors, fish passages)<br>• Manage caves/mines for native bats<br>• Re-seed native species<br>• Restore native habitat<br>• Restore native understory species<br>• Restore natural fire regime<br>• Restore riparian vegetation & hydrologic regime |
| **3 Species Management**<br>Actions directed at managing or restoring species, focused on the species of concern itself | **3.1 Species Management**<br>Managing specific plant and animal populations of concern (e.g., harvest management of wild mushrooms, culling buffalo to keep population size within park carrying capacity, controlling fishing effort) | • Develop and implement active disease management program<br>• Develop proactive conservation program<br>• Implement existing management/recovery plan<br>• Maintain deer/elk populations within carrying capacity for healthy habitat<br>• Reduce nest predators<br>• Write and implement management/recovery plan |
| | **3.2 Species Recovery**<br>Manipulating, enhancing or restoring specific plant and animal populations, vaccination programs (e.g., artificial nesting boxes, clutch manipulation, supplementary feeding, disease/parasite management) | • Maintain genetic connection/integrity within and between populations<br>• Provide artificial nesting boxes/platforms<br>• Reduce nest predators |
| | **3.3 Species Re-Introduction**<br>Re-introducing species to places where they formally occurred | • Re-introduce extirpated native species<br>• Translocate species to historic range |

| Level 1 | Level2<br>(general actions in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific actions in Tables 7 & 8) |
|---|---|---|
| | **3.4 Ex-Situ Conservation**<br>Protecting biodiversity out of its native habitats (e.g., captive breeding, artificial propagation, gene banking) | |
| **4 Education & Awareness**<br>Actions directed at people to improve understanding and skills, and influence behavior | **4.1 Formal Education**<br>Enhancing knowledge and skills of students in a formal degree program (e.g., public schools, colleges and universities, continuing education) | |
| | **4.2 Training**<br>Enhancing knowledge, skills and information exchange for practitioners, stakeholders, and other relevant individuals in structured settings outside of degree programs (e.g., monitoring workshops or training courses, learning networks or how-to manuals, stakeholder education on specific issues) | • Educate development industries about avoiding and/or mitigating wildlife impacts<br>• Improve communication among researchers and policy/decision-makers<br>• Improve knowledge of species, habitats, problems, via professional meetings and other venues |
| | **4.3 Awareness & Communications**<br>Raising environmental awareness and providing information through various media | • Implement landowner outreach/education and incentives programs<br>• Publish educational material/sponsor educational programs to raise public awareness |
| **5 Law & Policy**<br>Actions to develop, change, influence, and help implement formal legislation, regulations, and voluntary standards | **5.1 Legislation**<br>Making, implementing, changing, influencing, or providing input into formal government sector legislation or polices (e.g., state ballot initiatives, providing data to policy makers, zoning regulations, species protection laws) | |

| Level 1 | Level2<br>(general actions in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific actions in Tables 7 & 8) |
|---|---|---|
| | **5.2 Policies & Regulations**<br>Making, implementing, changing, influencing, or providing input into policies and regulations affecting the implementation of laws at all levels: international, national, state/provincial, local/community, tribal (e.g., input into agency plans regulating certain species or resources, working with local governments or communities to implement zoning regulations, promoting sustainable harvest on state lands) | • Encourage use of Farm Bill programs<br>• Establish mitigation requirements for developments<br>• Monitor water quality standards<br>• Promote consideration of biodiversity issues in transportation and land use planning processes<br>• Promote zoning that concentrates use and protects habitat<br>• Provide incentives for homeowners to increase tolerance of bats<br>• Work with state and federal partners to limit density of oil/gas leasing and development |
| | **5.3 Private Sector Standards & Codes**<br>Setting, implementing, changing, influencing, or providing input into voluntary standards & professional codes that govern private sector practice (e.g., Conservation Measures Partnership Open Standards, corporate adoption of forestry best management practices, sustainable grazing by a rancher) | • Implement Best Management Practices for<br>o agricultural production<br>o energy development & mining<br>o forest management<br>o livestock grazing<br>o transportation, urban development, landscaping<br>o water resource management |
| | **5.4 Compliance & Enforcement**<br>Monitoring and enforcing compliance with laws, policies & regulations, and standards & codes at all levels (e.g., water quality standard monitoring, initiating criminal and civil litigation) | • Enforce 404 wetlands regulations<br>• Enforce hunting, fishing, collecting regulations<br>• Enforce state/federal/local pollution standards<br>• Enforce wildlife and habitat protection laws<br>• Enforce travel regulations |

| Level 1 | Level2<br>(general actions in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific actions in Tables 7 & 8) |
|---|---|---|
| **6 Livelihood, Economic & Other Incentives**<br>Actions to use economic and other incentives to influence behavior | **6.1 Linked Enterprises & Livelihood Alternatives**<br>Developing enterprises that directly depend on the maintenance of natural resources or provide substitute livelihoods as a means of changing behaviors and attitudes (e.g., ecotourism, nontimber forest product harvesting) | |
| | **6.2 Substitution**<br>Promoting alternative products and services that substitute for environmentally damaging ones (e.g., farmed salmon as a replacement for pressure on wild populations, promoting recycling and use of recycled materials) | |
| | **6.3 Market Forces**<br>Using market mechanisms to change behaviors and attitudes (e.g., certification, positive incentives, grass and forest banking, valuation of ecosystem services such as flood control) | |
| | **6.4 Conservation Payments**<br>Using direct or indirect payments to change behaviors and attitudes (e.g., quid-pro-quo performance payments, resource tenure incentives) | • Implement the NRCS Black-footed Ferret Initiative program<br>• Implement Purchase/Transfer Development Rights program for habitat protection<br>• Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) |
| | **6.5 Non-Monetary Values**<br>Using intangible values to change behaviors and attitudes (e.g., spiritual, cultural, links to human health) | |
| **7 External Capacity Building**<br>Actions to build the infrastructure to do better conservation | **7.1 Institutional & Civil Society Development**<br>Creating or providing non-financial support & capacity building for non-profits, government agencies, communities, and for-profits (e.g., creating new local land trusts) | |

| Level 1 | Level2<br>(general actions in Tables 7 & 8) | Level 3 – illustrative examples<br>(specific actions in Tables 7 & 8) |
|---|---|---|
| | **7.2 Alliance & Partnership Development**<br>Forming and facilitating partnerships, alliances, and networks of organizations (e.g., Conservation Measures Partnership) | • Coordinate with related agencies to align goals, policies, measures of success<br>• Coordinate with related agencies to identify and secure funding<br>• Engage in collaborative, proactive planning and conservation programs |
| | **7.3 Conservation Finance**<br>Raising and providing funds for conservation work (private foundations, debt-for-nature swaps) | • Provide economic assistance for private land habitat improvements and/or species conservation |
| **8 Research and Monitoring***<br>(general actions in Tables 7 & 8) | | • Conduct primary research on species and habitat responses to changing climate<br>• Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing)<br>• Research critical life history/habitat components<br>• Research population parameters and/or monitor status.<br>• Research species/habitat response to management<br>• Research and develop an effective plague vaccine and delivery system<br>• Research genetic relation to other (sub)species |

# 1 Land/Water Protection

In the conservation community, the term "protect" as applied to private land refers to the acquisition of real property interest in land or water. In other words, a protection strategy involves purchase of land, development rights, or water rights for the purpose of preventing conversion or permanent loss of habitat. Types of actions that fall under the land/water protection category including purchase of land to establish preserves, sanctuaries, or parks; conservation easements that allow some uses (such as livestock grazing) but prohibit others (such as erections of homes or infrastructure); purchase of in-stream flow or water rights (for example, to maintain sufficient water in rivers and streams to support fisheries or waterbird populations);

and purchase or transfer of development rights programs (the right to build on a specific property is sold or traded for the right to build on a different property).

Protection strategies as applied to public lands include creation of new parks, monuments, or other conservation areas from publicly owned land, as well as special area designations such as Wilderness Areas, Research Natural Areas, Special Interest Areas, and so on. Management of these lands is based on specified allowable uses and activities, with a focus on conservation of specified natural resources (e.g., species, ecosystems, ecological processes). Examples of protection strategies as employed in Colorado include creation of the Great Sand Dunes National Park and Preserve, private preserves owned by The Nature Conservancy, the myriad of conservation easements held by Colorado's land trust community, the Transferred Development Rights program in Boulder County, and Colorado Water Conservation Board's Instream Flow Program. In the case of all these protection strategies, the destruction of habitat is, in effect, prohibited by law.

## 2 Land/Water Management

For the purposes of the SWAP, management of land and water encompasses the majority of activities that agencies and conservationists undertake to restore, maintain, or enhance the quality and function of ecological systems. This type of strategy can be applied to any habitat, regardless of land ownership. This category includes design and implementation of human activity and land use (for example, livestock grazing practices, forest management, recreation infrastructure) in a manner that is compatible with the needs of native wildlife species. Efforts to improve habitat condition or restore ecological processes are also included. A small sample of these include: weed control; realignment and rehabilitation of trails; adjusting the operation of dams to change the amount and timing of peak flows; planting of appropriate native species where vegetation has been damaged or to establish desired habitat structure; controlled burns to prevent catastrophic wildfire or to regenerate habitat; restoration of damaged streambanks or removal of instream barriers, and many more. Many habitat restoration projects require control of non-native or problematic species. Control of non-native vegetation might involve use of herbicides, fire, grazing, biocontrol, or other acceptable practices. Control of non-native animal species may consist of activities such as manual collection/removal, chemical control, and species-specific traps. Because many control methods have potential for negative impacts on non-target, sensitive native species, extreme care should be taken in adapting methods to site-specific needs. Management strategies are usually voluntary, and though they are often prescribed in agency management plans and similar strategic documents, they are generally not required by law.

## 3 Species Management

Species management strategies are actions that focus on particular species, rather than on habitats or ecosystems. Examples include culling herds, controlling fishing or hunting of particular species, relocation or re-introduction of species that have been lost from historically occupied habitat, captive breeding programs, and seed or gene banking. These activities are undertaken to improve the abundance, distribution, and health of particular populations, or of a species across its range. Species management strategies are most often employed for species that are hunted or fished, or species that have suffered precipitous declines and are in danger of extinction or extirpation. Two high-profile species management programs in Colorado are the captive breeding and re-introduction of black-footed ferrets, and the re-introduction of lynx.

## 4 Education & Awareness

Education and awareness strategies focus on people for the purpose of improving understanding and influencing behavior (Salafsky et al. 2008). Education may refer to formal degree programs, information sharing among professionals (workshops, conferences, and training programs), or activites to raise the awareness of the general public on issues concerning threats to species/habitats. Public awareness activities may be targeted toward people with interest in a particular issue, private landowners managing large acreages or significant habitats, or policy- and law-makers with influence over species and habitats, among others. CPW is engaged with many other entities in a cooperative, collaborative effort to deploy numerous private land biologists across the state. These collaborations have occurred with CPW, Rocky Mountain Bird Observatory, Natural Resources Conservation Service, Rocky Mountain Elk Foundation, Pheasants Forever, and in the past, Colorado Watershed network.

## 5 Law & Policy

Law and policy strategies involve formal government, and include laws as well as policies and regulations that guide interpretation and implementation. These are actions to develop, change, influence, and implement formal legislation, regulations, and voluntary standards. Examples include the Endangered Species Act and associated take permits, and permitting for development projects under the the National Environmental Policy Act or the Clean Water Act. This category also includes activities geared toward changing existing laws and regulations, such as ballot initiatives, and enforcement of existing laws, as well as local community codes and ordinances (such as land use zoning). Implementation of voluntary industry standards in both public and private enterprise is also considered a policy strategy. Examples include commitment to the use of Best Management Practices by the transportation, energy production, mining, forestry, and

agricultural industries. Note that proper use of Best Management Practices involves the careful articulation of what these practices entail, based on the particular species, suite of species, or habitat(s) that are of concern. In many cases, Best Management Practices do not currently exist, and would need to be developed. The State of Colorado, through several agencies, has developed some BMPs, but more work remains to be done.

## 6 Livelihood, Economic & Other Incentives

Livelihood, economic and other incentives involves the development, implementation and evaluation of programs intended to provide incentive for conservation-minded landowners to maintain their operations while also contributing to the net conservation benefit of a species or suite of species. Incentives can be delivered in several avenues. This may include using market forces to provide a value for ecosystem services such as flood control, conservation payments as a direct payment for conservation behavior, or non-monetary values where the incentives are something other than financial. Particular examples include mitigation banking, initiatives for participation in recovery of at-risk species such as the black-footed ferret, and credits for offsite habitat protection. The U.S. Department of Agriculture provides funds for habitat improvement and other conservation measures through a number of its Farm Bill programs. Species/habitat banks and crediting programs are increasing in Colorado as methods are developed, tested, and improved. The Farm Bill and other incentive or market-based programs can offer important benefits to species that rely on privately-owned land for a significant portion of their habitat(s). Managers and conservationists can encourage use of these programs by educating landowners on opportunities available, providing technical assistance on project design and implementation, and offering guidance on application process(es).

## 7 External Capacity Building

External capacity building describes actions that are intended to build infrastructure to do better conservation. The partnerships required to undertake the large-scale, meaningful conservation to aid in the long-term survival of many species and habitat types is covered by this action. This may involve the creation or provision of non-financial support and capacity building for non-profits, government agencies, communities and for-profits. It may also involve the forming and facilitation of partnerships, alliances and networks of organizations, and finally may involve the raising and provision of funds for conservation work. In some cases, alignment of policies and goals across agencies, in conjunction with implementation of conservation-compatible industry practices is needed. One example of this would be conservation of prairie dogs and associated species, where collaboration among state and local agencies and private landowners are needed to maintain viable populations of prairie dog species and the SGCN for which they create habitat.

# 8 Research & Monitoring

Research and monitoring actions are those that collect and use scientific information to assess population status, species response to various management techniques, habitat treatments, and many other aspects of wildlife management and conservation. Long-term research and monitoring can provide important ecological insights; both are very important for the improved management of SGCN, priority habitats, and treatments intended to benefit either.

# Chapter 5: Threats and Actions for SGCN

## Summary of Threats

Overall, lack of knowledge and natural systems modifications (including alteration of natural hydrological and fire regimes) are issues for the greatest number of Colorado's 159 vertebrate animal and mollusk SGCN (Figures 3–5). Lack of knowledge is a factor for over half of these SGCN – this is especially true for Tier 2 species. Impacts from non-native or problematic native species (including pathogens), habitat conversion (cropland, urban development), and incompatible agricultural practices are also significant for many SGCN. Of the 55 Tier 1 SGCN, more than half are affected by these threats. For descriptions of the threats represented in the figures below, refer to Chapter 4 and Table 5.

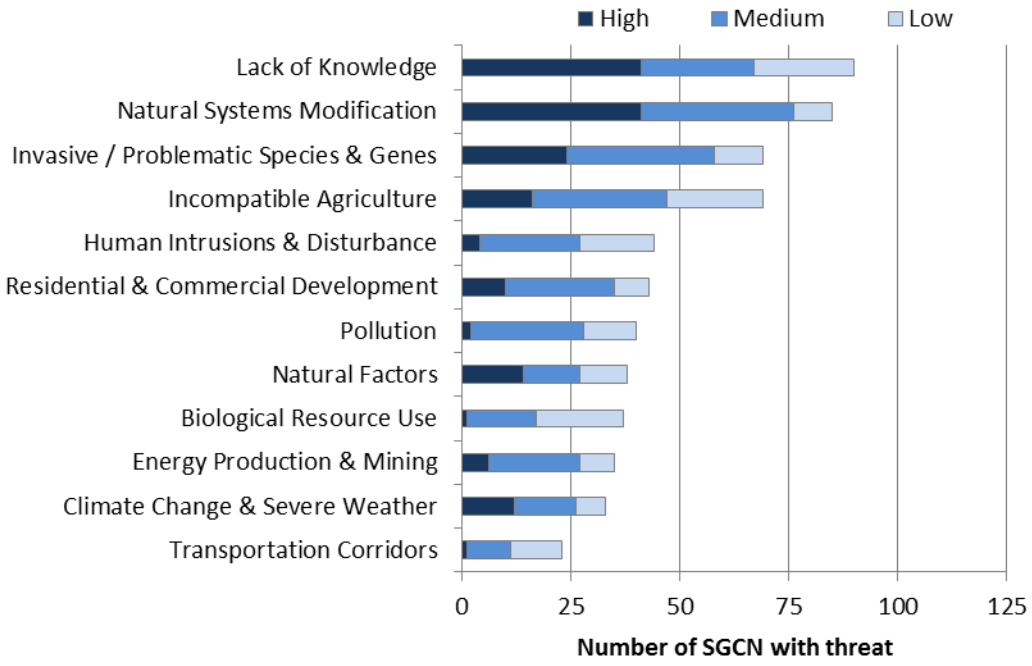



**Figure 3. Threats to vertebrate and mollusk SGCN by priority.**

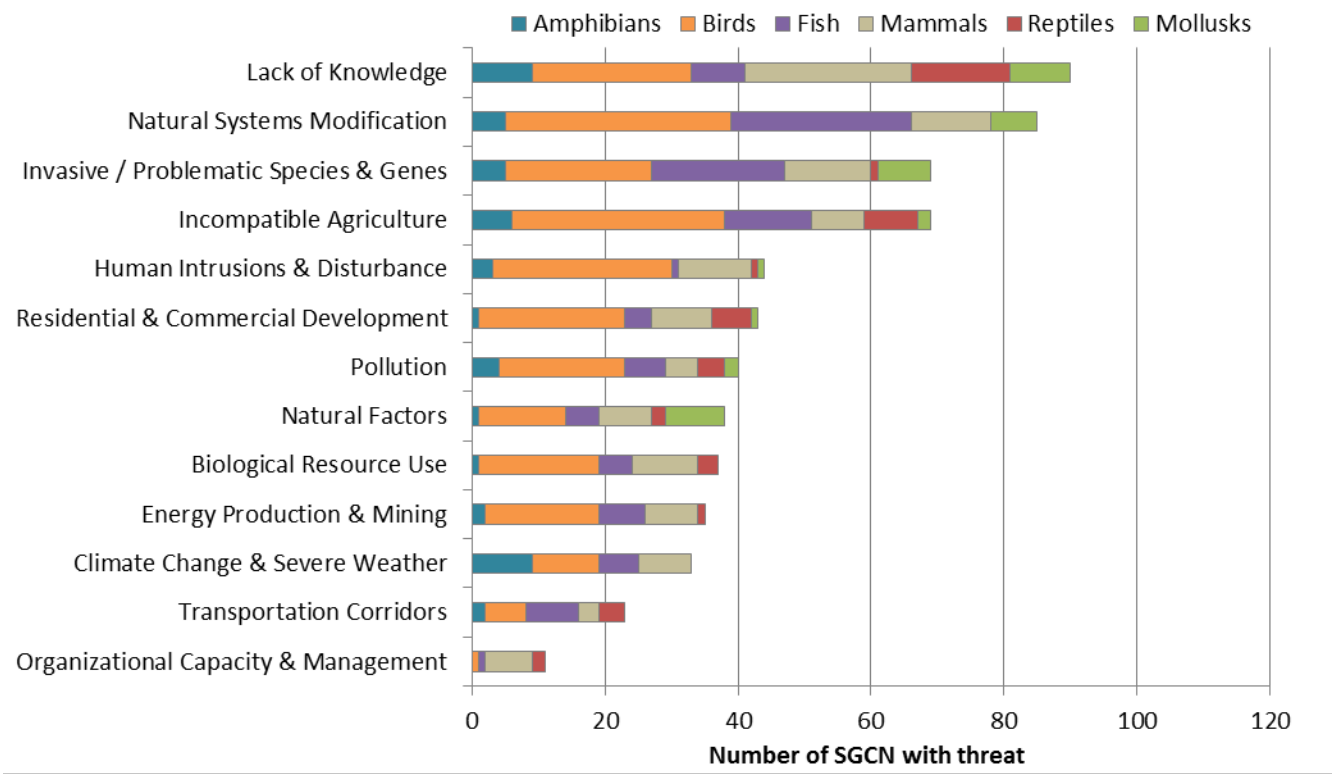



**Figure 4. Threats to vertebrate and mollusk SGCN by taxonomic group.**

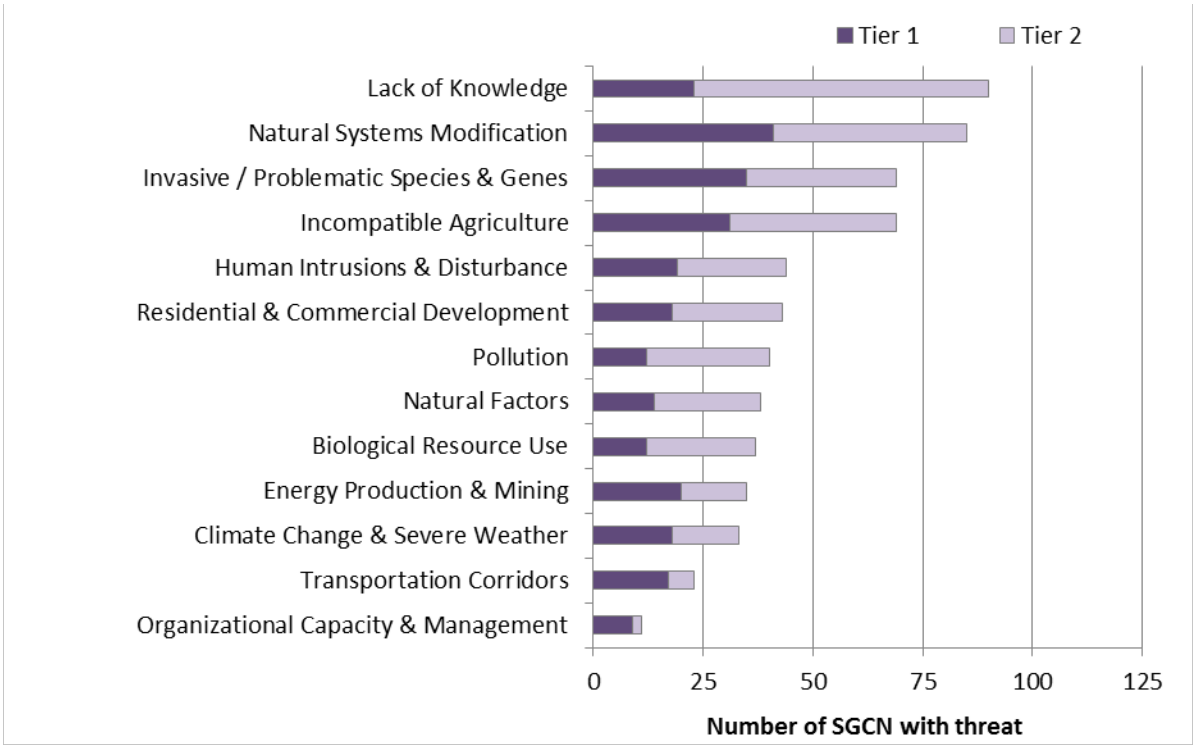



**Figure 5. Threats to vertebrate and mollusk SGCN by Tier.**

# Summary of Conservation Actions Needed

The highest priority conservation actions for SGCN include research/monitoring and management or restoration of habitats and ecological processes (Figure 6). For Tier 1 SGCN, restoration is the most needed conservation action, especially for aquatic species (Figures 7 and 8). Private enterprise also has a crucial role to play through application of standards such as Best Management Practices. Land and resource protection (conservation easements, water rights), control of invasive species, and application of policy and regulation are all important as well. Given the complexity of land use and ownership patterns in the state, conservation success for SGCN will require increasing the breadth and effectiveness of partnerships. Conservation of Colorado's wildlife is too big a task for one agency. Accomplishing the actions identified in this plan will require developing many new partnerships, as well as continuing to capitalize on existing partnerships. Creation, testing, and implementation of market-based conservation tools are ongoing – greater emphasis on these approaches is also needed. While research and monitoring won't achieve conservation in and of itself, conducting research to understand the limiting factors SGCN face is necessary to accurately identify and prioritize specific management/conservation actions needed. For descriptions of the conservation actions referenced in the figures below, refer to Chapter 4 and Table 6.

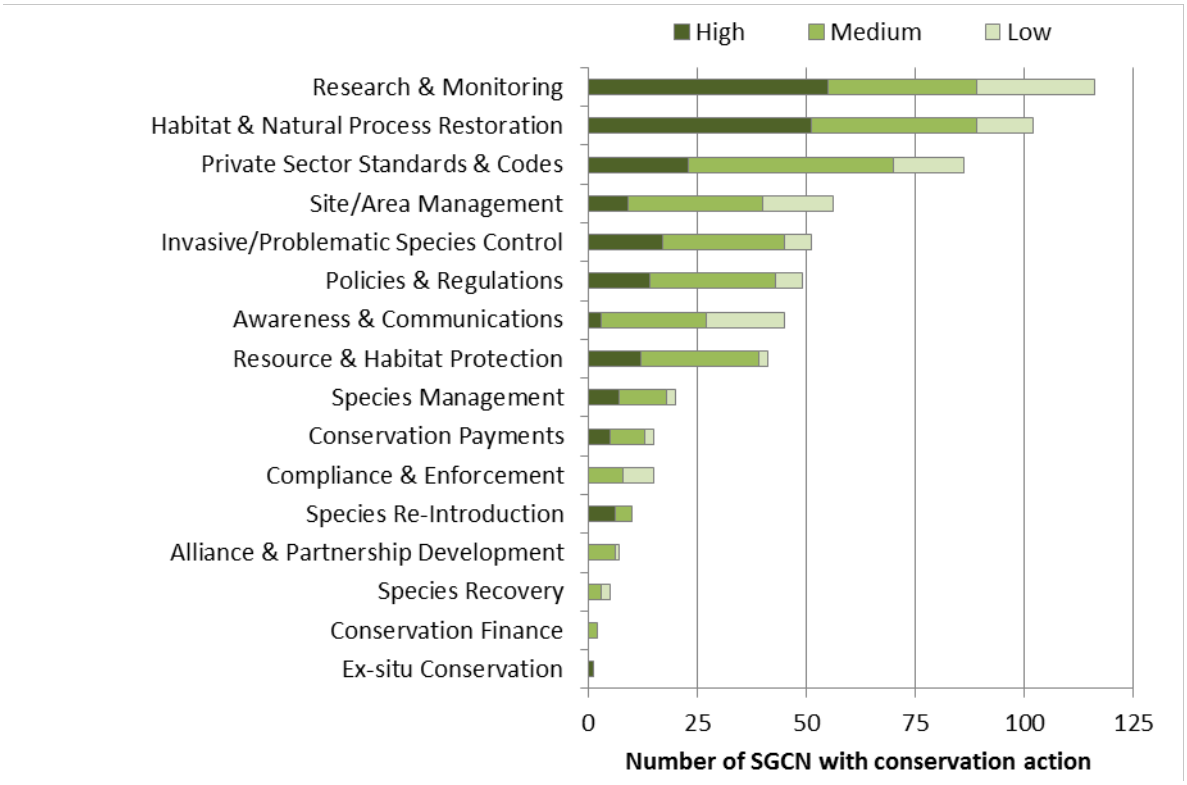



**Figure 6. Conservation actions needed for vertebrate and mollusk SGCN by priority.**

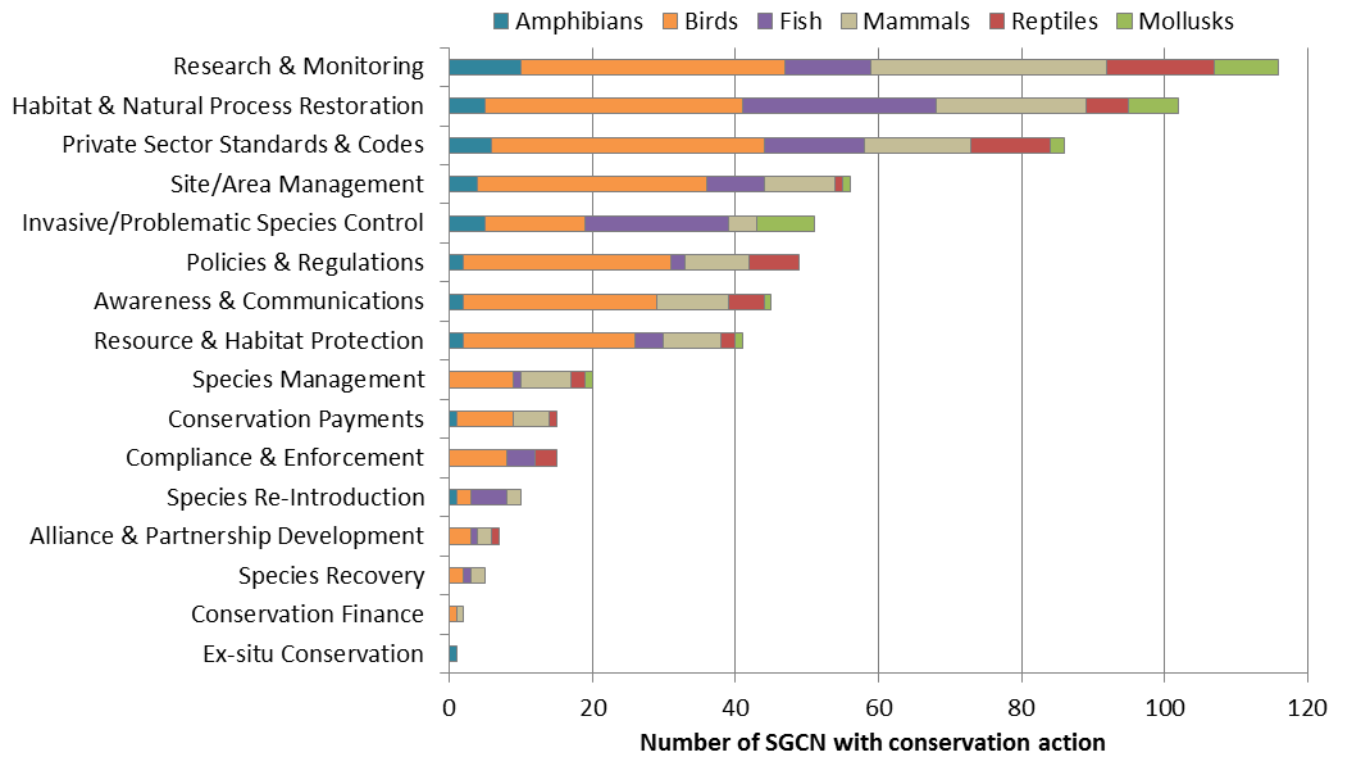



**Figure 7. Conservation actions needed for vertebrate and mollusk SGCN by taxonomic group.**

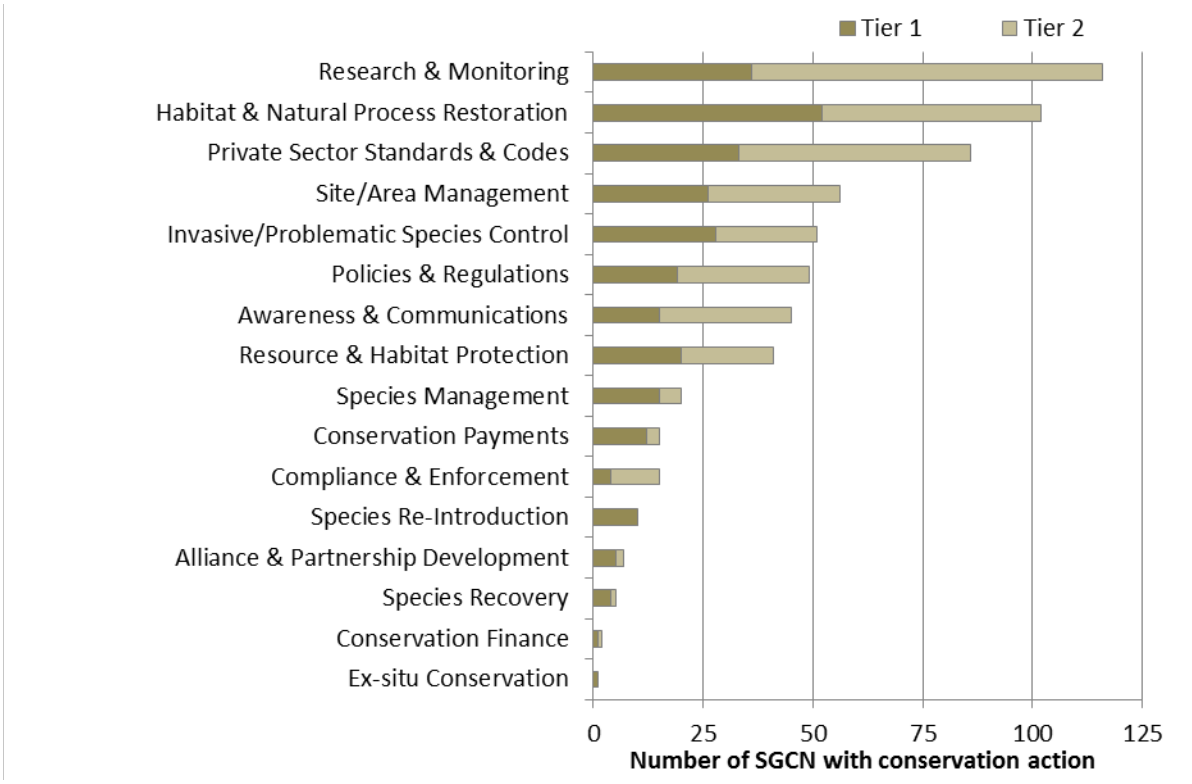



**Figure 8. Conservation actions needed for vertebrate and mollusk SGCN by Tier.**

# Threats & Actions Narratives for Tier 1 SGCN

As previously noted, there are a number of resources that explore threats to SGCN and conservation actions needed in considerable detail. These include existing conservation assessments, management or recovery plans, and published research results. For the purposes of the SWAP, the highest priority threats and conservation actions for Tier 1 SGCN are briefly summarized in the following narratives. Table 7 presents status and trend, habitats and distribution, threats, and prioritized conservation actions for all vertebrate and mollusk Tier 1 and Tier 2 SGCN. Refer to Appendix D for a list of management and recovery plans that provide additional information on threats, recommended or proposed conservation/management actions, and research needs for specific species. See Appendix E for a key to the distribution field.

In the following species summaries, threats are addressed in the order in which they appear in the Salafsky lexicon (described in Chapter 4).

# TIER 1 AMPHIBIANS

## Boreal Toad (*Anaxyrus boreas boreas*)

For detailed information on threats and conservation actions needed for this species, refer to the 2001 Conservation Plan and Agreement for the management and recovery of the Southern Rocky Mountain population of the Boreal Toad (*Bufo boreas boreas*) and the 2005 technical conservation assessment (links in Appendix D).

### *Threats*

#### 7 Natural Systems Modification

The loss of riparian zone cottonwood and aspen due to the encroachment of coniferous forest from natural forest succession has been identified as a threat to some boreal toad breeding habitat. The loss of cottonwoods and aspen causes beavers to shift to willow/shrub vegetation for dam construction, leaving dams more likely to blow out during flooding or runoff, increasing the risk of drying for associated wetlands. Boreal toad breeding ponds are commonly found in beaver pond complexes (Holland 2002).

#### 8 Invasives, Problematic Native Species, & Pathogens

The primary threat to boreal toad populations is from a pathogenic chytrid fungus (*Batrachochytium dendrobatidis;* Bd). Many amphibian declines and extinctions have been associated worldwide with amphibian chytridiomycosis caused by Bd infections (Berger et al.

1998; Green and Kagarise-Sherman 2001; Daszak et al. 2003). Bd is evidently native in many parts of the world, but genetic evidence indicates that one or more hypervirulent strains emerged recently from recombination of formerly geographically isolated lineages, likely the result of an increased worldwide trade in amphibians (Farrer et al. 2011). In Colorado, Bd has been implicated in dramatic declines in several populations of boreal toads since its discovery in the state in 1999 (Loeffler 2001). Bd infection is lethal to boreal toads (Carey et al. 2006) and directly impacts survival (Muths et al. 2003; Scherer et al. 2005; Pilliod et al. 2010). Carey (1993) developed a hypothesis that potential environmental stressors were leading to immunosuppression in boreal toads, causing them to be more susceptible to disease.

### 11 Climate Change & Severe Weather

The predicted effects of climate change in the west include reduced snowpack and shorter periods of snow cover, snowmelt that occurs earlier in the season, a hydrologic cycle that is more dynamic as extreme rainfall events occur with greater frequency, and an overall warmer, drier, and more drought-like conditions (Melillo 2014). Climate change has the potential to alter the timing of pond breeding amphibians (Blaustein et al. 2001). Changes in snowpack could impact survival and breeding success of boreal toads (Corn 2003; Scherer et al. 2008).

### Other Threats

Degradation of breeding habitat from activities such as recreation (Campbell 1970), grazing (Bartelt 1998), and sedimentation due to road sanding runoff can contribute to direct mortality of adults and juveniles. Large scale wetland alterations such as reservoir construction can eliminate breeding habitat causing population declines (Hammerson 1999). Direct mortality from vehicle collisions on busy roads has been documented and can cause significant losses if near a breeding site where toads congregate in large numbers.

## *Information Needs*

Further research is required on the ecology of the chytrid fungus (*Batrachochytium dendrobatidis*), including how it is spread, factors that make boreal toads susceptible to lethal infection, and environmental testing methods. Research is also needed on factors that potentially confer Bd resistance, including skin microbial community composition, particular habitat or behavioral characteristics, and possibly a genetic basis for a degree of Bd resistance.

## *Conservation Actions*

Accelerate the pace of re-introductions and translocations to establish additional populations within the species' native range. Rigorously assess factors affecting translocation success, to increase success of future efforts. Continue survey efforts to identify additional populations. Identify habitat protective actions effective at preventing Bd invasion, and implement such measures where feasible. Continue to support research on Bd resistance and Bd transmission.

# **Northern Leopard Frog** (*Lithobates pipiens*)

For detailed information on threats and conservation actions needed for this species, refer to the 2007 technical conservation assessment (link in Appendix D).

## *Threats*

### 1 Residential & Commercial Development

The loss of wetland habitat is believed to be one of the causes of northern leopard frog declines in Washington, Oregon, Idaho and Montana (Koch et al. 1996). Urban development was consistent with observed regional declines in eastern Colorado (Johnson et al. 2011). Northern leopard frogs depend on a variety of habitat types: breeding ponds, midsummer foraging habitat, and suitable water bodies for overwintering (Merrell 1977), so are at risk of habitat fragmentation. Impairment of movement between these critical habitats could be a major threat to the persistence of local populations (Pope et al. 2000). Leopard frogs are also highly vulnerable to road mortality (Bouchard et al. 2009).

### 8 Invasives, Problematic Native Species, & Pathogens

The introduction of bullfrogs in western United States has been linked to northern leopard frog declines (Lannoo et al. 1994; Koch et al. 1996; Livo et al. 1998; Hammerson 1999; Johnson et al. 2011). Localized declines in Boulder County, Colorado, were attributed to a bullfrog introduction (Hammerson 1982). Typical northern leopard frog breeding habitat is devoid of predaceous fish (Merrell 1977), which makes them susceptible to introduced game fish.

The pathogenic chytrid fungus (*Batrachochytium dendrobatidis*) has been implicated in amphibian declines around the world (Berger et al. 1998; Daszak et al. 2003). Chytrid fungus has been documented in Colorado populations of northern leopard frogs (Muths et al. 2003; Livo 2004; Johnson 2011).

### 11 Climate Change & Severe Weather

The predicted effects of climate change in the West include reduced snowpack and shorter periods of snow cover, snowmelt that occurs earlier in the season, a hydrologic cycle that is more dynamic as extreme rainfall events occur with greater frequency, and overall warmer, drier, and more drought-like conditions (Melillo 2014). Climate change has the potential to alter the timing of pond breeding amphibians (Blaustein et al. 2001) and changes in snowpack could also impact amphibians (Corn 2003). Drought was implicated in the extirpation of six populations in Larimer County, Colorado (Corn and Fogleman 1984).

### *Information Needs*

Further research is required on the ecology of the chytrid fungus (*Batrachochytium dendrobatidis*) and the susceptibility of northern leopard frogs to this pathogen. Information is also needed on the chytrid fungus status of northern leopard frog populations in Colorado. Effective control methods for non-native bullfrogs are needed, as are inventory to identify occupied wetland habitats to guide protection of wetland habitats for this species.

### *Conservation Actions*

Protection of wetland habitat, e.g., through easements and other landowner agreements, is a key priority, particularly on the Front Range. Wetland areas that remain uninvaded by bullfrogs and other exotic amphibians are especially important. Identify opportunities to create or restore additional suitable habitat. Continue to support research on Bd resistance and Bd transmission. Carefully evaluate agency and private fish stocking locations to minimize impacts on northern leopard frog and other native amphibians.

# TIER 1 BIRDS

## **Brown-capped Rosy-Finch** (*Leucosticte australis*)

### *Threats*

#### 2 Incompatible Agriculture

Grazing by sheep may have a negative effect on brown-capped rosy-finches at wintering sites if they trample vegetation and disturb seed availability in arid shrublands.

#### 6 Human Intrusions & Disturbance

In Colorado, the brown-capped rosy-finch breeds in alpine environments that occur predominantly on U.S. Forest Service land, with many acres designated as wilderness and in national parks. The brown-capped rosy finch remains at high elevations throughout the year unless severe storm events push them down to lower elevations in the winter months (Johnson et al. 2000). During the breeding season, populations are distant from most human activities and are relatively isolated from threats, but in winter they may be impacted by human activities as they drop to lower elevations to forage and roost. As access and participation in recreational activities in the alpine environment increases, recreation may have an impact on this species. Disturbance to nest sites could occur from recreational activities such as hiking, spring skiing, or rock climbing (Johnson et al. 2000).

#### 11 Climate Change & Severe Weather

The brown-capped rosy finch breeds above treeline in Colorado where it can find suitable nest sites in steep cliff faces overlooking the alpine tundra (Johnson et al. 2000). During the breeding

season, this species forages on and at the edges of snowfields and glaciers where insects and seeds are deposited and in fell fields, cliffs, and rock slides (Kingery 1998; Johnson et al. 2000). The brown-capped rosy finch is thought to be susceptible to climate change due to the potential depletion of late lying snowfields as temperatures increase and winter precipitation patterns change. Though it is unknown if brown-capped rosy finches are dependent on snowfields, they do provide access to an abundant food source as insects are trapped there when wind updrafts are cutoff and insects fall stunned to the snow surface (Kingery 1998). Breeding success could be impacted if summer monsoonal moisture patterns change, resulting in alterations in the alpine plant communities that affect insect abundance and seed availability. If severity of winter storms intensify and increase, causing birds to migrate more frequently, winter mortality could also be impacted by climate change.

### *Information Needs*

Information regarding population abundance and trends at both local and statewide levels is needed to better assess this species' status. Declining population trends have been shown for this species using Christmas Bird Count Data (Johnson et al. 2000), but these data may not provide an accurate assessment of the species since winter populations are eruptive and nomadic. The development of a statewide status assessment and monitoring program is therefore needed to determine if a downward trend is occurring, and what mechanism is driving this cycle. Potential threats at both summer breeding and wintering sites needs to be investigated to gain an understanding of potential impacts to populations.

### *Conservation Actions*

Develop techniques to assess the population status and develop a long-term monitoring program to evaluate changes in populations and distribution in the face of climate change are also needed. Secure habitats and protect them from potential detrimental anthropogenic effects to provide a buffer for any effects due to climate change.

## **Burrowing Owl** (*Athene cunicularia*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Western Grasslands Initiative – a Plan for Conserving Grassland Habitat and Wildlife (2011); Burrowing Owl (*Athene cunicularia*): a technical conservation assessment (2004); Conservation Plan for Grassland Species in Colorado (2003); Status Assessment and Conservation Plan for Western Burrowing Owl in the United States (2003) (links in Appendix D).

## *Threats*

### 1 Residential & Commercial Development

The burrowing owl is closely associated with prairie dog colonies, and therefore is affected, directly or indirectly, by issues that threaten prairie dogs. Burrowing owl habitat has decreased in area and become fragmented as prairie dog colonies have been eradicated or gone extinct (McDonald et al. 2004). Prairie dog colonies have been converted to residential and commercial development and cropland across much of their range.

### 2 Incompatible Agriculture

In addition to habitat conversion, agricultural activities increase owl mortality and loss of prey through use of insecticides and pesticides, which jeopardize the health and stability of owl populations (Klute et al. 2003; Gervais et al. 2006). Intentional eradication of prairie dog colonies for agricultural purposes also directly affects burrowing owls.

### 5 Biological Resource Use

Recreational shooting of prairie dogs can decrease owl fecundity (Woodward 2002) or cause direct mortality when owls are mistaken for prairie dogs (Butts 1973). Seasonal shooting closures have been implemented on public land to help conservation of prairie dog populations.

### 8 Invasives, Problematic Native Species, & Pathogens

Prairie dog colonies have undergone dramatic collapses from sylvatic plague and eradication efforts, which has led to decreases in abundance of burrowing owls (Desmond et al. 2000).

## *Information Needs*

Some of the greatest influences on burrowing owl population demographics (adult and first-year survival) may be driven by conditions or impacts at wintering grounds in Mexico. Determining what factors are controlling population stability on wintering grounds may provide needed information for effective conservation.

## *Conservation Actions*

Conservation of burrowing owls hinges on the protection of healthy prairie dog colonies. Direct loss of prairie dog colonies through anthropogenic alternation (e.g., exurban development, energy development, poisoning) should be addressed through outreach to appropriate audiences, implementation of best management practices, securing of conservation easements and other habitat protections, and, when appropriate, use of zoning and other regulatory mechanisms to protect habitat. Indirect loss of prairie dog colonies due to sylvatic plague may be reduced through the development and use of vaccines to protect prairie dogs. The negative effects of sylvatic plague on burrowing owls may also be addressed by the conservation of large numbers or well-dispersed prairie dog colonies at landscape scales.

# **Columbian Sharp-tailed Grouse** (*Tympanuchus phasianellus columbianus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*): a technical conservation assessment (2007); Columbian Sharp-tailed Grouse Conservation Plan, Routt, Moffat, and Rio Blanco Counties, Northwest Colorado (2001) (links in Appendix D).

## *Threats*

### 1 Residential & Commercial Development

Urbanization leads to fragmentation and the loss of native cover at lek sites, nesting and brooding areas, and winter habitat, rendering urban landscapes unsuitable for Columbian sharp-tailed grouse (Hoffman 2001). Hoffman (2001) states that the greatest threat of urbanization in northwestern Colorado is in Routt County, within a 20 mile (32 kilometer) radius of Steamboat Springs. Continuously balancing future residential and commercial development with conservation of Columbina sharp-tailed grouse habitat is necessary to prevent the decline of this species in Colorado.

### 2 Incompatible Agriculture

#### *Cropland*

Conversion of native cover to pasture and cropland in the past has resulted in dramatic decline of grouse populations. Healthy grouse populations require large, undisturbed, natural habitats with intact ecological functions, including natural disturbance regimes (Storch 2000). However, Columbian sharp-tailed grouse do use Conservation Reserve Program (CRP) fields, mine reclamation lands, and occasionally grain fields. Though sharp-tailed grouse are considered moderately tolerant of habitat change (Hoffman and Thomas 2007), they cannot persist on overly modified landscapes or in small, isolated native habitats. Within the current Colorado range of the Columbian sharp-tailed grouse, the conversion of native cover to cropland has run its course, with little conversion of native habitats currently taking place. In northwestern Colorado, where Columbian sharp-tailed grouse still persist, it is because these areas were unsuitable for crops and native cover suitable for grouse was left undisturbed (Hoffman 2001). Historically Columbian sharp-tailed grouse ranged across southwestern Colorado, but conversion of native cover to cropland extirpated grouse from this portion of their native range (Oyler-McCance et al. 2001). The loss of habitat to cropland has been reversed to some extant in Colorado by recovery of previously converted wheat acreage to CRP lands. In Colorado, preventing future loss of grouse habitat to agricultural uses and encouraging the placement of current croplands into the CRP will benefit Columbian sharp-tailed grouse.

### *Grazing*

Private lands supply 71% of the Columbian sharp-tailed grouse habitat in northwestern Colorado (Hoffman 2001). Grazing in a manner that is incompatible with sharp-tailed grouse reduces or eliminates key food plants and the abundance of insects important to the growth and development of chicks, and increases predation rates by reducing cover needed for concealment from predators (Baines 1996; Hoffman and Thomas 2007). Use of herbicides to remove shrubs and create grassland for cattle is detrimental to sharp-tailed grouse, which require adequate shrub cover for nesting and overwintering. Consequently, incompatibly grazed habitat supports fewer leks, fewer males at leks, and smaller populations (Hoffman 2001; Flanders-Wanner et al. 2004). Alternately, compatible livestock grazing management can maintain and/or enhance habitat by promoting desirable plant communities, preventing weed encroachment, providing residual cover, and increasing plant diversity (Hoffman 2001). Compatible grazing on rangelands is based on controlling the intensity, timing, frequency, selectivity, and distribution of grazing animals (MWCC 1999). The use of sound grazing management practices within sharp-tailed grouse habitats will help prevent declines and could increase Columbian sharp-tailed grouse populations in Colorado.

### *Herbicide Use*

In Colorado, herbicide use is more problematic to sharp-tailed grouse than the use of pesticides (Hoffman and Thomas 2007). The impacts of herbicide use include modification of habitat components required for both cover and food, which can cause increased levels of predation and starvation (Hoffman 2001). Consequently, managing herbicide use in grouse habitat will benefit Colorado sharp-tailed grouse.

### *Loss of Conservation Reserve Program (CRP) Lands*

Within the Colorado range of the Columbian sharp-tailed grouse, there are 21,000 acres of CRP land. Approximately 21% of all known leks occur on these CRP lands, which also provide critical nesting and brood-rearing habitat. If these CRP lands are lost, sharp-tailed grouse populations will decline (Hoffman and Thomas 2007). Lands are enlisted in the CRP for 10 to 15 years. A concerted effort should be made to re-enlist lands whose contracts are expiring, and to enlist new lands into the program within the Colorado range of the Columbian sharp-tailed grouse. This is particularly true for CRP lands in the vicinity of Steamboat Springs, Colorado, where land values for urban development are high (Hoffman and Thomas 2007).

### *Degradation of Wetlands*

Columbian sharp-tailed grouse are attracted to wetlands for the succulent vegetation as well as the abundance of invertebrates, which are an important nutritional resource for growing chicks (Hoffman 2001). In Colorado, wetlands within the range of sharp-tailed grouse have been converted to cropland and have suffered damage to wetland vegetation due to incompatible grazing by livestock (Hoffman 2001). Protecting the remaining wetland habitats within their current range will benefit Columbian sharp-tailed grouse.

### 3 Energy Production & Mining

The Rocky Mountain west is an important oil and gas producing region in the United States. Since the early 2000s, oil and gas development within the area occupied by the Columbian sharp-tailed grouse in northwestern Colorado has increased dramatically. According to GIS data from the Colorado Oil and Gas Conservation Commission, as of October 2014 there are over 1,300 oil and gas wells currently permitted or drilled within habitat of the Columbian sharp-tailed grouse in Colorado (http://cogcc.state.co.us/). Traffic and infrastructure from energy development, including roads, pads, tanks, utility lines and buildings, stresses sharp-tailed grouse populations, and leads to fragmentation and loss of native cover. Ultimately, this negatively impacts lek sites, nesting and brooding areas, and winter habitat, rendering them marginal for the Columbian sharp-tailed grouse (Hoffman and Thomas. 2007).

### 7 Natural System Modifications

Historically, fire was the major disturbance factor in sagebrush and mountain shrub biomes occupied by Columbian sharp-tailed grouse (Hoffman and Thomas 2007). A lack of fire in sharp-tailed grouse habitat is the most significant problem in Colorado (Hoffman and Thomas 2007). Within the range of sharp-tailed grouse, fire frequency has been altered over the past 150 years due to the introduction of both livestock and noxious weeds. Cattle remove vegetation, thereby reducing fuel loads. Reduction of fuel loads, combined with the fire suppression practiced in the west for the past century, has reduced the frequency of fires. In Colorado, lack of fire is the main problem for grouse, where large acreages of Gambel's oak, which sharp-tailed grouse don't use, have become decadent and overgrown, crowding out other more suitable xeric mountain shrubs (Connelly et al. 2004). Fire management that restored openings and species diversity in the shrub community would benefit sharp-tailed grouse in Colorado. Caution in use of fire as a management tool is recommended, however, because sagebrush does not recover quickly from fire, and can be eliminated by intense, frequent fires (Hoffman 2001).

### 8 Invasives, Problematic Native Species, & Pathogens

Grazing by wild ungulates may also negatively impact sharp-tailed grouse populations. When significant amounts of privately-owned land are closed to hunting and native predators are controlled, populations of native grazers (particularly elk) increase due to lack of both hunter and predator take. The result is that the ground and shrub cover required by grouse are diminished by elk browsing. Grazing by elk has increased in sagebrush and on CRP lands for these reasons (Hoffman and Thomas 2007). Efforts to meet elk management goals through enhanced harvest by hunters would benefit sharp-tailed grouse populations.

### 11 Climate Change & Severe Weather

Predicted changes in climate suggest that the West will experience an increase in temperature, a decrease in frosts, and increases in precipitation (Melillo et al. 2014). These changes are predicted to lead to an increase in conifers at the expense of shrublands, and an increase in fires

because of increasing fuel loads (Neilson et al. 2005). The effects of these changes, should they occur, is hard to predict, but incompatible management of sharp-tailed grouse habitat could intensify the adverse effects of climate change.

## *Information Needs*

Research is currently underway on population demographics, chick and hen survival, and habitat use.

## *Conservation Actions*

CPW recently embarked on a long term translocation program aimed at restoring Columbian sharp-tailed grouse to as much of their historic range as possible, according to the recently completed "Colorado Columbian Sharp-tailed Grouse Translocation Guidelines" (CPW 2014a).

Collaboration should be continued and expanded with Federal agency partners that manage lands occupied by Columbian sharp-tailed grouse, to ensure that grazing planning and practices acknowledge the importance of wildlife habitat and incorporate the needs of sharp-tailed grouse into grazing planning and prescriptions. Grazing should be prescribed to account for adequate nesting and brood rearing habitat for sharp-tailed grouse. Additionally, efforts should be undertaken to minimize the amount of undesirable woody encroachment into previously or currently occupied sharp-tailed grouse habitat. Suitable sharp-tailed grouse habitat needs are fairly well known, and can be generally characterized as diverse grassland/shrubland complexes with abundant forbs, adequate grass height, and limited or few trees. Rigorous assessments of habitat quality will dictate what management actions need to occur. Private lands provide a significant and important amount of habitat for Columbian sharp-tailed grouse, and interested partners, including CPW, need to be active in advocating for, and helping when necessary, in restoring disturbed private land habitat, including mine reclamation and CRP maintenance, establishment, and mid-contract management. CRP stands and seed mixes should include a diverse suite of beneficial forbs and legumes, including beneficial non-natives such as alfalfa where appropriate. Efforts to educate private landowners on the habitat needs of sharp-tailed grouse, and provide technical guidance and, if necessary, financial assistance to implement compatible grazing plans and/or to assist with the management of woody encroachment.

# **Golden Eagle** (*Aquila chrysaetos*)

## *Threats*

### 1 Residential & Commercial Development

The expansion of urban and exurban development has resulted in the loss of breeding habitat along Colorado's Front Range (Boeker 1974; Scott 1985). Along with urbanization comes increased recreational activity that can cause disturbance to golden eagles.

### 2 Incompatible Agriculture

Agricultural development can render areas once used as wintering habitat unsuitable for golden eagles (Craig et al. 1986).

### 3 Energy Production & Mining

Golden eagles are at greater risk to mortality from wind turbines than other raptors (USFWS 2011a), and they are also susceptible to death from collisions with cars, fences, and wires (Kochert et al. 2002). Additionally, disturbance from pre-construction, construction, or operation and maintenance activities at wind developments may disturb eagles at concentration sites, or result in loss of productivity at nearby nests, leading to permanent loss of nesting territory (USFWS 2013a). The U.S. Fish and Wildlife Service lists the following three factors as reasons for the increased risk of collision by eagles with wind turbines (USFWS 2011a):

(1) topographic features, season, and wind currents interact to create favorable conditions for slope soaring or kiting (stationary or near-stationary hovering) in the vicinity of turbines;
(2) behavior that distracts eagles and presumably makes them less vigilant (e.g., active foraging or inter- and intra-specific interactions); and
(3) resident status, with resident adults and young less vulnerable and dispersers and migrants (especially sub-adults and floating adults) more vulnerable. This latter point should not be taken to undercut the potential severity of the risk to breeding adult eagles and their young, as losses from these segments of the population, especially breeding adults, can have serious consequences to populations.

### 5 Biological Resource Use

Golden eagles appear to be less susceptible to chemical pollution than other raptors (Kochert et al. 2002). However, secondary poisoning can occur when eagles consume carrion killed by herbicides, pesticides, rodenticides, and lead shot. Rodent control may also impact eagles by reducing abundance of prey species.

### 6 Human Intrusions & Disturbance

Human activity near nests can cause breeding failures, but most evidence is anecdotal or correlative (Kochert et al. 2002). Colorado Parks and Wildlife recommends no surface

occupancy within ¼ mile of active golden eagle nests beyond that which already occurs, as well as restriction of human activity to within ½ mile of active nests from December 15 through July 15 (CPW 2008). Additionally, researchers can cause disturbance at nests, resulting in nest abandonment, nest mortality due to excessive egg cooling or heating during periods when the researcher is at the nest and brooding adults are away, or cause young to fledge prematurely (Kochert et al. 2002). Such disturbance can be avoided if proper protocols and precautions are developed and followed by researchers.

#### 7 Natural System Modifications

The recent increase in the incidence of catastrophic wildfire in the intermountain West, including Colorado, has the potential to disrupt the breeding biology of golden eagles. Nesting success at burned territories in Snake River Canyon, Idaho, declined after major fires, with abandoned territories being subsumed by neighboring pairs, resulting in a decreased number of nesting pairs (Kochert et al. 1999). Changes in precipitation and temperature predicted for the Rocky Mountain region over the next 50 years suggest the observed increase in wildfires recently witnessed in Colorado may persist (Westerling et al. 2006).

### *Information Needs*

Monitoring is required to determine the population status in the western U.S., where declines in golden eagles is suspected (Kochert et al. 2002, but see Nielson et al. 2014). The factors that may be involved in these declines and factors responsible for population trends in general, including fire, are poorly understood and require further elucidation. Further information on how environmental pollutants and habitat alterations at both breeding and winter grounds affect populations is needed. Estimates of current population size and trends would be useful in assessing proposals to harvest eagles for use by Native American's in religious ceremonies.

### *Conservation Actions*

Conduct research to better understand how golden eagles use space and interact with topography surrounding wind farms. Appropriate siting, micro-siting, and implementation of best management practices to mitigate effects of wind power development are also needed. Securing protection of large, unfragmented landscapes to alleviate habitat loss and degradation from oil and gas development, conversion to cropland, and other anthropogenic alterations is important for the conservation of stable golden eagle populations.

## **Greater Sage-grouse** (*Centrocercus urophasianus*)

The information presented here is a very limited summary of the detailed threats and conservation actions described in the 2008 Colorado Greater Sage-grouse Conservation Plan, and should not be construed as a comprehensive or prioritized list of the threats. The Colorado

Conservation Plan (link in Appendix D) should be referenced in developing threat assessments and conservation interventions for the species. Note that the impacts of the threats described below are variable across the distribution of greater sage-grouse; some threats are less significant or non-existent in some populations.

## *Threats*

### 1 Residential & Commercial Development

The primary cause of sage-grouse decline is the loss and fragmentation of sagebrush habitats (USFWS 2013e). Habitat has been lost and fragmented by suburban and rural development, agricultural conversion to cropland, intensive grazing pressure, alterations to fire regimes, and invasion of non-native annual grasses (Schroeder et al. 1999; Walker et al. 2007). Housing development and the associated infrastructure (e.g., roads, fencing, powerlines, increased human activity) results in permanent habitat loss, degradation, and fragmentation. Colorado's human population growth has resulted in conversion of agricultural lands to residential land uses, and impacts of development have spread onto nearby public lands.

### 2 Incompatible Agriculture

Grazing is one of the major land uses in sagebrush habitats, and has influenced sage-grouse habitat in a variety of ways, including removal of sagebrush from some areas, as well as alterations to understory plants needed for nesting, brood rearing, and other life history requirements. Direct and indirect impacts from improper grazing (grazing incompatible with local ecological conditions) on Greater Sage-grouse are uncertain and complex. However, grazing can also be used as a management tool to achieve desirable habitat conditions for the sage-grouse.

### 3 Energy Production & Mining

Habitat has been lost and fragmented by energy development and the associated infrastructure (e.g., powerlines, pipelines, and roads). In Colorado, there is considerable overlap in the potential for oil and gas drilling and oil shale extraction (CGSSC 2008). Also, the largest coal reserves in the state significantly overlap with Greater sage-grouse habitat. Demand for both oil and gas and coal is expected to remain high. Potential threats related to energy production and mining activities and infrastructure include reduction in amount of available habitat, fragmentation and degradation of remaining habitat, direct disturbance and/or mortality of individual birds, and increased predation. Increased human disturbance related to oil and gas development can also reduce viability of sage-grouse populations (Walker et al. 2007).

### 8 Invasives, Problematic Native Species, & Pathogens

Noxious and invasive weeds are considered a threat to rangeland health in much of greater sage-grouse habitat. Noxious weeds have the potential to degrade greater sage-grouse habitat,

primarily by increasing the fire regime frequency, decreasing plant diversity, and changing structure of plant and insect communities. A potentially significant issue for greater sage-grouse is the invasion of cheatgrass in the understory of sagebrush habitats. If cheatgrass out-competes native perennial plant species (which sage-grouse eat) to the point that the understory is comprised exclusively of annual grasses (which sage-grouse do not eat), value of the habitat could be significantly reduced. Juniper and pinion pine encroachment into sagebrush communities is occurring in some greater sage-grouse populations. Fire is important for suppressing expansion of pinion-juniper into shrub-steppe communities.

## *Information Needs*

The Colorado Greater Sage-grouse Conservation Plan (CGSSC 2008) provides a detailed section on research needs related to greater sage-grouse. The section identifies detailed research topics that 1) are important to understanding greater sage-grouse populations and habitat; and 2) lead to more effective greater sage-grouse management. Some of the issues identified in the plan are listed below; see the plan for detailed, specific objectives and conservation strategies relates to each issue.

How greater sage-grouse population dynamics and sustainability are impacted by the quality and quantity of habitat and human-controlled activities in greater sage-grouse habitat is not well understood. The effectiveness of current measures designed to protect greater sage-grouse from impacts, specifically impacts of energy and mineral development, is unknown. The population-level impacts of predation, West Nile virus, and harvest are not well understood. There is also lack of information on invasive weed distribution in and the potential impact on greater sage-grouse habitat in Colorado.

Also, current methods for monitoring trends in greater sage-grouse populations and for estimating greater sage-grouse population size from lek counts make many unsupported assumptions. Research is needed to establish reliable and effective methods for monitoring greater sage-grouse population trends and estimating population size. CPW is currently undertaking this research.

## *Conservation Actions*

The 2008 Colorado Greater Sage-grouse Conservation Plan provides comprehensive, detailed information and should be referenced in developing conservation actions for the species (link in Appendix D).

In this plan, each potential issue/threat has various objectives with corresponding conservation strategies. Each strategy has accompanying information regarding Responsible Parties, Timeline, and Cost. Because greater sage-grouse in Colorado are found in six separate populations, the potential threats and conservation strategies are diverse and complex. Existing local working

groups have developed local conservation plans. The statewide plan provides strategies for the cumulative, landscape-wide impacts to greater sage-grouse. Readers should consult and implement appropriate strategies within the statewide plan, and should also read and apply strategies with the applicable local plans. In some cases, more detail will be found in the local plans and in other cases, the statewide plan will be more specific.

## **Greater Sandhill Crane** (*Grus canadensis tabida*)

### *Threats*

#### 2 Incompatible Agriculture

##### *Staging areas*

During migration, greater sandhill cranes feed primarily in agricultural fields. Changes in agricultural practices and the loss of farmland to the effects of climate change and urbanization all have the potential to impact populations of greater sandhill cranes in Colorado. Farming practices after harvest frequently determine the amount of waste seed available for sandhill cranes (Littlefield and Ivey 2002). In the San Luis Valley, spring food for cranes is becoming a critical issue as waste grain is being reduced by fall tilling and irrigation of fields after harvest (SRMGSC 2007). This process is used to stimulate sprouting and then freezing of waste seed after harvest, which leaves a clean field for spring planting.

##### *Breeding Areas*

Breeding sandhill cranes are dependent upon wet hay meadow and grain fields along the Yampa and Elk rivers in Routt County for foraging habitats (SRMGSC 2007). Cranes with broods prefer to forage in open, flooded meadows (Gerber at al. 2014). Frequently these sites are subject to agricultural practices that can be detrimental to nesting and fledging. Though meadows are generally good foraging sites for cranes, late June and July meadow mowing can kill crane chicks as they hide in dense vegetation and remain motionless, waiting for the threat to pass (Littlefield and Ivey 1994). In addition, meadows are often dried in June for hay harvest, and early drying can result in the unavailability of invertebrate foods, sometimes contributing to chick starvation (Littlefield and Ivey 2002).

#### 7 Natural System Modifications

##### *Staging Areas*

The single greatest threat to sandhill cranes appears to be loss of non-breeding habitat; particularly fall and spring staging areas in Colorado (Gerber et al. 2014). The major fall and spring migration stop for the Rocky Mountain population of the greater sandhill crane is in the San Luis Valley, Colorado. Most roosting areas are on the Monte Vista National Wildlife Refuge (NWR), Baca National Wildlife Area, Higel State Wildlife Area, Rio Grande State Wildlife Area,

the channel of the Rio Grande River, and private marshes and wet meadows along the river from the town of Monte Vista to the Alamosa NWR. Water withdrawal for urban and agricultural use, combined with climate change and drought, has lowered the water table in the San Luis Valley resulting in shrinking habitat for sandhill cranes (SRMGSC 2007). This loss of habitat has caused crowding leading to disease outbreaks. Consequently, avian tuberculosis, cholera, and botulism have caused crane mortality in staging areas in the San Luis Valley (Drewien et al. 2001).

#### *Breeding Areas*

Habitat loss within breeding areas is a serious threat to greater sandhill cranes in Colorado. Breeding cranes utilize the river valleys, marshes, and wet meadows of northern Colorado, where human populations are low but increasing. In Colorado, breeding sites are located on private lands that are desirable for exurban development (SRMGSC 2007).

### *Information Needs*

Habitat inventories are needed to identify, classify, rank, and catalog habitats used by greater sandhill cranes in Colorado. This information will help facilitate the protection of important habitat through acquisition, easement, cooperative agreements, special-use permits, and mitigation exchanges and developments (SRMGSC 2007). Understanding how changing human impacts (including changes in agricultural practices induced by climate change) affect both breeding and non-breeding staging sites will be important for creating long-term conservation strategies (Gerber et al. 2014). Investigation of how changing agricultural practices are diminishing food availability in the San Luis Valley and the feasibility of augmenting food supplies by developing natural forage sites through wetland creation and enhancement is needed (SRMGSC 2007).

### *Conservation Actions*

Conservation and appropriate management of important habitats is needed. In particular, maintaining or improving the health of riparian and wetland habitats, and ensuring adequate availability of food resources, is needed.

## **Gunnison Sage-grouse** (*Centrocercus minimus*)

The information presented here is a very limited summary of the detailed threats and conservation actions described in the 2005 Gunnison Sage-grouse Rangewide Conservation Plan, and should not be construed as a comprehensive or prioritized list of the threats. The Rangewide Conservation Plan should be referenced in developing threat assessments and conservation interventions for the species (link in Appendix D). For additional information, refer also to the U.S. Fish and Wildlife Service's final listing decision (USFWS 2014a).

Note that the impacts of the threats described below are variable across the distribution of Gunnison sage-grouse; some threats are less significant for the Gunnison population compared with some satellite populations.

## *Threats*

### 1 Residential & Commercial Development

As noted in the Rangewide Conservation Plan, if not managed properly, residential and commercial development and associated infrastructure (e.g., roads, power lines, reservoirs) have the potential to impact Gunnison sage-grouse habitat and populations. Current and future human population growth rates and patterns vary widely across the species' range, but are generally higher in low-elevation meadows, grasslands, and sagebrush. The impacts of residential and commercial development can be minimized by concentrating new growth in or near areas outside of occupied or suitable habitat. Gunnison County, where the majority of Gunnison sage-grouse are found, has successfully implemented land use regulations and voluntary conservation measures (including significant conservation easements) to avoid, minimize and/or mitigate potential adverse impacts of new construction in the county on the species. Development in the Gunnison Basin is currently considered by the United States Fish & Wildlife Service to be a threat of low magnitude to the persistence of the species. In the smaller satellite population areas, similar measures can aid in avoiding or minimizing the impacts of population growth on Gunnison sage-grouse habitat.

### 2 Incompatible Agriculture

In addition to habitat conversion to cropland, grazing (one of the major land uses in sagebrush habitats) has influenced sage-grouse habitat in a variety of ways. Direct and indirect impacts from improper grazing (grazing that is incompatible with local ecological conditions) on Gunnison sage-grouse are uncertain and complex. Potential impacts include removal of sagebrush from some areas, as well as alterations to understory plants needed for nesting, brood rearing, and other life history requirements. However, grazing can also be used as a management tool to achieve desirable habitat conditions for the grouse. Conservation measures from the Gunnison Basin Candidate Conservation Agreement (CCA) should continue to address potential impacts from livestock grazing and operations on Federal lands in the Gunnison Basin. Also, conservation measures within the Candidate Conservation Agreement with Assurances (CCAA) Program have minimized impacts from livestock grazing and operations on private lands across the range of Gunnison sage-grouse.

### 3 Energy Production & Mining

Current and potential leasable energy development is limited to a small portion of the species' overall range and to date, the majority of oil and gas development has occurred outside of occupied habitat for Gunnison sage-grouse. The San Miguel Basin and Dove Creek populations

are the only areas within Gunnison sage-grouse range that currently have a moderate amount of oil and gas production. There are no active coal operations in Gunnison sage-grouse habitat, and recoverable coal resources are limited in Gunnison sage-grouse range. Localized threats related to energy production and mining activities and infrastructure may include reduction in amount of available habitat, fragmentation and degradation of remaining habitat, direct disturbance and/or mortality of individual birds, and increased predation. These localized impacts, however, are not projected to pose a significant threat to the species.

### *Information Needs*

The Gunnison Sage-grouse Rangewide Conservation Plan (2005) provides a detailed section on research needs related to Gunnison Sage-grouse. The section identifies broad research topics that 1) are important to understanding populations and habitat; and 2) lead to more effective management. The highest priority research need is to evaluate the effect of habitat quality and quantity on the behavior and population dynamics.

### *Conservation Actions*

Again, the reader is referred to the Rangewide Conservation Plan in developing threat assessments and conservation interventions for the species (available online: http://cpw.state.co.us/learn/Pages/GunnisonSagegrouseConservationPlan.aspx).

## **Lesser Prairie-chicken** (*Tympanuchus pallidicintus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: The Lesser Prairie-chicken Range-wide Conservation Plan (2013); Lesser Prairie-chicken Conservation Initiative (2008); Lesser Prairie-chicken (*Tympanuchus pallicicinctus*): a technical conservation assessment (2005); Federal listing documents; Lesser Prairie-chicken Recovery Plan (1992) (links in Appendix D).

### *Threats*

#### 2 Incompatible Agriculture

Fragmentation, degradation, and conversion of grasslands has led to isolation and reduced viability of lesser prairie-chicken populations (Johnson et al. 2003; Silvy and Hagen 2004). In Colorado, a majority of the historically suitable habitat has been converted to croplands. The remaining landscape is sandy rangeland sites charactized by choppy or deep sands and sandsage. The primary limiting factor for lesser prairie-chicken populations in Colorado is the current lack of large continuous blocks of diverse grassland, approximately mid-calf to knee high, that contains abundant forbs, legumes and/or sandsage. This diverse grassland/forb/shrub community must provide the height and density that will provide adequate cover for nesting, brood-rearing, and year-round survival. This habitat has been dramatically altered by grazing

systems and management that have resulted in nearly complete loss of native mid-grass species which are critical for nesting. The majority of sandsage in Colorado is now dominated by shortgrass species, and/or has a dramatically reduced or eliminated grass component. Many of these habitats are lacking necessary components (e.g., adequate concealing cover for nesting, escape cover). Conservation Reserve Program fields contribute important habitat for lesser prairie-chickens. Loss of CRP fields and CRP fields planted with incompatible seed mixes exacerbate the degraded condition of available habitat.

### 3 Energy Production & Mining

Oil and gas development fragments habitat and leads to behavioral avoidance, including lek abandonment, in areas where production and related infrastructure occur (Van Pelt et al. 2013). Hunt (2004) found well densities higher near abandoned leks than near active leks. Increasing densities of oil and gas wells may result in reduced lesser prairie-chicken populations.

### 14 Natural Factors

Because lesser prairie-chickens have small home ranges and habitats are becoming more isolated and disjunct (Robb and Schroeder 2005), there is evidence of diminishing genetic diversity (Johnson et al. 2003, 2004). This can lead to appearance of deleterious recessive alleles, reduced reproductive output, and susceptibility to stochastic events.

## *Information Needs*

Some basic rangewide natural history information is still lacking for the lesser prairie-chicken, including information on dispersal, recruitment, and the importance of parasites and infectious diseases. Also, information on local population size and the capacity for connectivity, as well as how habitat quality and patch size can mitigate mortality factors, is needed (Robb and Schroeder 2005). Research to better determine the direct and indirect effects of anthropogenic structures (e.g., oil and gas wells, wind turbines) is needed to implement the most effective mitigation programs. For restored grasslands, research to determine most effective seed mixes and planting techniques is needed, including how habitat responds to intentional occasional disturbance such as mid-contract management for CRP parcels.

## *Conservation Actions*

Conservation of lesser prairie-chickens is dependent on the protection of large, unfragmented landscapes with suitable habitat. When possible, permanent conservation easements should be used to secure habitat in perpetuity. While permanent easements are preferable, term easements may have utility in some situations. Term length should be a minimum of 5-10 years, although longer is highly desirable. Programs that dis-incentivize the conversion of native habitats or planted grass cover to rowcrop production should be implemented. Negative effects from anthropogenic activities which cause habitat loss and fragmentation (oil and gas, wind power, electrical transmission) must be ameliorated through appropriate avoidance and minimization

and, when necessary, offsetting mitigation. Because of very low populations in Colorado, habitat protection and improvement around remaining leks is imperative and the possibility of population enhancement through translocations should be explored. Severe and long-term droughts have significant impacts on lesser prairie-chicken populations. While droughts themselves can not be prevented, providing sufficient high-quality habitat will allow the species to persist during such stressful periods.

In Colorado, sandsage rangelands and planted grass habitats (e.g., CRP) must be managed to provide habitat for lekking, nesting, and brood rearing. Landowner outreach, the Farm Bill, and other incentive programs (e.g., Lesser Prairie-chicken Rangewide Conservation Plan) should be used to encourage landowners to implement agricultural practices that are compatible with lesser prairie-chicken conservation. Cropland can be converted to suitable lesser prairie-chicken habitat using a diverse mix of plant species. The largest and most familiar program to do this is the Conservation Reserve Program.

The most limiting factor in the degree of suitablilty of currently enrolled CRP fields for lesser prairie-chicken in Colorado is the widespread use of an aggressive native grass, sideoats grama, which largely does not provide suitable lesser prairie-chicken habitat under current management regimes. This native species tends to out-compete other native grasses and necessary forbs and legumes in the highly disturbed system. Current CPW habitat use research using GPS radio telemetry is corraborating previous work from Kansas and abundant anecdotal evidence that the use of non-native but highly beneficial dryland adapted alfalfa in CRP plantings is providing habitat to lesser prairie-chickens in CRP dominated landscapes. CRP seed mixes must be designed so that the resulting habitat will address the structural and composition needs of lesser prairie-chickens.

Another factor limiting the potential for CRP to provide habitat is the declining national acreage cap, and the counties in southeastern Colorado often reach their allowable enrollment cap. However, establishing suitable habitat for lesser prairie-chickens through CRP or similar programs remains one of the quickest and most effective management actions to improve conditions for lesser prairie-chicken populations in Colorado.

Grazing management to ensure an adequate interspersion of habitat types and the mid-height warm season grasses and abundant forbs that are critical components of suitable lesser prairie-chicken habitat is needed. To be successful, this will require sound technical assistance, financial incentives, and landowner buy-in. Use of grazing management to improve habitat is on a much longer time frame than establishing adequate and suitable habitat on previously cropped acres through the CRP or similar programs. It is unknown how many years it will take to (or if it is even possible) to restore the most highly degraded sandsage areas to suitable habitat for lesser prairie-chickens.

Improving habitat conditions for lesser prairie-chickens in Colorado will require continued and improved commitment from a variety of government agencies and partners. Effective outreach will be necessary to engage private landowners in lesser prairie-chicken habitat efforts as the vast majority of potential habitat is on privately owned lands. Lastly, management actions must effectively incorporate scientific data and use sound techniques and methodology to recover or establish habitat that will directly address population limiting factors for lesser prairie-chickens.

## **Mountain Plover** (*Charadrius montanus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Western Grasslands Initiative – a Plan for Conserving Grassland Habitat and Wildlife (2011); Conservation Plan for Grassland Species in Colorado (2003); Mountain Plover (*Charadrius montanus*): a technical conservation assessment (2003); Proposed federal listing documents (links in Appendix D).

### *Threats*

#### 1 Residential & Commercial Development

The major threat to the mountain plover is the loss of native habitats and the loss of those species that can create suitable habitat (especially prairie dogs) (Dinsmore 2003). In Colorado, residential and commercial development has replaced mountain plover habitat along the Front Range, in scattered locations throughout the eastern plains, and in South Park.

#### 2 Incompatible Agriculture

Much mountain plover habitat in Colorado has been converted to cropland. Mountain plovers can adapt to changing landscapes by utilizing surrounding cropland for nesting. Though mountain plovers do use cropland, it may be less suitable in some areas (i.e., low chick survival rates) than shortgrass prairie or prairie dog towns (Dreitz 2008). As prairie dogs have undergone precipitous declines (Dreitz 2009), so have the bare-ground/shortgrass habitats that are ideal for mountain plover. Domestic livestock grazing has replaced the historic grazing regimes once found on the Great Plains, but livestock do not necessarily replicate grazed conditions necessary for plover nesting success. Instead, livestock often convert the mosaic of bare ground and vegetation structure favored by mountain plovers to more homogenous structure lacking the crucial bare ground component (Dinsmore 2003). Augustine and Derner (2012) suggest that prescribed burn and prairie dog grazing provide more suitable habitat on shortgrass prairie than intense livestock grazing alone.

### 3 Energy Production & Mining

Oil and gas development near suitable habitat may limit plover use of areas and may fragment contiguous patches of suitable habitat. This, in combination with the above threats, contribute to a landscape that has become more fragmented for plover habitat, reducing the size of viable patches, and possibly isolating some breeding or wintering populations. In addition, associated disturbances such as noise, presence of humans, and vehicle traffic may result in behavioral avoidance. However, because plovers are attracted to disturbed ground for nesting, oil and gas development activities may hinder some nesting, but they could also attract plovers. If nests are known to be in the area, efforts to avoid destruction should be made.

### 8 Invasives, Problematic Native Species, & Pathogens

Sylvatic plague is a significant threat to remaining prairie dog colonies, and mountain plovers are positively associated with prairie dog colonies. Addressing plague management would be a positive benefit to mountain plover conservation.

## *Information Needs*

Precise rangewide and local population demographics information, including population size, is lacking for mountain plovers. There is a lack of understanding of how landscape management activities impact plover populations. Also, the movement patterns among and within regional populations is poorly understood. Lastly, knowledge of predator and prey communities and their dynamics at breeding and wintering grounds needs further study. It is possible the greatest threats to mountain plovers are not in Colorado on their breeding grounds, but rather on their wintering grounds, since research in Colorado shows significant use of fallow agricultural lands, which are abundant, for nesting habitat. Additional research is needed to determine what factors are limiting the population so that effective management can be implemented.

## *Conservation Actions*

In Colorado, conservation and management of shortgrass prairie is necessary for maintenance of healthy mountain plover populations. Use of best management practices (for example, prescribed fire, promotion of prairie dog colonies) to limit impacts from energy development, cropland conversion, and exurban development should be encouraged. Landowner outreach and incentive programs through the Farm Bill or other programs can be used to encourage grazing practices that are compatible with mountain plovers. Because prairie dogs are important for creating short grassland habitats preferred by mountain plovers, conservation actions which benefit prairie dogs should be implemented. Direct loss of prairie dog colonies through anthropogenic alternation (e.g., exurban development, energy development, poisoning) should be addressed through outreach to appropriate audiences (including policy-makers and landowners), implementation of best management practices, securing of conservation easements and other habitat protections, and, when appropriate, use of zoning and other regulatory mechanisms to protect habitat. Indirect loss of prairie dog colonies due to sylvatic plague may be

reduced through the development and use of vaccines to protect prairie dogs. The negative effects of sylvatic plague on mountain plovers may also be addressed by the conservation of large numbers or well-dispersed prairie dog colonies at landscape scales.

# Plains Sharp-tailed Grouse (*Tympanuchus phasianellus jamesi*)

## *Threats*

### 1 Residential & Commercial Development

Plains sharp-tailed grouse in Colorado have been negatively impacted by residential and commercial development. Douglas County, one of the perennially fastest growing counties in the United States for a number of years, historically provided some of the best plains sharp-tailed grouse habitat in the state. This former stronghold does not currently, and likely never will, provide sharptail habitat due to habitat loss to residential development.

### 2 Incompatible Agriculture

#### *Cropland*

Conversion of native cover to pasture and cropland in the past has resulted in dramatic decline of grouse populations. Healthy grouse populations require large, undisturbed, natural habitats with intact ecological functions including natural disturbance regimes (Storch 2000). Historically, plains sharp-tailed grouse ranged across the northern two thirds of eastern Colorado, but conversion of native cover to cropland has extirpated plains sharp-tailed grouse from much of their native range. In Colorado, preventing future loss of habitat to agricultural uses and encouraging the enrollment of croplands into the CRP within the current range of plains sharp-tailed grouse will benefit this species.

#### *Grazing*

Private lands supply approximately 50 percent of the plains sharp-tailed grouse habitat in northeastern Colorado. Grazing that is incompatible with sharp-tailed grouse results in reduction or elimination of key grouse food plants and the abundance of insects important to the growth and development of chicks, and increases predation rates of adult and young grouse by reducing cover needed for concealment from predators (Baines 1996; Hoffman and Thomas 2007). Consequently, incompatibly grazed habitat supports fewer leks, fewer males at leks, and smaller populations of sharp-tailed grouse (Flanders-Wanner et al. 2004). Alternately, proper grazing management can maintain and/or enhance sharp-tailed grouse habitat by promoting desirable plant communities, preventing weed encroachment, providing residual cover, and increasing plant diversity (Hoffman 2001). Proper grazing management on rangelands is based on controlling the intensity, timing, frequency, selectivity and distribution of grazing animals (MWCC 1999). The use of sound grazing management practices within sharp-tailed grouse

habitats will help prevent declines and could increase plains sharp-tailed grouse populations in Colorado.

### 3 Energy Production & Mining

#### *Oil and Gas*

The Rocky Mountain west is an important oil and gas producing region in the United States. Since the early 2000s, oil and gas development within the area occupied by the plains sharp-tailed grouse in northeastern Colorado has increased dramatically. According to GIS data from the Colorado Oil and Gas Conservation Commission, as of October 2014 there are over 1,500 oil and gas wells currently permitted or drilled within habitat of the plans sharp-tailed grouse in Colorado (COGCC 2014). Traffic and infrastructure from energy development, including roads, pads, tanks, utility lines and buildings, stress sharp-tailed grouse populations and lead to fragmentation and the loss of native cover. Ultimately, this negatively impacts lek sites, nesting and brooding areas, and winter habitat, rendering them marginal for sharp-tailed grouse (Hoffman and Thomas 2007).

#### *Renewable Energy*

There are four large scale wind farms within the range of the plains sharp-tailed grouse in Colorado, with potential for more development in the future (NRDC 2014). No research has been conducted on the impacts that wind turbines and other infrastructure (e.g., transmission lines) have on plains sharp-tailed grouse, but concerns include noise, habitat disruption, disturbance, fragmentation, and increased predator access (USFWS 2004; UWIN 2010). Pruet et al. (2009) demonstrated that greater prairie-chicken (*Tympanuchus cupido*) movements are altered by wind energy development; they avoid crossing under transmission lines and avoid activity near the tall structures associated with wind energy. However, it is unknown whether or not plains sharp-tailed grouse respond in a similar way. Sharp-tailed grouse tend to be fairly tolerant of limited development and disturbance, often using disturbed habitat such as homesteads, tree rows, and agricultural fields at certain times of year. Given the uncertainties surrounding the impacts of wind energy development on prairie grouse, the USFWS (2004) recommends restricting installation of wind turbines or wind facilities within a 5-mile radius of active grouse leks.

## *Information Needs*

Knowledge of plains sharp-tailed grouse biology in Colorado is limited. Research is needed on the effects of grazing practices on sharp-tailed grouse habitat, and on the minimum habitat patch size needed to support stable populations of sharp-tailed grouse (Braun et al. 1992). The spatial configuration of habitat suitable for prairie grouse may become critical if the amount of available habitat drops below a threshold. Consequently, information on the spatial description of habitat requirements is needed, particularly in areas that may be fragmented by cropland and energy development (Niemuth 2011).

### *Conservation Actions*

Effective conservation of remaining plains sharp-tailed grouse populations in Colorado rest largely with maintaining suitable habitat on previously cropped lands enrolled into the Conservation Reserve Program. Suitable habitat complexes of CRP, limited amounts of dryland agriculture in cereal grains, and native range exhibiting and maintaining a mid-grass and/or native shrub component will be necessary to sustain plains sharp-tailed grouse. Grazing management can be improved adjacent to CRP, but the existing rangeland where sharp-tailed grouse still occur is marginal at best, and this species is now exceedingly reliant upon suitable CRP, as the best of their historic range in Colorado has been permanently lost.

## **Southern White-tailed Ptarmigan** (*Lagopus leucura altipetens*)

For detailed information on threats and conservation actions needed for this subspecies, refer to the following resources: White-tailed Ptarmigan (*Lagopus leucura*): a technical conservation assessment (2006) (link in Appendix D).

### *Threats*

#### 2 Incompatible Agriculture

Grazing in the alpine environment by livestock, mostly sheep, may have a negative effect on white-tailed ptarmigan populations due to alterations in the alpine plant community as well as disturbance to willow carrs. Studies have shown that sheep grazing in the alpine reduces cover of some important food sources for ptarmigan (Hoffman 2006 and references therein).

#### 6 Human Intrusions & Disturbance

Recreation in alpine areas has increased over the past few decades and will likely continue to increase. Recreational activities include skiing, hiking with dogs, all-terrain vehicle use, and snowmobiling, all of which have the potential to disturb white-tailed ptarmigan populations and/or degrade habitat.

#### 8 Invasives, Problematic Native Species, & Pathogens

Expansion of wild ungulates, primarily elk but also mountain goats and moose, into alpine habitat may negatively affect white-tailed ptarmigan populations (Hoffman 2006). Elk grazing and browsing in the alpine & subalpine willow habitat of some areas (e.g., Rocky Mountain National Park) may result in reduced suitability for ptarmigan. Degradation of willow in alpine and subalpine habitats by elk could impact ptarmigans on wintering areas by reducing survival and lowering body condition.

### 11 Climate Change & Severe Weather

White-tailed ptarmigan are an alpine species that depend on willows in the winter months to survive and lush alpine vegetation in the summer to breed and fledge young. There is concern that the species will be negatively impacted by climate change. Changes that could impact the species in Colorado are loss of willow carrs due to drying and degradation, increases in thaw/melt cycles in winter that limit roosting sites, changes in summer monsoonal patterns that result in warmer summer temperatures and less precipitation to maintain productive vegetation in alpine systems, increases in and severity of spring storms when young chicks are vulnerable, increase in predators not normally occurring at higher elevations due to warming trends, and potentially increases in avian diseases.

Ptarmigan are not well-adapted physiologically for dealing with high temperatures (Johnson 1968). Wang et al. (2002), in their study of white-tailed ptarmigan in Rocky Mountain National Park, found that over 25 years the average median hatch date has advanced 15 days, and that winter temperatures may have contributed to this species' long-term decline.

### *Information Needs*

Continued monitoring of the species is needed to evaluate how it may respond to changing environmental conditions brought about by climate change. Recent research has provided reliable estimates of statewide survival and abundance (Seglund 2011; Seglund and Street 2013). Continuing this work is needed to test trends in survival, reproductive success, and population size.

### *Conservation Actions*

In 2010, the southern white-tailed ptarmigan was petitioned to be listed as threatened under the Endangered Species Act. Colorado supports the largest population of southern white-tailed ptarmigan in the lower 48 states. Thus, if the subspecies does become listed, CPW will be responsible for the bulk of the protection and management of the species. Therefore, continued long-term monitoring using enhanced models to monitor range-wide trends in distribution and evaluate population status is needed. Coordination among agencies would help in these efforts.

## **Southwestern Willow Flycatcher** (*Empidonax traillii extimus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Final Recovery Plan Southwestern Willow Flycatcher (*Empidonax traillii extimus*) (2002); Federal listing documents (links in Appendix D).

## *Threats*

### 2 Incompatible Agriculture

Incompatible grazing by livestock in riparian habitat has resulted in the loss of riparian vegetation, particularly within the arid west (Belsky et al. 1999). Incompatible grazing in riparian areas can reduce the overall density of vegetation, which is a primary attribute of southwestern willow flycatcher breeding habitat (USFWS 2002a). Related impacts may include soil compaction, increased runoff leading to gullying, downcutting, and a lowered water table, subsequently furthering the loss of riparian vegetation. Livestock can also directly destroy willow flycatcher nests (Valentine et al. 1988). In the arid mountain regions of the west, water resources and fertile land suitable to support cropland exists mainly along streams where water for irrigation and rich soils deposited on stream floodplains is found. These areas that once contained extensive riparian habitat suitable for willow flycatchers have been converted to agriculture (USFWS 2002a). Farming operations can also create habitat for brown-headed cowbirds (*Molothrus ater*) by creating short-grass fields, grain storage and livestock concentrations in proximity to willow flycatcher nesting habitat (USFWS 2002a).

### 7 Natural System Modifications

The riparian habitat the southwestern willow flycatcher depends on has been disturbed by multiple human-induced activities, including reductions in water flow, interruptions in natural hydrological events and cycles, physical modifications to streams, modification of native plant communities by invasion of exotic species, and direct removal of riparian vegetation (USFWS 2002a). Streams occupied by the flycatcher have been disturbed by impoundments, dams, and reservoirs that alter the timing, frequency and quantity of flows, which in turn adversely impact riparian vegetation, rendering it unsuitable for willow flycatchers. Water diversion and groundwater pumping have dried riparian zones, leading to the loss of riparian shrubs necessary for willow flycatchers. Channelization, bank stabilization, levees, and other forms of flow controls have separated streams from their floodplains, reducing the cover of wooded riparian habitats willow flycatchers are dependent upon.

Fire within riparian habitats can be particularly damaging to riparian plant communities because they are not adapted to fire, nor are they fire regenerated. There is evidence that fire has increased in western riparian habitats where streams have been regulated because the reduction of flooding has allowed fuels to buildup, and because of the expansion and dominance of the highly-flammable tamarisk (Busch 1995). The loss of riparian habitat due to increased frequency of fire causes the direct loss of willow flycatcher habitat.

### 8 Invasives, Problematic Native Species, & Pathogens

Many waterways within the range of the southwestern willow flycatcher have been invaded by tamarisk (*Tamarix ramosissima*). Southwestern willow flycatchers will nest in some habitats that

have become invaded by, or have become dominated by, tamarisk (Paradzick et al. 2000). Consequently, the restoration of riparian habitat through the removal of tamarisk can pose a threat to southwestern willow flycatchers. When conducted in areas of suitable habitat (occupied or unoccupied), and when conducted in the absence of restoration plans to ensure replacement by vegetation of equal or higher functional value, the result can be a decline in willow flycatcher populations (USFWS 2002a).

#### 14 Natural Factors

The southwestern willow flycatcher suffers brood parasitism from brown-headed cowbirds, which reduces reproductive performance (USFWS 2002a). Under normal conditions, brood parasitism would not affect willow flycatcher viability. However, the increase in cowbird populations induced by the farming practices, in conjunction with the decline in condition of western riparian habitats, could be contributing to the population decline of willow flycatchers (Rothstein 1994).

### *Information Needs*

Many life history traits of southwestern willow flycatchers require further study, including spacing and site tenacity, fecundity and mortality, mating system, and population structure and regulation. The dispersal and migratory behavior of juveniles is poorly understood, and information is needed on the winter status and distribution for much of the flycatcher's winter range, especially in northern South America (Sedgwich 2000; USFWS 2002a).

### *Conservation Actions*

Maintenance of healthy riparian forest habitats in the San Luis Valley and southwestern Colorado is imperative for the conservation of southwestern willow flycatcher. Implementation of water management policies that encourage sustainable flows and support healthy willow and mature cottonwood riparian forests are needed. Public lands (state wildlife areas, national wildlife refuges, BLM) should be managed to benefit the species. Outreach to landowners and the use of incentive programs to maintain riparian forest and prevent habitat alteration or degradation (e.g., due to overgrazing) are important tasks.

## **Western Yellow-billed Cuckoo** (*Coccyzus americanus occidentalis*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Yellow-billed Cuckoo (*Coccyzus americanus*): a technical conservation assessment (2005); Federal listing documents (links in Appendix D).

## *Threats*

### 2 Incompatible Agriculture

Incompatible grazing by livestock in riparian habitat has resulted in the loss of riparian vegetation, particularly within the arid west (Bock et al. 1993). Grazing in riparian areas can cause changes in the structure and composition of riparian vegetation, which may affect suitability of habitat for western yellow-billed cuckoo breeding and prey population abundance (USFWS 2014b). In the arid mountain regions of the west, water resources and fertile land suitable to support cropland exists mainly along streams, where water for irrigation and rich soils deposited on stream floodplains is found. Large areas of cottonwood–willow floodplain vegetation have been converted to agricultural uses, reducing the extent of habitat available to cuckoos for breeding (USFWS 2002a).

### 4 Transportation & Service Corridors

Roads and railroads often follow along rivers, causing the loss and degradation of riparian habitat (NAS 2002). Additionally, gravel mining for road construction generally occurs along rivers and in the floodplain, affecting groundwater levels and riparian vegetation (Kondolf 1995).

### 7 Natural System Modifications

The riparian habitat the western yellow-billed cuckoo depends on has been disturbed by multiple human induced activities, including alteration of hydrology due to dams, water diversions, management of river flow that differs from natural hydrological patterns, channelization, and levees and other forms of bank stabilization that encroach into the floodplain (USFWS 2014b). Impoundments, dams and reservoirs alter the timing, frequency and quantity of flows, which adversely affects riparian vegetation, rendering it unsuitable for cuckoos (Greco 2012). Water diversion and groundwater pumping has resulted in water stress to riparian habitat, ultimately reducing and degrading foraging, nesting, and cover habitat for cuckoos (USFWS 2014b). Channelization, construction of levees, bank stabilization, and flood control structures that encroach into the river and its floodplain cause direct loss of cuckoo habitat and separate the channel from the floodplain. This, in turn, results in reduction of water available to support riparian vegetation in the floodplain, causing the further loss of cuckoo habitat (USFWS 2014b).

Fire within riparian habitats can be particularly damaging because riparian plant communities are not adapted to fire, nor are they fire regenerated. There is evidence that fire has increased in western riparian habitats where streams have been regulated, due in part to the reduction of natural flooding, which has allowed fuels to build up. This situation is further exacerbated by the expansion and dominance of the highly-flammable tamarisk (Busch 1995; Stromberg and Chew 2002). The loss of riparian cottonwood forests due to increased frequency of fire results in the direct loss of cuckoo habitat.

### 8 Invasives, Problematic Native Species, & Pathogens

Many western waterways have been invaded by tamarisk (*Tamarix ramosissima*). Areas that are dominated by tamarisk are unsuitable for cuckoos (USFWS 2014b). Habitat restoration should employ techniques that are sensitive to temporary impacts to cuckoos inhabiting degraded woodlands.

### 11 Climate Change & Severe Weather

The primary impacts of climate change on the western yellow-billed cuckoo are expected to be through changes in the availability and distribution of habitat. The predicted effects of climate change in the West include a reduced snowpack and shorter periods of snow cover, snowmelt that occurs earlier in the season, a hydrologic cycle that is more dynamic as extreme rainfall events occur with greater frequency and overall warmer, drier, and more drought-like conditions (USFWS 2014b). The effect of these alterations will be a change in the magnitude and frequency of floods and a greater likelihood of drought. These changes could be either beneficial or detrimental to cuckoos. Where flooding increases water available to riparian floodplains, it may have a regenerative effect on cuckoo habitat, but where channelization has occurred excessive scouring could cause the loss of any remaining habitat (USFWS 2014b). Long droughts could also cause the death of cottonwood riparian forests without subsequent regeneration.

## *Information Needs*

Detailed censuses of declining western populations must continue in order to determine effective population sizes necessary for future conservation programs (Hughes 1999). Various life history traits of the cuckoo require additional research, including spacing and site tenacity, fecundity and mortality, mating system, and population structure and regulation (Hughes 1999). Many characteristics of juvenile biology are unknown, including parental dependence, and dispersal and migratory behavior. Yellow-billed cuckoos are brood parasites that will occasionally lay eggs in other yellow-billed cuckoo nests. Information is needed on the physiological and behavioral controls associated with the production of extra eggs, the frequency of parasitism, and the overall success rates of parasitically laid eggs (Hughes 1999).

## *Conservation Actions*

Western yellow-billed cuckoos are dependent on the maintenance of healthy riparian forests throughout western Colorado and the San Luis Valley. Implementation of water management policies which encourage sustainable flows and support healthy willow and mature cottonwood riparian forests is needed. Public lands (state wildlife areas, national wildlife refuges, BLM) should be managed to benefit the species. Outreach to landowners and the use of incentive programs to maintain riparian forest and prevent habitat alteration or degradation (e.g., due to overgrazing) are important tasks.

# TIER 1 FISH

## Arkansas Darter (*Etheostoma cragini*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Arkansas Darter (*Etheostoma cragini*) Recovery Plan (2001) (link in Appendix D).

### *Threats*

#### 7 Natural System Modifications

Arkansas darters prefer low-gradient, cool, clear, spring-fed streams with dense vegetation and silty, sandy or sandy gravel substrates (Labbe and Fausch 2000; CPW 2001). Such ideal habitat has been reduced in the lower Arkansas River and its tributaries by anthropogenic activities. Ongoing and extensive water diversions, groundwater mining and impoundments in the Great Plains beginning in the 19th century have altered the hydrologic regime of Arkansas darter habitat, leading to increased drying and habitat intermittency (Falke et al. 2011). Although the Arkansas darter is adapted to the harsh, flashy hydrology of true plains streams, the level of anthropogenic disturbance to this habitat is beyond the limit of what many local species can tolerate in some areas (Fausch and Bestgen 1997; Samson et al. 2004). The mining of groundwater may be particularly detrimental for the species, as a recent study showed that overwinter survival was high in spring-fed pools where groundwater moderated winter temperatures and created patches of cooler water in summer temperatures (Groce et al. 2012). A study of genetic and demographic patterns revealed small effective population sizes, low levels of genetic diversity within populations, and high levels of genetic structure across the 12 remaining populations of Arkansas darter in Colorado (Fitzpatrick et al. 2014). These results suggest that the species may be at risk of negative effects of inbreeding depression, although no such effects have been observed.

#### 8 Invasives, Problematic Native Species, & Pathogens

The non-native northern pike (*Esox lucius*) are predators of Arkansas darter. Results from a study by Labbe and Fausch (2000) indicate that northern pike have greatly reduced the distribution and abundance of the Arkansas darter in a 13 km stretch of upper Big Sandy Creek near Ramah Reservoir. Additionally, non-native largemouth bass (*Micropterus salmoides*), a potential predator, occur in some streams within Arkansas darter range, as a result of stocking into small impoundments.

### Other Threats

The degradation of stream banks and shallow wetlands from livestock grazing, and construction activities and water pollution near urban areas, have contributed to the reduction of Arkansas darter habitat in the lower Arkansas River drainage (CPW 2001).

## *Information Needs*

Further elucidation regarding the effect of non-native species on the Arkansas darter is needed. More studies are necessary to understand genetic and adaptive variation across the entire range of the Arkansas darter in Arkansas, Colorado, Kansas, Missouri, and Oklahoma. Fitzpatrick et al. (2014) suggest measuring and comparing fitness-related traits, using genetic data for reconstructing wild pedigrees, and conducting reciprocal transplant experiments as important next steps for long-term management of Arkansas darter populations.

## *Conservation Actions*

Securing water availability and habitat quality for existing populations (e.g., through easements and other landownwer agreements) is a key priority, particularly for streams on the plains and in headwater reaches. Efforts should continue to identify additional potential re-introduction sites within the species' native range. Where necessary, agreements should be reached to improve habitat, for example by providing alternative stock-water sources so that over-grazed riparian reaches can be fenced. Culture techniques should continue to be refined, and factors affecting stocking success more formally evaluated.

# **Bluehead Sucker** (*Catostomus discobolus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: State of Colorado conservation and management plan for the Roundtail Chub (*Gila robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomus latipinnis*) (in development); Range-wide conservation agreement and strategy for Roundtail Chub (*Gila robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomus latipinnis*) (2006); Bluehead Sucker (*Catostomus discobolus*): a technical conservation assessment (2005) (links in Appendix D).

## *Threats*

### 7 Natural System Modifications

The bluehead sucker (*Catostomus discobolus*) was historically common and abundant in the Upper Colorado River and its tributaries within the state of Colorado (Miller and Rees 2000, Ptacek et al. 2005). Presently, they are found in only 45% of this historic range in western Colorado (Bezzerides and Bestgen 2002). The major threats to this species are dams and reservoirs, diversion of water and associated changes in flow, stream channelization, and general

deterioration of riparian corridors (Weitzel 2002a; Ptacek et al. 2005). Dams along the Colorado River and its tributaries have complex direct and indirect effects on the species. Large dams such as Flaming Gorge, Navajo, and the Aspinall Unit, and associated alterations have directly influenced thermal and hydrological regimes, reducing bluehead sucker populations in both the Lower and Upper Colorado River basins (e.g., Vanicek et al. 1970). Additionally, lowhead dams and constructed wetlands along Muddy Creek, a tributary of the Little Snake River in the Upper Colorado River basin, were shown to restrict downstream movement of bluehead sucker and create novel wetland habitat favoring non-native fish species (Beatty et al. 2009). These dams and constructed wetlands, however, may have positive indirect effects as they create a barrier to the upstream spawning of non-native fish species that prey on, hybridize, and compete with the bluehead sucker for resources. These findings highlight the complex impacts of dams on Colorado's native fish populations (Beatty et al. 2009). Fish passageways have been created for the bluehead sucker and other native fish at dam sites in the Colorado River near Palisade and on the Gunnison River (Landers 2012).

### 8 Invasives, Problematic Native Species, & Pathogens

Hybridization between the non-native white sucker (*Catostomus commersoni*) and bluehead sucker has been documented, as well as individuals with genetic contributions from the white sucker, bluehead sucker, and native flannelmouth sucker (*Catostomus latipinnus*) (McDonald et al. 2008). The non-native white sucker has facilitated introgression between two native species, and therefore threatens the genetic integrity of the bluehead and flannelmouth suckers.
A genetic study of the species revealed three distinct geographic areas that are evolutionarily significant for maintaining the genetic integrity of the bluehead sucker (referred to as evolutionarily significant units): the Bonneville Basin, the Upper Little Colorado River, and the Colorado River (Hopken et al. 2013). All bluehead sucker populations in the state of Colorado belong to the Colorado River unit (Hopken et al. 2013). The bluehead sucker is vulnerable to predation by several non-native fish species including northern pike and brown trout (Nesler 1995; Webber et al. 2012).

### Other Threats

The construction of roads through highly erodible soils, improper timber harvest practices, and overgrazing of riparian areas can alter stream channel flows, increase sediment loads, and degrade riparian habitat thereby affecting the quality of occupied bluehead sucker habitat (Ptacek et al. 2005).

## *Information Needs*

Further studies are needed to monitor and detect hybridization of the bluehead sucker with other species, especially non-natives (CPW 2014b). Furthermore, efforts should be made to determine the effectiveness of non-native species removal in bluehead sucker occupied habitat (CPW 2014b). Preliminary work has estimated that the species is fairly long-lived, with age estimates

ranging from 8-18 years at sites in Wyoming (Sweet et al. 2009) and in the White and Gunnison Rivers (CPW unpublished data). More information is needed on population demographics and habitat requirements for bluehead sucker within Colorado, noting any differences among streams (CPW 2014b). The role of tributaries in spawning and life history stages needs further investigation. Ideal habitat for the species should be identified to direct protection efforts throughout the Upper Colorado Basin. Lastly, more research is needed to determine if and where flow stages are too low to support bluehead sucker populations (CPW 2014b).

### *Conservation Actions*

Hybridization with non-native suckers is the most pressing conservation threat. Reaches that presently support bluehead and/or flannelmouth suckers and do not contain non-native suckers should be individually evaluated and all appropriate measures identified to ensure they remain uninvaded. Constructed barriers, in conjunction with mechanical or chemical removal, may be feasible in some streams, to open up additional habitat for re-introduction. Suppression of non-native predators, particularly northern pike and smallmouth bass, must continue throughout the basins where these species have invaded. Colorado's DRAFT Conservation and Management Plan for the 'three species,' which needs to be finalized, specifies additional conservation actions.

## **Bonytail Chub** (*Gila elegans*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Bonytail (*Gila elegans*) Recovery Goals – Amendment and Supplement to the Bonytail Chub Recovery Plan (2002) (link in Appendix D).

### *Threats*

The bonytail chub (*Gila elegans*) is considered functionally extinct in Colorado (Carlson and Muth 1989). This species, endemic to the Colorado River Basin, was once widespread and abundant in the Yampa, Green, Colorado and Gunnison rivers (Jordan 1891). It is now the rarest native fish species in the basin. No verifiable occurrences of wild bonytail chub have been documented in Colorado since 1984, when one individual was caught in the Black Rocks area near Grand Junction, Colorado (Kaeding et al. 1986). A captive broodstock was established from some of the last wild bonytail collected, and stocking of captive-reared individuals is a primary recovery strategy (Nesler et al. 2003). Captive-bred bonytail are tagged with Passive Integrated Transponder (PIT) tags prior to stocking. Stocked fish have been detected in subsequent sampling, sometimes in large numbers, but there is little evidence of long-term survival, and no confirmed reproduction or recruitment. The primary threats to the species are streamflow regulation, habitat modification, predation by non-native fish, hybridization, and pesticides and pollutants (Vanicek and Kramer 1969; USFWS 2002b; Bestgen, Zelasko, and Compton 2006).

### 3 Energy Production & Mining

A large uranium mill tailings pile from the Atlas Mine near Moab, Utah, poses two significant threats to endangered fish in the Colorado River: 1) toxic discharges of pollutants, particularly ammonia, enter the river through groundwater and could be directly toxic to bonytail chub (*Gilia elegans*); and 2) risk of catastrophic pile failure could bury nursery areas and destroy fish habitat (Fairchild et al. 2002; USFWS 2002b). If functional bonytail chub populations are established in Colorado, individuals may be capable of traveling downstream to areas affected by the mine. However, migration distances for bonytail chub are unknown.

### 4 Transportation & Service Corridors

The Denver and Rio Grande railroad tracks parallel sections of the Colorado River near Grand Junction, Colorado and Cisco, Utah. No known derailments have occurred in these areas, but potential spills of hazardous materials threaten all endangered fish in this portion of the Colorado River (USFWS 2002b).

### 7 Natural System Modifications

The construction of dams in the Colorado River Basin has fragmented and inundated riverine habitat; released cold, clear waters; altered ecological processes; affected seasonal availability of habitat; and blocked fish passage (USFWS 2002b). All of these factors have led to the decline of the bonytail chub (Carlson and Muth 1989; Minckley et al. 2003).

### 8 Invasives, Problematic Native Species, & Pathogens

Non-native fish species now dominate many portions of the Upper Colorado River Basin, comprising 40 of the 54 total species in the basin as a whole (UCREFRP 2004). Many of these non-native species are thought to prey on bonytail chub, including smallmouth bass (*Micropterus dolomieu*), and have been implicated as one of the chief causes for lack of recruitment in native fishes (McAda and Wydoski 1980; Tyus et al. 1987; Minckley 1991; Bestgen, Zelasko, and Compton 2006; Marsh et al. 2013).

### 9 Pollution

Pollutants and pesticides from agricultural runoff have been suggested as possible threats to the species, but no tissue analysis has been conducted on bonytail chub (Haynes and Muth 1981; Wick et al. 1981).

## *Information Needs*

Few studies on the bonytail chub were completed before populations experienced massive declines. Future studies should focus on understanding the life history and specific habitat requirements of bonytail chub using stocked populations (USFWS 2002b). This information is necessary for improving survival of stocked fish, and for identifying—and if necessary re-creating—the conditions needed for reproduction and recruitment; for example, off-channel

breeding habitat for bonytail chub (Minckley et al. 2003). More studies focusing on the effects of pesticides and pollutants on bonytail chub are also needed.

### *Conservation Actions*

Stocking success must be rigorously evaluated to identify factors contributing to survival. Stocked fish should be tracked as closely as possible to discover presumptive life-history traits. These traits should in turn direct and inform future recovery actions. Suppression of non-native predators, particularly northern pike and smallmouth bass, must continue throughout the basins where these species have invaded. Recovery efforts for this species are coordinated primarily by the Upper Colorado Endangered Fish Recovery Program, in which Colorado is a partner agency.

## **Brassy Minnow** (*Hybognathus hankinsoni*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: South Platte Native Fish Conservation Plan & Arkansas Native Fish Conservation Plan (in development).

### *Threats*

The brassy minnow (*Hybognathus hankinsoni*) occurs in the Republican and South Platte river basins (Scheurer and Fausch 2002). The species has experienced a decline in abundance and distribution in Colorado, and was listed as state threatened in 1998 (Scheurer 2001; CPW 2014). Major threats to the species are habitat drying, habitat degradation, and non-native species.

#### 2 Incompatible Agriculture

Grazing by livestock has damaged 80% of the streams and riparian ecosystems in the western United States (USDOI 1994; Belsky et al. 1999). Erosion and siltation from cattle grazing can degrade habitat for native fishes like brassy minnow that prefer clear waters and densely vegetated streambanks with grasses, willows, and cottonwoods (Scheurer and Fausch 2002). Grazing has caused bank erosion in occupied brassy minnow habitat in the Arikaree River (Scheurer et al. 2003).

#### 7 Natural System Modifications

Although this species is adapted to withstand drought conditions that are common in the Great Plains, the additive effects of drought combined with streamflow reduction from diversions, reservoir storage, and irrigation pumping may cause further declines and even the extirpation of the species in Colorado. For example, irrigation pumping from sites in the Arikaree River coincided with the larval hatching season for brassy minnow, causing dewatering of occupied habitat, resulting in the death of most larvae during the dry summer of 2000 (Scheurer and Fausch 2002).

The species uses seasonally flooded habitats for spawning, recruitment and growth (Copes 1975; Goldowitz and Whiles 1999). In the Arikaree River, investigators found that brassy minnow survival and recruitment was strongly influenced by habitat drying as a result of the interactions of groundwater pumping, climate, and stream geomorphology (Falke et al. 2010). The use of temporary habitats makes the species extremely vulnerable to stochastic local extinction (Scheurer and Fausch 2002). Survival of brassy minnow is higher in spawning habitats that are large and dry slowly (Falke et al. 2010). Deep pools complexes, often created by beaver activity, serve as important refugia for the species during drought and winter freezing (Scheurer and Fausch 2002). Any water management activity that alters the processes that create these pools could have negative effects on the brassy minnow.

#### 8 Invasives, Problematic Native Species, & Pathogens

Non-native fish species such as largemouth bass are capable of decimating native fish populations, and may pose a threat to brassy minnow populations in off-channel ponds (Scheurer and Fausch 2002). Smallmouth bass have been shown to have a strong negative effect on brassy minnow (Schlosser 1988).

### *Information Needs*

More surveys, as well as studies evaluating threats and investigating metapopulation dynamics are needed in the South Platte basin in Colorado, as most studies have focused on the Republican River basin.

### *Conservation Actions*

Secure water availability and habitat quality for existing populations (e.g., through easements and other landownwer agreements); this is particularly urgent in the Republican basin. Identify potential re-introduction sites within the species' native range, emphasizing opportunities to protect or re-create seasonally connected backwater and slough habitats. Study metapopulation dynamics, to understand importance of barriers and seasonal connectivity in life history, to direct future conservation activities.

## **Colorado Pikeminnow** (*Ptychocheilus lucius*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Colorado Pikeminnow (*Ptychocheilus lucius*) Recovery Goals – Amendment and Supplement to the Colorado Squawfish Recovery Plan (2002); Colorado Squawfish Revised Recovery Plan (1991) (links in Appendix D).

### *Threats*

The Colorado pikeminnow (*Ptychocheilus lucius*) is the largest native fish in the Colorado River basin (Tyus 1991). It was listed as federally Endangered in 1967. Formerly called the Colorado

squawfish, the Colorado pikeminnow is a member of a unique assemblage of fishes that evolved in warm, uninterrupted stretches of the Colorado River and its tributaries (Miller 1959; USFWS 2002c). The species now utilizes approximately 1,090 miles of river habitat in the upper Colorado River Basin above Lake Powell in the Green River, upper Colorado River, and San Juan River subbasins (USFWS 2011b). Wild populations in the lower part of the basin in Arizona, California, Nevada, and New Mexico are extirpated (USFWS 2011b). The wild population in the San Juan subbasin was also functionally extirpated and efforts to recover it are based upon stocking. Colorado pikeminnow are highly migratory, often traveling several hundred river kilometers to spawning sites, and subsequently making the journey in reverse back to a home range (Tyus and McAda 1984; Osmundson et al. 1998). The primary threats to the Colorado pikeminnow are streamflow regulation and associated habitat modification, and non-native fish (USFWS 2002c).

### 3 Energy Production & Mining

A large uranium mill tailings pile from the Atlas Mine near Moab, Utah, on the north bank of the Colorado River poses two significant threats to Colorado pikeminnow: toxic discharges of pollutants and risk of catastrophic pile failure (USFWS 2011b).

### 7 Natural System Modifications

Dam construction has resulted in the loss and degradation of habitat for the Colorado pikeminnow across its native range (Minckley and Deacon 1968; Clarkson and Childs 2000). Extensive dam building in the 1930s through the 1960s has been cited as the primary cause for the extirpation of Colorado pikeminnow in the lower Colorado River basin (Mueller and Marsh 2002; Osmundson 2011). Although the species still persists in the upper Colorado River basin, dams have blocked upstream passage, converted free-flowing riverine segments into lentic reservoir habitat, and cooled downstream reaches with hypolimnetic releases (Osmundson 2011). Altered flow regimes from dams and diversions can affect food web dynamics and interactions between Colorado pikeminnow and non-native fish species (Osmundson et al. 2002; Bestgen, Zelasko, and Compton 2006, Bestgen, Beyers, Rice, and Hains 2006). Flow recommendations that consider these dynamics have been developed for Colorado pikeminnow (Modde and Smith 1995; Osmundson et al. 1995; Holden 1999; McAda 2000; Muth et al. 2000). Other water management activities such as irrigation and groundwater pumping can result in high levels of selenium that may affect the survival and reproductive success of Colorado pikeminnow (Simpson and Lusk 1999; Osmundson et al. 2000; Osmundson et al. 2008). Entrainment of larval and/or adult pikeminnow into irrigation canals remains a significant cause of mortality (data in prep).

### 8 Invasives, Problematic Native Species, & Pathogens

Colorado pikeminnow occur sympatrically with approximately 20 non-native fishes that are suspected to compete with and prey upon Colorado pikeminnow at various life stages, including

red shiners (*Cyprinella lutrensis*), fathead minnow (*Pimephales promelas*), channel catfish (*Ictalurus punctatus*), northern pike (*Esox lucius*), smallmouth bass (*Microperus dolomieu*), walleye (*Sander vitreus*), and green sunfish (*Lepomis cyanellus*) (USFWS 2002c, 2011b). Smallmouth bass, northern pike, walleye and channel catfishhave been identified as the principal non-native threats to adult and sub-adult Colorado pikeminnow, with burbot (*Lota lota*) an emerging new predator (Johnson et al. 2008). These non-native fishes occupy the same habitat types as Colorado pikeminnow and likely compete for food resources (USFWS 2002c; Franssen and Durst 2014).

### *Information Needs*

Fish passageways have been created at several dams in the Upper Colorado River basin. Long-term monitoring should be in place to assess the effectiveness of the passageways for Colorado pikeminnow, as well as their use by non-native fish species. Also, more information is needed on the impacts of climate change to the Colorado River basin and its native fish species (USFWS 2011b). Lastly, more studies are needed to assess the impact of mercury on Colorado pikeminnow, as it may be causing reproductive impairment (USFWS 2011b).

### *Conservation Actions*

Continue non-native predator suppression throughout the basins where these species have invaded, and continue to improve its effectiveness. Continue to conduct habitat improvement in appropriate areas, to benefit native fish and disadvantage non-natives. In collaboration with the Upper Colorado Endangered Fish Recovery Program, assess entrainment at unscreened diversions and screens that do not operate continuously. Assess utilization of fish passage structures. Evaluate potential and pursue opportunities to develop experimental nonessential populations, disconnected from critical habitat, as fisheries. Recovery efforts for this species are coordinated primarily by the Upper Colorado Endangered Fish Recovery Program, in which Colorado is a partner agency.

## **Colorado River Cutthroat Trout** (*Oncorhynchus clarkii pleuriticus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Range-wide Status of Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*): 2010 (2013); Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*): a technical conservation assessment (2008); Conservation Agreement for Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*) in the States of Colorado, Utah, and Wyoming (2006) (links in Appendix D).

## *Threats*

The Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*) presently occurs in Colorado, Utah, and Wyoming (Hirsch et al. 2013). It formerly also inhabited portions of northern Arizona and New Mexico, but has been extirpated from those states (Hirsch et al. 2013). It is one of the three extant subspecies of trout native to Colorado (Behnke 1992; CPW 2014), and the only subspecies indigenous to Colorado's West Slope. Colorado River cutthroat trout (CRCT hereafter) are found in the following river basins of Colorado: Dolores, Gunnison, Upper Green, Upper Colorado, Yampa, White, and San Juan (Hirsch et al. 2013). Recent genetic and meristic studies have identified two extant cutthroat lineages within this range, provisionally designated the Blue Lineage, native to the Yampa, Green and White River Basins, and the Green Lineage, native to the Upper Colorado, Gunnison and Dolores basins (Metcalf et al. 2012; Bestgen, Rogers, and Granger 2013; USFWS 2014d). A third lineage native to the San Juan basin is evidently extinct, though blue and green lineage populations have been established in this basin by stocking. In keeping with currently-recognized inland cutthroat taxonomy, this account considers all cutthroats indigenous to the West Slope as CRCT (see the greenback cutthroat trout narrative for further detail). The subspecies occupies only 7% of its historic range in Colorado (Hirsch et al. 2013), and is considered a species of special concern (CPW 2014).

### 2 Incompatible Agriculture

Intense concentrations of livestock can degrade habitat for CRCT by damaging stream banks, increasing sediment concentrations, and removing streambank and aquatic vegetation (Belsky et al. 1999; Agouridis et al. 2005).

### 3 Energy Production & Mining

Mining in Colorado has altered stream channels and flushed heavy metals into water bodies. These impacts have resulted in the loss of native fish habitat and in some cases extensive fish kills (Alves 1997a). Although mining was present within the influence zone of only 12 CRCT sites rangewide (Hirsch et al. 2013), drainages in CRCT habitat could be affected by heavy metal pollution.

### 4 Transportation & Service Corridors

The most common land uses occurring in the area of influence around CRCT conservation populations are recreation (non-angling and angling), livestock grazing, and timber harvest (Hirsch et al. 2013). A network of roads exists to support these land use activities, and these roads can create higher sediment loads in streams (Eaglin and Hubert 1993; Trombulak and Frissell 2000). Roads often require culverts that can create barriers to fish passage (Young 2008).

### 7 Natural System Modifications

Habitat degradation from water development activities has contributed to the extirpation or reduction of CRCT populations across its native range (Young 2008). Interactions of stochastic

disturbances, such as channel drying and freezing, together with habitat fragmentation threaten CRCT populations, especially those that occupy stream reaches that are <7km long (Roberts et al. 2013). As of 2010, 27 out of 361 CRCT conservation populations have received in-stream flow enhancements (Hirsch et al. 2013).

### 8 Invasives, Problematic Native Species, & Pathogens

Nonnative salmonids have affected populations of CRCT through hybridization, food and space competition, and predation. For example, nonnative rainbow trout (*Oncorhynchus mykiss*) have hybridized with CRCT, thus reducing the genetic integrity of the subspecies (Allendorf and Leary 1988; Forbes and Allendorf 1991; CRCT Conservation Team 2006; Hirsch et al. 2013). Managers recognize "conservation populations" as those that exist in a genetically unaltered condition (>99% purity) and/or have unique ecological, genetic, and behavioral attributes of significance that may be genetically introgressed (Utah Division of Wildlife Resources 2000; Hirsch et al. 2013). Brown trout (*Salmo trutta*) are predatory on CRCT (Hirsch et al. 2013). Rainbow, brown, and brook trout (*Salvelinus fontinalis*) all compete with CRCT for food and space (Hirsch et al. 2013). As of 2010, 54 conservation populations have experienced physical removal of competing/hybridizing species, and 51 have experienced chemical removal of competing/hybridizing species (Hirsch et al. 2013).

Natural or constructed barriers exist to limit genetic mixing of nonnative trout species and CRCT. However, these barriers also pose a threat to CRCT as they tend to restrict individuals to short, headwater stream segments (Young 2008). This restriction renders populations more vulnerable to extirpation from stochastic events, and could result in the long term loss of genetic variability (Young 2008; Roberts et al. 2013).

Whirling disease (*Myxobolus cerebralis*, WD) is a threat to CRCT. Habitat currently inhabited by CRCT is generally not optimal for tubifex worms (essential to the life history of the WD parasite), due to higher gradient, cold water and lack of organic matter. However, research has shown that high elevational habitats are still susceptible to infection. Regulatory mechanisms have been put in place to prevent stocking of WD-positive fish into any salmonid habitats.

## *Information Needs*

Restoration, conservation, and management activities have been implemented for CRCT conservation populations. More information is needed on the effectiveness of these actions (Hirsch et al. 2013).

## *Conservation Actions*

Provide additional security for existing populations where needed (e.g., through easements, setbacks, landownwer agreements, barriers). Identify opportunities to extend length of available habitat for existing populations and, especially, to restore presumed metapopulations by

connecting populations that are currently isolated. Identify additional potential re-introduction sites within the species' historic range, and aggressively pursue re-introduction opportunities. Emphasis should especially be given to protecting and establishing additional GL populations, as well as those with potential unique life history adaptations (e.g., thermal tolerance).

## **Common Shiner** (*Luxilus cornutus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: South Platte Native Fish Conservation Plan & Arkansas Native Fish Conservation Plan (in development).

### *Threats*

The common shiner (*Luxilus cornutus*) occurs in the South Platte River Basin (CPW 2014). It is rare in the mainstem South Platte River and has been documented in only four of its tributaries (Goettl 1981; Propst 1982; Nesler et al. 1997). It is one of several "glacial relict" fish species restricted to the transition zone along the Front Range, and subject to a number of threats associated with urban development (Fausch and Bestgen 1997, and see "transition zone" description in Habitat section of this Plan). The common shiner was listed as state threatened in 1998 (CPW 2014).

#### 2 Incompatible Agriculture

Excessive grazing in riparian zones can lead to erosion and siltation that compromises the cool, clear waters and clean gravels that are required for common shiner (Trial et al. 1983; Rahel and Hubert 1991; Belsky et al. 1999; CPW 2014). The species is not able to spawn in silt-bottomed streams (Miller 1964).

#### 7 Natural System Modifications

Although the streams historically and presently inhabited by common shiner continue to have perennial flows, most are moderately to heavily fragmented by diversion structures that are barriers to fish movement, and likely reduce connectivity to spawning and rearing habitat in at least some cases. Flow regime alteration may produce a mismatch between spawn timing and spawning habitat availability, compounded by channel alteration resulting in disconnected floodplain. Altered thermal regimes may also arise from hydrologic alteration and potentially impact life history processes.

Siltation has been identified as the primary factor in the extirpation of common shiner in several Front Range streams where they formerly occurred (Propst 1982; Nesler et al. 1997). As a result of vast urban development and the resulting loss of proper stream function, siltation is a widespread issue across nearly all common shiner habitats in Colorado. Studies of common

shiner in Vermont indicated that the species needs both riffle and pools, and in Wyoming it was associated with moderate currents (Rahel and Hubert 1991; Clark et al. 2008). Any water management activity that alters the processes that maintain these habitats could result in the further decline of common shiner in Colorado.

#### 8 Invasives, Problematic Native Species, & Pathogens

Non-native fishes including predatory species have become increasingly abundant in Front Range streams such as Boulder Creek, Saint Vrain Creek, and the Cache La Poudre River, where common shiners formerly or presently occur. Native fish (though not specifically common shiner) have been found to comprise a large proportion of the diet of non-native largemouth bass in the St. Vrain, where an imperiled population of common shiner occurs (CPW unpublished data). Brown trout also co-occur with common shiner in St. Vrain and other Front Range streams and have increased in numbers coincident with apparent declines in common shiner abundance (CPW unpublished data). Aspects of the common shiner's life history could make it particularly vulnerable to predation.

### *Information Needs*

More information is needed on the life history, habitat requirements, and ecology of common shiner. More surveys are needed to determine its abundance and current distribution in Colorado. Lastly, more studies are needed to identify primary threats to the species.

### *Conservation Actions*

Securing water availability and habitat quality for existing populations (e.g., through easements and other landownwer agreements) is a key priority. Continue efforts to identify additional potential re-introduction sites within the species' presumptive native range. Identify opportunities for habitat improvement to create or restore suitable habitat. Evaluate feasibility of measures to suppress non-native predation on the St. Vrain population, and take any suitable actions. Re-establish a captive broodstock at the Mumma Native Aquatic Species Restoration Facility (NASRF) and/or in secure, isolated ponds. If appropriate, augment the St. Vrain population through stocking, and create additional populations through stocking when suitable habitat becomes available.

## **Flannelmouth Sucker** (*Catostomus latipinnis*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: State of Colorado conservation and management plan for the Roundtail Chub (*Gila robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomus latipinnis*) (in development); Range-wide conservation agreement and strategy for Roundtail Chub (*Gila robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth

Sucker (*Catostomus latipinnis*) (2006); Flannelmouth Sucker (*Catostomus latipinnis*): a technical conservation assessment (2005) (links in Appendix D).

## *Threats*

The flannelmouth sucker (*Catostomus latipinnins*) occurs in large streams and rivers in the Western United States. In Colorado, it is found on the western slope in the Upper Colorado River Basin (Bezzerides and Bestgen 2002). The species has declined throughout the Basin, and now occupies half of its historic range (Bezzerides and Bestgen 2002). It has no listing status by the state of Colorado or the U.S. Fish and Wildlife Service. Habitat degradation and interactions with non-native species have been identified as the primary threats to flannelmouth sucker (Tyus and Saunders 2000; Rees, Ptacek, Carr, and Miller 2005; CPW 2014b).

### 2 Incompatible Agriculture

Intense concentrations of livestock can degrade habitat for flannelmouth sucker by damaging stream banks, increasing sediment concentrations, and removing streambank and aquatic vegetation (Belsky et al. 1999; Agouridis et al. 2005). Increased sediment loads could have a negative impact on flannelmouth sucker populations (Rees, Ptacek, Carr, and Miller 2005), but the exact mechanisms and thresholds for the species are unknown.

### 4 Transportation & Service Corridors

Road construction for timber harvesting, agriculture, recreation, and housing development can fragment native fish habitat and increase sediment loads in streams. Higher sediment loads can result in changes to stream channel geometry, thereby affecting the quality of habitat for flannelmouth sucker (Rees, Ptacek, Carr, and Miller 2005). The species has been shown to be highly associated with deep runs (Anderson and Stewart 2003, 2007), and changes in channel geometry could result in less availability of these runs.

### 7 Natural System Modifications

Large dams such as Flaming Gorge, Navajo, and the Aspinall Unit, and the associated alterations have directly influenced thermal and hydrological regimes, reducing flannelmouth sucker populations in both the Lower and Upper Colorado River basins (e.g., Vanicek et al. 1970). Habitat loss has occurred through the de-watering of streams and the construction of dams that block the movement of flannelmouth sucker (Rees, Ptacek, Carr, and Miller 2005). Dams, impoundments and diversions can cause changes in channel geometry, water chemistry, water temperature and flow regimes. These changes can affect the quality of habitat occupied by flannelmouth suckers (Rees, Ptacek, Carr, and Miller 2005). For example, hypolimnetic dam releases have been shown to slow the growth of flannelmouth suckers, delay transition to the juvenile stage, and decrease swimming ability (Clarkson and Childs 2000; Ward et al. 2002). Changes in flow regimes and water temperature created by Flaming Gorge Dam displaced flannelmouth suckers to warmer locations during summer and reduced spawning success

(Vanicek et al. 1970). Impoundments can also have negative impacts on flannelmouth sucker populations (McAda 1977; Chart and Bergersen 1992; Bezzerides and Bestgen 2002). Although water development activities are generally viewed as detrimental to the native fish species that evolved in the lower Colorado River, there is evidence that the altered conditions can support natural flannelmouth sucker reproduction in areas downstream of the Grand Canyon (Mueller and Wydoski 2004).

Lowhead dams and constructed wetlands along Muddy Creek, a tributary of the Little Snake River in the Upper Colorado River basin, were shown to restrict downstream movement of flannelmouth sucker and create novel wetland habitat favoring non-native fish species (Beatty et al. 2009). These dams and constructed wetlands, however, may have positive indirect effects as they create a barrier to the upstream spawning of non-native fish species that prey on, hybridize, and compete with flannelmouth sucker for resources. These findings highlight the complex impacts of dams on Colorado's native fish populations (Beatty et al. 2009). Fish passageways have been created for the flannelmouth sucker and other native fish at dam sites in the Colorado River near Palisade and on the Gunnison River (Landers 2012).

### 8 Invasives, Problematic Native Species, & Pathogens

Nonnative fish species hybridize with and prey upon flannelmouth sucker. The nonnative northern pike is a known predator of flannelmouth sucker (Nesler 1995). Other nonnative fish species that are common in the Colorado River and its tributaries, such as brown trout (*Salmo trutta*), rainbow trout (*Oncorynchis mykiss*), red shiner (*Notropis lutrensis*), and smallmouth bass (*Micropterus dolomieu*), likely also eat flannelmouth sucker, though direct evidence is lacking for some of these species (Rees, Ptacek, Carr, and Miller 2005). Hybrids between nonnative white sucker (*Catostomus commersoni*) and flannelmouth sucker have been documented in the Colorado, Gunnison, and Yampa rivers (Douglas and Douglas 2003; Shiozawa et al. 2003; Anderson and Stewart 2007). Hybridization between the non-native white sucker and the native bluehead sucker has also been documented, as well as individuals with genetic contributions from the white sucker, bluehead sucker, and native flannelmouth sucker (*Catostomus latipinnus*) (McDonald et al. 2008). The non-native white sucker has facilitated introgression between two native species, and therefore threatens the genetic integrity of the bluehead and flannelmouth suckers. White suckers have become pervasive throughout the Colorado River Basin, hybridizing readily with flannelmouth suckers, thus creating a serious extinction risk to flannelmouth suckers (McDonald et al. 2008).

## *Information Needs*

Information about flannelmouth sucker has been collected as a by-product of studies for other Colorado River fish that are federally listed (Rees, Ptacek, Carr, and Miller 2005), but more studies need to focus on obtaining information on the life history, ecology, movement patterns,

influence of non-native fish species, and the effects of anthropogenic habitat modification (Rees, Ptacek, Carr, and Miller 2005).

### *Conservation Actions*

Hybridization with non-native suckers is the most pressing conservation threat. Reaches that presently support flannelmouth and/or bluehead suckers and do not contain non-native suckers should be individually evaluated and all appropriate measures identified to ensure they remain uninvaded. Constructed barriers, in conjunction with mechanical or chemical removal, may be feasible in some streams, to open up additional habitat for re-introduction. Suppression of non-native predators, particularly northern pike and smallmouth bass, must continue throughout the basins where these species have invaded. Colorado's DRAFT Conservation and Management Plan for the 'three species,' which needs to be finalized, specifies additional conservation actions.

## **Flathead Chub** (*Platygobio gracilis*)

### *Threats*

Flathead chub (*Platygobio gracilis*) occupy the mainstems of turbid rivers from the Northwest Territories of Canada south to Texas (Kucas 1980). In Colorado, the species is found in the Arkansas and Rio Grande river basins (Alves 1997b; Nesler et al. 1999). Its range within the state has been reduced (Woodling 1985; CPW unpublished data), and it is now listed as a species of special concern (CPW 2014).

#### 2 Incompatible Agriculture

Overgrazing by livestock can degrade flathead chub habitat by increasing stream width, decreasing channel depth, and increasing stream intermittency (Platts 1991; Rahel and Thel 2004a). Livestock waste in streams occupied by flathead chub can decrease water quality by lowering oxygen concentrations and increasing ammonia (Scarnecchia 2002).

#### 3 Energy Production & Mining

Heavy metal contamination from mining activities has been proposed as a contributing factor to the loss of flathead chub in the Arkansas River between the towns of Salida and Florence, Colorado (Woodling 1985; Rahel and Thel 2004a). Although water quality has improved in this stretch of the Arkansas River (Rahel and Thel 2004a), historic mines can still pose a threat to flathead chub. Stochastic events such as extreme rainstorms and mudslides can flush heavy metals from these mines into water bodies and cause extensive fish kills (Alves 1997a).

A significant amount of coalbed methane production occurs in the Raton Basin: an area that contains the Purgatorie River as well as smaller streams that are tributaries to the Arkansas River. Flathead chub have been documented as one of the most common fish species in the Purgatoire

River (Bramblett and Fausch 1991; Nesler et al. 1999; CPW unpublished data). Wastewater produced by coalbed methane production in the Purgatoire River drainage could alter streamflow conditions, making them more favorable for nonnative fish species. Discharged wastewater can convert intermittent streams on the plains into perennial flows (Freilich 2004), which in turn could allow the establishment of nonnative piscivorous fish (Rahel and Thel 2004a). This produced wastewater could also result in higher concentrations of saline and heavy metals, which could be toxic to flathead chub (Rahel and Thel 2004a).

### 7 Natural System Modifications

Water development activities have led to the loss and degradation of habitat for flathead chub. Irrigation and groundwater pumping have caused channel dewatering in the Great Plains, resulting in loss of suitable habitat for the chub (Rahel and Thel 2004a). The species has been extirpated in the Arkansas River in western Kansas due to groundwater pumping from the Ogallala Aquifer (Cross and Moss 1987).

In Colorado, the apparent decline or disappearance of flathead chub from some stream reaches coincides strongly with fragmentation by diversion structures, dams and other barriers (CPW unpublished data). Impoundments and dams can negatively affect flathead chub populations by blocking fish movement, changing turbidity levels, creating reservoir habitat that can favor nonnative piscivores, and altering flow regimes (Bonner and Wilde 2002; Quist et al. 2004, Walters et al. 2014). Dams and impoundments also fragment habitat by dissecting long, continuous stretches of free-flowing streams that the species appears to require (Durham and Wilde 2008). Perkin and Gido (2011) estimated a minimum fragment length required for persistence as approximately 180 river kilometers, which is consistent with observed distribution patterns in Colorado. The abundance of flathead chub has been shown to be positively correlated with the percentage of fine substrate in the Missouri River drainage (Quist et al. 2004). Dams and impoundments typically lower the percentage of fine substrate downstream, creating less favorable habitat for flathead chub, a species associated with turbid plains river systems.

### 8 Invasives, Problematic Native Species, & Pathogens

Non-native piscivores can negatively affect flathead chub through competition and predation. The influence of these piscivores likely interacts with the effects of impoundment such as stabilized flows and reduced turbidity (Quist et al. 2004). These changes can give sight-feeding non-native predators an advantage over species like flathead chub that evolved in turbid, dynamic river systems (Rahel and Thel 2004a). The combined effects of non-native piscivores and large impoundments and reservoirs are thought to have had a significant effect on flathead chub in portions of its range (Cross and Moss 1987; Pflieger and Grace 1987; Bonner and Wilde 2000).

### *Information Needs*

Research is needed to elucidate the mechanisms responsible for population trends in the Arkansas and Rio Grande river basins in Colorado (Rahel and Thel 2004). The life history of this species is poorly known, although research projects are underway within Colorado (Colorado State University and CPW) that will significantly increase our understanding, particularly of reproductive ecology and fish movement. Lastly, more research is necessary to understand the role of competitors and predators in limiting population size of flathead chub (Rahel and Thel 2004a).

### *Conservation Actions*

Continue ongoing studies of life history requirements and population dynamics in Fountain Creek. Evaluate restoration potential in reaches from which flathead chub have declined or disappeared, given results of these studies. Rigorously evaluate impacts of the newly-constructed fish passage structure at Owens-Hall diversion, and of Southern Delivery System infrastructure and operations, once in effect.

## **Greenback Cutthroat Trout** (*Oncorhynchus clarkii stomias*)

For available information on threats and conservation actions needed for this species, refer to the following resources: Greenback Cutthroat Trout (*Oncorhynchus clarkii stomias*): a technical conservation assessment (2009); Greenback Cutthroat Trout Recovery Plan (1998) (links in Appendix D). Planning documents currently in preparation (multi-agency MOU; Recovery Outline) will provide the framework for future conservation actions once they are completed.

### *Introduction*

The greenback cutthroat trout (*Oncorhynchus clarkii stomias*) has been the subject of intense research and extensive conservation efforts in Colorado for over forty years. It was federally listed as endangered in 1973, then downlisted to threatened in 1978. Recently, genetic and meristic studies have supported major changes to traditionally held views on the taxonomy and distribution of cutthroat trout subspecies occurring within Colorado (USFWS 2014d). Until recently, the greenback cutthroat trout was considered to be the subspecies native to drainages east of the Continental Divide (Behnke 1992; USFWS 1998a; Young 2009), was thought to be represented on the landscape by a number of populations, and was being considered for delisting. Recent genetic and meristic studies revealed that Bear Creek, in the Arkansas River Basin west of Colorado Springs, contained the only known remaining population of greenback cutthroat trout in the world (Metcalf et al. 2012; Bestgen, Rogers, and Granger 2013; USFWS 2014d). The Bear Creek population likely represents the cutthroat trout lineage that was native to the South Platte River (Metcalf et al. 2012), ironically now occurring in Bear Creek as a result of stocking efforts from South Platte River sources (Kennedy 2010; Rogers 2012).

Other than the Bear Creek population, East Slope cutthroat populations that were formerly assumed to be greenback cutthroat trout now appear to represent one of two lineages, temporarily known as the Blue Lineage (hereafter BL) and the Green Lineage (hereafter GL) (Metcalf et al. 2007, 2012; Bestgen, Rogers, and Granger 2013; USFWS 2014d). BL populations almost certainly arise from early stocking efforts driven by wild spawn operations at Trappers Lake, in the headwaters of the White River Basin, from which at least 80 million eggs were taken in the first half of the 20th century. A full understanding of the GL populations' origins remains problematic; they may be native to the Western Slope and present on the East Slope due to stocking efforts (Metcalf et al. 2007, 2012); however the amount of genetic diversity among GL populations, as well as the distribution of unique genotypes, suggests that some GL populations may in fact be East Slope natives (USFWS 2014d). Ongoing research efforts are underway to help clarify the taxonomy of the GL.

At this writing inland cutthroat taxonomy has not been formally revised to reflect the recent findings. In terms of federal listing status, until FWS completes the ESA status review all populations that had previously been considered as "greenback cutthroat trout" continue to receive protection under the ESA. This includes populations of green lineage in Colorado on both sides of the Continental Divide.

Regardless of eventual taxonomic and regulatory status decisions, the lineage represented by Bear Creek will certainly remain a top conservation priority, as will the genetically unique GL populations. East Slope BL populations are probably a lower conservation priority because they are all replicates of the Trappers Lake source population, and the lineage is relatively well-represented on the West Slope. This summary will focus on the primary threats to the GL on the East Slope and the Bear CCreek GCT (threats to West Slope GL and BL are described in the Colorado River Cutthroat Trout narrative). Historically, the main threats to GL were mining, agriculture and water development activities (Young 2009). Non-native species introductions and invasions are likely the cause of more recent declines (Young 2009). Primary ongoing threats to the Bear Creek GCT are recreation activities. A short account of these threats is provided below.

## *Threats to Bear Creek Greenback Cutthroat Trout*

### 6 Human Intrusions & Disturbance

Bear Creek is located on the east side of Pike's Peak west of Colorado Springs. A network of Pike National Forest trails winds through occupied BCGCT habitat. Sections of the trail are highly eroded from heavy use, and are resulting in the loss of vegetation and increased sediment loading in Bear Creek (Reed and Billmeyer 2010). Efforts are underway to control sediment influx from trail erosion (Reed and Billmeyer 2010).

## *Threats to the Green Lineage*

### 2 Incompatible Agriculture

Intense concentrations of livestock in riparian zones often lead to bank damage, higher sediment loading in streams, and the removal of streambank vegetation (Belsky et al. 1999; Agouridis et al. 2005). These changes can contribute to trout population reductions (Young 2009).

### 3 Energy Production & Mining

Mining in GL habitat has caused alterations in stream channel geometry, contributed to higher sediment loads, and released toxic substances such as heavy metals (Young 2009). Regulations on new mines are much more stringent today, but massive rainstorms, mudslides, or other stochastic events could lead to the release of heavy metals from historic mines and result in catastrophic fish kills such as those documented in Kerber Creek (Alves 1997a).

### 7 Natural System Modifications

Most current populations are established within headwater reaches on public lands and are not typically subject to water management issues.

### 8 Invasives, Problematic Native Species, & Pathogens

Competition and predation by introduced non-native salmonids (brown trout *Salmo trutta*, brook trout *Salvelinus fontinalis* and rainbow trout *Oncorhynchus mykiss*) are serious threats. Additionally, cutthroats hybridize readily with rainbow trout creating an introgressed hybrid swarm. Most cutthroat populations that persist occur upstream of natural or artificial barriers that prevent invasion by non-native salmonids.

Whirling disease (WD) is a threat to greenback cutthroat trout. Habitat currently inhabited by greenbacks is not considered optimal habitat for tubifex worms (essential to the life history of the whirling disease parasite), due to higher gradient, cold water and lack of organic matter. However, research has shown that high elevational habitats are still susceptible to infection. Regulatory mechanisms have been put in place to prevent stocking of WD-positive fish into any salmonid habitats.

## *Information Needs*

More work is needed to resolve the taxonomy of the Bear Creek and Green lineages. East and West Slope Green Lineage fish have distinct morphological and genetic differences that warrant additional investigation (Bestgen, Rogers, and Granger 2013). Additional meristic studies of museum specimens, especially from the South Platte River basin, are also needed (Bestgen, Rogers, and Granger 2013).

### *Conservation Actions*

Aggressively pursue opportunities to establish additional BCGCT populations within the species' presumptive native range. Rigorously evaluate translocation success to determine extent of future stocking (e.g., are the effects of recent genetic bottlenecking pronounced?). Secure additional protection as needed for the extant population in Bear Creek, and for GL populations on the East Slope.

## **Humpback Chub** (*Gila cypha*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Humpback Chub (*Gila cypha*) Recovery Goals – Amendment and Supplement to the Humpback Chub Recovery Plan (2002); Humpback Chub 2nd Revised Recovery Plan (1990) (links in Appendix D).

### *Threats*

The humpback chub is endemic to the Colorado River. It is a member of a suite of federally endangered "big river" fish species including bonytail chub (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*). Once common in the Colorado River, humpback chub are now restricted to approximately 7,300 to 13,800 individuals spread among six extant populations (USFWS 2002d). Only two of those populations exist in Colorado: the Yampa Canyon population on the Yampa River and the Black Rocks population on the Colorado River. The Yampa population has declined dramatically and is extremely imperiled. The primary threats to humpback chub identified in the Federal Recovery Plan are streamflow regulation, habitat modification, predation by non-native fish species, parasitism, hybridization with other native *Gila*, and pesticides and pollutants (USFWS 2002d).

#### 4 Transportation & Service Corridors

The Denver and Rio Grande Western railroad tracks parallel the Colorado River at Black Rocks and Westwater Canyon. Potential hazardous waste spills resulting from a train derailment threaten humpback chub populations in these areas. A network of pipelines containing petroleum products cross or closely follow the Yampa River upstream of Yampa Canyon, none of which contain emergency shut-off valves (USFWS 2002d). Leaking or bursting pipes could result in deleterious effects to the fish community in the Yampa River.

#### 7 Natural System Modifications

The construction of dams along the mainstem of the Colorado River and its tributaries has fragmented and inundated riverine habitat, released cold, clear waters; altered ecological processes; affected seasonal availability of habitat; decreased turbidity that serves as cover from predators and creates sandy backwater habitat for young humpback chub; and blocked fish

passage (Minckley and Deacon 1968; Marsh and Douglas 1997; Valdez and Ryel 1997; USFWS 2002d). Flow recommendations have been developed that specifically consider flow-habitat relationships in habitats occupied by humpback chub in Colorado including Black Rocks (McAda 2000) and Yampa Canyon (Modde and Smith 1995; USDOI 1995; Modde et al. 1999; USFWS 2002d). The Green River Dam in Utah is slated for rehabilitation, and the final plans for renovation include a fish passageway to allow for the upstream and downstream movement of native fishes, including humpback chub (USDOA 2014).

### 8 Invasives, Problematic Native Species & Genes, & Pathogens

Predation by non-native northern pike (*Esox lucius*) and smallmouth mass (*Micropterus dolomieu*) has likely impacted the Yampa Canyon population. These non-native species remain uncommon in the Black Rocks section of the Colorado, although they may have increased recently.

The non-native Asian tapeworm (*Bothriocephalus acheilognathi*) has been implicated in the decline in the condition of humpback chub below Glen Canyon Dam (Meretsky et al. 2000). In 2005, an Asian tapeworm was documented for the first time in a roundtail chub (*Gila robusta*) in the Yampa River (Ward 2005). The tapeworm could pose a serious threat to the humpback chub populations in Colorado as they are difficult to eradicate, have a rapid life cycle of only 15 days, and are non-host specific (Hoffman 1976; Granath and Esch 1983).

Several members of the genus *Gila* reside in the Colorado River including humpback chub (*G. cypha*), roundtail chub (*G. robusta*), and bonytail chub (*G. elegans*). While members of the group historically were likely allopatric, dams and diversions have eliminated or compromised the realized niches of these species, and they now occur sympatrically (Douglas et al. 1998). Morphological characters can be used to separate out each taxon, but hybrids often possess intermediate characters. Hybrid intermediacy has led to inaccurate field identification. In Black Rocks and Westwater Canyon, researchers have documented higher proportions of roundtail chub during low flow years (Kaeding et al. 1990; Chart and Lentsch 2000). These low flow years result in increased sympatry between both chub species, and potentially increase the chances for hybridization (USFWS 2002d). Thus, it is necessary to mimic natural hydrological flow regimes to maintain natural proportions of *Gila* species and intergrades (USFWS 2002d).

### 9 Pollution

Pollutants and pesticides from agricultural runoff have been suggested as possible threats to the species, but no tissue analysis has been conducted on humpback chub (Haynes and Muth 1981; Wick et al. 1981).

### *Information Needs*

Because of the difficulty of sampling in canyon-bound, big river reaches preferred by this species, accurate population estimates are particularly difficult to obtain. Life history studies in Arizona at the confluence of the Little Colorado River and the Colorado River have revealed that larger adults spawn more frequently than smaller adults, that there are residents in spawning grounds, and that juveniles move out of the Little Colorado River in large numbers during monsoon season (July-September) (Yackulic et al. 2014). Comparably detailed studies that focus on movement, growth, and survival of humpback chub are needed in occupied habitat in the state of Colorado at Black Rocks near Grand Junction and Yampa Canyon. More information is needed to determine the extent, if any, of Asian tapeworm infestations and any associated declines in the condition of humpback chub in Yampa Canyon and Black Rocks. Tissue analysis of humpback chub is also needed to determine levels of bioaccumulation of pesticides and pollutants (USFWS 2002d).

### *Conservation Actions*

Continue to suppress non-native predators, particularly northern pike and smallmouth bass, throughout the basins where these species have invaded. Recovery efforts for this species are coordinated primarily by the Upper Colorado Endangered Fish Recovery Program, in which Colorado is a partner agency.

## **Mountain Sucker** (*Catostomus platyrhynchus*)

### *Threats*

The mountain sucker (*Catostomus platyrhynchus*) is distributed throughout western North America. In Colorado, it occurs in the northwestern part of the state in the Green River drainage, as well as the headwaters of the Colorado, Yampa, and White rivers (Snyder 1981; Belica and Nibbelink 2006). Population trends are largely undocumented for Colorado, but declines have been documented in California (Erman 1986), Wyoming (Patton et al. 1998), and South Dakota (Schultz and Bertrand 2012). It is listed as a species of special concern in Colorado (CPW 2014).

#### 3 Energy Production & Mining

This species occurs in northwestern Colorado, an area that has undergone significant energy development in the last decade. More roads and culverts have been built in the area, and this could result in the fragmentation of mountain sucker habitat. Spills from oil and gas related activities could result in the contamination of occupied mountain sucker habitat.

### 7 Natural System Modifications

Dams and impoundments can fragment habitat and create barriers to movement, eliminate habitat, and alter fish species assemblages (Decker and Erman 1992; Moyle 2002; Belica and Nibbelink 2006). All of these changes can threaten the long-term survival of mountain sucker. Populations that occur downstream from dams may experience changes in flow regimes and water temperatures. These could have deleterious effects on mountain sucker (Belica and Nibbelink 2006).

Backwater pools and off-channel habitats provide refugia for mountain suckers in the presence of non-native brown trout (Olsen and Belk 2005). Water management activities that degrade or eliminate off-channel habitats could exacerbate the negative effects of predatory, non-native fish species (Scott and Helfman 2001; Olsen and Belk 2005).

### 8 Invasives, Problematic Native Species, & Pathogens

Predation from non-native salmonids is considered a potentially limiting factor for mountain sucker (Isaak et al. 2003). For example, mountain sucker has been found to be negatively associated with the predatory, non-native brown trout (*Salmo trutta*) (Decker and Erman 1992; Giddings et al. 2006; Dauwalter and Rahel 2008). Interactions with other non-native fish species are largely unknown.

## *Information Needs*

In Colorado, more information is needed on population trends of mountain sucker (Belica and Nibbelink 2006). Movement patterns and habitat requirements are not well known for the species (Belica and Nibbelink 2006). Further, more studies are needed assessing the impacts of oil and gas development on mountain sucker. Lastly, future research should focus on understanding aspects of the community ecology of mountain sucker, such interaction and competition with non-native fish species.

## *Conservation Actions*

Hybridization with non-native suckers is the most pressing conservation threat. Reaches that presently support mountain suckers and do not contain non-native suckers should be individually evaluated and all appropriate measures identified to ensure they remain uninvaded. Constructed barriers, in conjunction with mechanical or chemical removal, may be feasible in some streams, to open up additional habitat for re-introduction. Suppression of non-native predators, particularly northern pike and smallmouth bass, must continue throughout the basins where these species have invaded.

# Northern Redbelly Dace (*Phoxinus eos*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: South Platte Native Fish Conservation Plan & Arkansas Native Fish Conservation Plan (in development); Northern Redbelly Dace (*Phoxinus eos*): a technical conservation assessment (2006) (link in Appendix D).

## *Threats*

The northern redbelly dace (*Phoxinus eos*) occurs in Canada, the northeastern United States, west to Montana. The southernmost populations occur in the South Platte River basin in Colorado, where it is listed as state endangered (CPW 2014). As a glacial relict species restricted to the transition zone along the Front Range, it is subject to a number of threats associated with urban development (Fausch and Bestgen 1997, and see "transition zone" description in Habitat section of this Plan). Since 1986, the species has only been documented in one area in Colorado: the West Plum Creek drainage south of Denver (Bestgen 1989; Nesler et al. 1997).

### 1 Residential & Commercial Development

The West Plum Creek drainage is located south of Denver near Sedalia, Colorado in Douglas County. The population of Douglas County has grown 7.2% from 2010 to 2013 (U.S. Census Bureau 2014). The West Plum Creek area is relatively close to Denver, and housing developments have been built since Bestgen (1989) confirmed the presence of northern redbelly dace in the area. This increased development may result in loss, degradation or fragmentation of occupied dace habitat. Reaches of St. Vrain Creek and the Big Thompson River where northern redbelly dace were historically collected have been impacted by urban development to a much greater extent.

### 7 Natural System Modifications

The northern redbelly dace is typically found in clear, spring-fed, low velocity streams and small ponds with cool water, high vegetation cover (Stasiak 1987; Wright 2011; Felts and Bertrand 2014). Impoundments, diversions groundwater pumping, and dams could degrade or fragment habitat by increasing turbidity, changing channel morphology, and dewatering and/or altering flows (Stasiak 2006). Stream channelization for flood control has greatly reduced the amount of permanent near-channel standing water or low-flow habitat for the species along the Front Range of Colorado (CPW 2014).

### 8 Invasives, Problematic Native Species, & Pathogens

Introduced fish species are considered a major threat to northern redbelly dace (Stasiak 2006). In the headwaters of the Niobrara River in Nebraska, northern redbelly dace may be declining due to the presence of stocked brown trout (*Salmo trutta*), northern pike (*Esox lucius*), bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*) (Stasiak 1976; Stasiak 1989; Stasiak

2006). Western mosquito fish may negatively impact northern redbelly dace by displacement from its preferred thermal regime (Ciepiela et al. 2013).

### *Information Needs*

Increased frequency of sampling, as well as studies on the hydrology and flow dynamics are needed in the W. Plum Creek area (Wright 2011).

### *Conservation Actions*

Securing water availability and habitat quality for existing populations (e.g., through easements and other landownwer agreements) is a key priority. Continue efforts to identify additional potential re-introduction sites within the species' native range. Identify opportunities for habitat improvement to create or restore suitable habitat. Maintain the broodstock at NASRF and create additional populations through stocking when suitable habitat becomes available.

## **Orangespotted Sunfish** (*Lepomis humilus*)

### *Threats*

The orangespotted sunfish (*Lepomis humilus*) is widespread throughout the Central United States. In Colorado, it is occurs in the Arkansas and South Platte River basins (Nesler et al. 1997; Nesler et al. 1999). Few studies have investigated the status and trends of orangespotted sunfish in Colorado.

#### 7 Natural System Modifications

The orangespotted sunfish occurs in both lakes and streams on Colorado's Eastern Plains, and is tolerant of low flow conditions and high water temperatures (Tomelleri and Eberle 1990). However, tolerance thresholds for these harsh conditions are unknown. The dewatering of streams caused by groundwater pumping may be a threat to this species. In stream habitats the orangespotted sunfish prefers clear streams with rocky substrate, but is tolerant of brief periods of siltation (Tomelleri and Eberle 1990). Dams and diversions that alter both the creation and maintenance of these rocky beds and sediment concentrations could create less favorable habitat for species. Anecdotal observation suggests that declines may be associated with increased siltation (CPW unpublished data). The species also inhabits standing water —historically mostly near-channel floodplain ponds, which have decreased in availability through channelization, and often declined in quality due to contaminants and nutrients (Nesler et al. 1997). Although abundant new lentic habitat has been created for water storage and gravel mining, most of these waters contain largemouth bass and other centrarchids; it has been speculated that these may outcompete orangespotted sunfish based on size, aggressiveness and physiochemincal tolerance (Propst 1982).

### *Information Needs*

More information is needed on the habitat preferences, threats, and status of orangespotted sunfish in Colorado.

### *Conservation Actions*

Secure water availability and habitat quality for existing populations, e.g., through easements and other landownwer agreements. Identify potential ponds for broodstock maintenance, should that become necessary. Identify opportunities for habitat improvement to create or restore suitable habitat. Maintain the broodstock at NASRF and create additional populations through stocking when suitable habitat becomes available.

## **Orangethroat Darter** (*Etheostoma spectabile*)

### *Threats*

The orangethroat darter (*Etheostoma spectabile*) is widespread throughout the central United States. In Colorado, it is restricted to the far eastern side of the state in the Republican River Basin (Cancalosi 1980; Woodling 1985). The species is also found in Lodgepole Creek, in Wyoming, a tributary to the South Platte that joins the South Platte near Ovid, Colorado. One may surmise from this that the orangethroat darter historically also occurred in eastern portions of South Platte basin within Colorado, but it has never been collected there.

#### 7 Natural System Modifications

Dewatering, primarily due to groundwater depletion, is an immediate or prospective threat for much of the Republican Basin within Colorado (Falke et al. 2011; McGuire 2011). The species is tolerant of warm water and able to withstand short periods of intermittent stream flow, taking refuge in small pools (Cross and Collins 1975). However, tolerance thresholds for the darter are unknown; it is likely that direct habitat loss and fragmentation for extended periods of time due to dewatering could negatively affect the species. The orangethroat darter prefers fast moving water and silt-free habitats (Pfleiger 1997). Dams and diversions create lentic habitats, block fish passage, and alter sediment concentrations, creating less favorable habitat for orangethroat darter (Woodling 1985).

### *Information Needs*

Basic information is needed on life history and habitat preferences as they relate to potential impacts of fragmentation.

### *Conservation Actions*

Securing water availability and habitat quality for existing populations, e.g., through easements and other landownwer agreements, is a key priority. Identify reaches most likely to retain unfragmented, perennially-flowing water 30-50 years from now, and concentrate efforts to protect surface and groundwater in those areas.

## **Plains Minnow** (*Hybognathus placitus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: South Platte Native Fish Conservation Plan & Arkansas Native Fish Conservation Plan (in development); Plains Minnow (*Hybognathus placitus*): a technical conservation assessment (2005) (link in Appendix D).

### *Threats*

The plains minnow (*Hybognathus placitus*) is a small, slender fish that occurs in the Great Plains region from Montana to Texas. In Colorado, it is found on the eastern plains, and is listed by the State of Colorado as endangered (CPW 2014). Specimens have been collected from the Republican River, South Platte River, and Arkansas River basins, but it is considered extremely rare in the state (Cancalosi 1980; Goettle 1981; Propst 1982; Woodling 1985; Scheurer 2002; CPW 2014). In the Arkansas River, CPW has recently (2013) initiated a stocking augmentation program. Little information is available on the distribution, life history, population trends, and community ecology of plains minnow (Rees, Carr, and Miller 2005a). This information is critical for the management and conservation of this species.

#### 2 Incompatible Agriculture

Grazing by livestock has damaged 80% of the streams and riparian ecosystems in the western United States (USDOI 1994; Belsky et al. 1999). Erosion and siltation from cattle grazing can degrade habitat for native fishes (Scheurer and Fausch 2002). Although water quality parameters are undefined for this species, it is likely that a reduction in water quality could lead to a reduction in overall fitness of plains minnow (Rees, Carr, and Miller 2005a).

#### 7 Natural System Modifications

Population declines in the Arkansas River (Kansas and Colorado) are associated with dewatering and changes in channel morphology (Cross and Moss 1987). These changes are caused by

groundwater pumping, diversions, impoundments, and land use practices that modify flow regimes (Rees, Carr, and Miller 2005a).

#### 8 Invasives, Problematic Native Species, & Pathogens

Non-native fish species are likely to threaten the health and population of plains minnow through competition and predation (Rees, Carr, and Miller 2005a). However, there is a lack of research on the interactions between plains minnow and non-native fish species.

### *Information Needs*

More sampling is needed in the Republican River, Arkansas River, and South Platte River basins to determine how much of this species' historic range is still occupied (Scheurer et al. 2003). More information is needed on the life history, ecology and habitat requirements of plains minnow (Rees, Carr, and Miller 2005a). Further studies are also needed examining the impacts of nonnative fish species on the plains minnow. Lastly, determining the response of the species to changes in stream flow is critical for informing management decisions on flow regimes (Rees, Carr, and Miller 2005a).

### *Conservation Actions*

Establish a South Platte basin broodstock and initiate an augmentation stocking program in the South Platte Basin. Continue stocking in the Arkansas basin. Rigorously evaluate factors affecting survival and persistence, to increase success of future efforts. Identify opportunities for habitat improvement to create or restore suitable habitat.

## **Plains Topminnow** (*Fundulus sciadicus*)

### *Threats*

The plains topminnow (*Fundulus sciadicus*) is a Great Plains endemic. In Colorado, it occurs in the mainstem of the South Platte River and its tributaries (Woodling 1985). Population declines have been documented across its range (Weitzel 2002b). In 2013, the US Fish and Wildlife Service found the species not warranted for federal ESA listing or candidate status (USFWS 2013f). It has no special status in Colorado, although certain populations appear to have declined (CPW unpublished data), and it is vulnerable given its life history requirements. The primary threats to plains topminnow are competition with nonnative fish species, water management activities, urban and rural development, and intense livestock grazing (Rahel and Thel 2004b; Pasbrig et al. 2012; USFWS 2013f).

#### 1 Residential & Commercial Development

Plains topminnow habitat has likely been lost or degraded due to the rapid development of the Front Range of Colorado (Nesler et al. 1997). Urban and ex-urban development in the Front Range corridor has caused stream channelization and water quality degradation.

### 2 Incompatible Agriculture

Across its range, the plains topminnow is most abundant in spring fed pools with clear water and high cover of macrophytes (Rahel and Thel 2004b). Intense cattle grazing can result in a loss of aquatic vegetation, as well as an increase in turbidity, therefore degrading plains topminnow habitat (Platts 1991; Rahel and Thel 2004b). Overgrazing can also lead to increased bank erosion and stream intermittency (Platts 1991).

### 7 Natural System Modifications

The decline in plains topminnow populations has been linked to the de-watering of critical backwater habitats from irrigation drawdown and drought (Haas 2005; Koupal and Pasbrig 2010). Although drought conditions are a common occurrence across the Great Plains, the lowering of ground water levels from irrigation pumping has increased the magnitude of stream de-watering (Fausch and Bestgen 1997; Dodds et al. 2004; Rahel and Thel 2004b). Plains topminnow are usually located in headwater and naturally intermittent reaches of prairie streams, and are therefore highly vulnerable to habitat loss from irrigation and water diversions that lower the water tables and in-stream flows (Rahel and Thel 2004b). They tend to prefer standing water or slow-moving habitat such as backwater, sloughs, or seasonally-connected near-channel habitat. These habitat types are particularly likely to be impacted by channel modification associated with water management and/or urban development.

### 8 Invasives, Problematic Native Species, & Pathogens

Several nonnative fish species have been suggested as potential predators and competitors of plains topminnow including largemouth bass (*Micropterus salmoides*) and, especially, Western mosquitofish (*Gambusia affinis*). In a laboratory experiment, western mosquitofish likely caused plains topminnow mortality by direct injury and competition for food resources (Haas 2005). Western mosquitofish could cause dramatic reductions in plains topminnow populations (Rahel and Thel 2004b; Haas 2005). Another study revealed that a shift in fish species assemblage over to generalist and nonnatives coincided with the loss of plains topminnow (Fischer and Paukert 2008). In Colorado, CPW researchers found a strong correlation between mosquitofish invasion and subsequent apparent disappearance of plains topminnow at invaded sites (CPW unpublished data).

## *Information Needs*

More information is needed on basic life history traits, the roles of predation and competition, and mechanisms used by plains topminnow to re-establish populations after local extirpations (Rahel and Thel 2004b).

## *Conservation Actions*

Secure water availability and habitat quality for existing populations (e.g., through easements and other landowner agreements). Continue efforts to identify additional potential re-introduction sites within the species' presumptive native range. Sites that remain uninvaded by

*Gambusia* are especially important. Rigorously evaluate factors affecting success of translocations, to increase success of future efforts. Continue survey efforts to identify additional populations. Identify opportunities for habitat improvement to create or restore suitable habitat.

## **Razorback Sucker** (*Xyrauchen texanus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Razorback Sucker (*Xyrauchen texanus*) Recovery Goals – Amendment and Supplement to the Razorback Sucker Recovery Plan (2002); Razorback Sucker (*Xyrauchen texanus*) Recovery Plan (1998) (links in Appendix D).

### *Threats*

The razorback sucker (*Xyrauchen texanus*) was once common to abundant throughout the Colorado River Basin and its tributaries (Minckley 1991). In 1991, the razorback sucker was listed as Endangered throughout its entire range (USFWS 2002e). In Colorado, all extant populations are supplemented with stocked fish. Stocked fish survive well, with individual fish known to have persisted for over a decade post-release. Reproductive behavior and larval production are observed regularly in the Colorado River and more recently in the White (as well as in reaches outside of Colorado); however, evidence that wild-spawned fish survive to be juveniles or recruit to adulthood remains elusive. Threats to the species include streamflow regulation, habitat modification, competition with and predation by nonnative fish species, and pesticides and pollutants (USFWS 2002e).

#### 2 Incompatible Agriculture

Irrigation has caused high selenium concentrations in upper Colorado River, the Gunnison River, and the San Juan River (Anderson et al. 1961). Selenium concentrations have been shown to be negatively correlated with egg diameter and percent hatch, and positively correlated with deformities in razorback suckers (Hamilton et al. 2005).

#### 3 Energy Production & Mining

A large uranium mill tailings pile from the Atlas Mine near Moab, Utah poses two significant threats to endangered fish in the Colorado River: 1) toxic discharges of pollutants, particularly ammonia, enter the river through groundwater and are directly toxic to razorback sucker, and 2) risk of catastrophic pile failure could bury nursery areas and destroy fish habitat (Fairchild et al. 2002; USFWS 2002e).

#### 4 Transportation & Service Corridors

The Denver and Rio Grande Western railroad tracks parallel the Colorado River at Black Rocks and Westwater Canyon. Potential hazardous waste spills resulting from a train derailment

threaten razorback sucker populations in these areas. A network of pipelines containing petroleum products cross or closely follow the Yampa River upstream of Yampa Canyon, none of which contain emergency shut-off valves (USFWS 2002e). Leaking or bursting pipes could result in deleterious effects to the fish community in the Yampa River.

### 7 Natural System Modifications

The construction of dams along the mainstem of the Colorado River and its tributaries has fragmented and inundated riverine habitat; released cold, clear waters; altered ecological processes and sediment regimes; affected seasonal availability of habitat; and blocked fish passage (Minckley and Deacon 1968; Marsh and Douglas 1997; Holden 1979; USFWS 2002e). Fish passageways have been created for the razorback sucker and other native fish at dam sites in the Colorado River near Palisade and on the Gunnison River (Landers 2012). The Green River Dam in Utah is slated for rehabilitation, and the final plans for renovation include a fish passageway to allow for the upstream and downstream movement of native fishes, including razorback sucker (USDOA 2014).

The razorback sucker evolved under the highly variable flows of the Colorado River before dams and impoundments were established. Adult razorback suckers spawn over clean cobble bars during spring runoff, and their larvae drift into floodplain habitats inundated during the spring floods (McAda and Wydoski 1980; Wick et al. 1982; USFWS 2002e). The dam-related changes in timing and flow levels on the Colorado River and its tributaries, along with channelization, have led to a loss of floodplain nurseries that are necessary for the survival and reproduction of the razorback sucker (McAda and Wydoski 1980). Re-creation of suitable nursery habitat (mostly in Utah) and timing of dam releases to coincide with razorback spawning appear to hold promise for meeting the razorback sucker's life history requirements despite the persistence of these threats (UCREFRP 2012).

### 8 Invasives, Problematic Native Species, & Pathogens

Numerous non-native species are reported as predators on the razorback sucker, including striped bass (Karam et al. 2008), common carp, green sunfish, largemouth bass, and flathead catfish (20+ authors, see citation list on pg. 23 of the Recovery Plan, USFWS 1998b). Smallmouth bass (*Microperus dolomieu*) northern pike (*Esox lucius*), walleye (*Sander vitreus*) and channel catfish (*Ictalurus punctatus*) have been identified as the foremost threats, along with burbot (*Lota lota*), an emerging new predator (Johnson et al. 2008). These non-native species are cited as the primary biological threat to the survival and reproduction of razorback sucker (USFWS 1998b).

## *Information Needs*

More information is needed on suitable habitat for razorback sucker. Pesticides have been cited as a possible threat to the razorback sucker, but little to no research has been done investigating the effects of pesticides on the species. The severity of selenium impacts needs to be determined with much more certainty.

### *Conservation Actions*

Suppression of non-native predators, particularly northern pike and smallmouth bass, must continue throughout the basins where these species have invaded. Recovery efforts for this species are coordinated primarily by the Upper Colorado Endangered Fish Recovery Program, in which Colorado is a partner agency.

## **Rio Grande Chub** (*Gila pandora*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Rio Grande Chub (*Gila pandora*): a technical conservation assessment (2005) (link in Appendix D).

### *Threats*

The Rio Grande chub (*Gila pandora*) was once widespread in New Mexico (Rio Grande and Pecos River basins), Colorado (upper Rio Grande and San Luis River basins), and Texas (Pecos River basin) (Zuckerman and Langlois 1990; Bestgen, Compton, Zelasko and Alves 2003; Rees, Carr, and Miller 2005b). In Colorado, overall numbers of individuals have been reduced by as much as 75% (Zuckerman and Langlois 1990; Bestgen, Compton, Zelasko and Alves 2003; Rees, Carr, and Miller 2005b). It is now considered a Species of Special Concern (CPW 2014). Major threats are degradation of habitat following dam and impoundment construction, predation by and competition with non-native fish species, heavy metals from natural sources and mining, and excessive grazing (Bestgen, Compton, Zelasko and Alves 2003; Rees, Carr, and Miller 2005b).

#### 2 Incompatible Agriculture

The Rio Grande chub is commonly associated with aquatic macrophytes such as *Potamogeton*, woody debris, and overhanging riparian vegetation. Overgrazing in occupied habitat can lead to the degradation or elimination of these microhabitat types, and is thus cited as a possible threat to the species although studies are lacking (Calamusso and Rinne 1999; Bestgen, Compton, Zelasko and Alves 2003).

#### 3 Energy Production & Mining

Heavy metals and cyanide from the Summitville Mine were released into the headwaters of the Alamosa River beginning in 1986 (Csiki and Martin 2008). These pollutants may be responsible for absence of fishes upstream and in Terrace Reservoir (Woodling 1995). In 1997, heavy metals from historic mines were flushed by a summer rainstorm into Kerber Creek. All fish in Kerber Creek died, along with 43% of the fish in a 4km stretch of San Luis Creek (Alves 1997a; Bestgen, Compton, Zelasko and Alves 2003). Rio Grande chub were known to occupy these two creeks, and continued monitoring of the site has shown a decline in numbers of individuals following the contamination event (Bestgen, Compton, Zelasko and Alves 2003).

### 7 Natural System Modifications

The construction of at least 56 large-scale dams along the entire length of Rio Grande River began in the late 1800s, and accelerated through the 1960s (Cowley 2006). These structures have homogenized and depleted flows, altered natural seasonal flow regimes (Molles et al. 1998), fragmented habitat, and interrupted fundamental processes such as sediment and nutrient transport (Ellis et al. 2001), causing a decline in the Rio Grande chub and other native fish species.

### 8 Invasives, Problematic Native Species, & Pathogens

Negative interactions with non-native species have been cited as one of the main contributing factors to the decline of the Rio Grande chub in the Carson and Santa Fe National Forests in northcentral New Mexico, close to the Colorado border (Calamusso and Rinne 1999). The species composition at occupied Rio Grande chub sites in Colorado was found to be dominated by non-native fish: the most common among these were fathead minnow (*Pimephales promelas*), white sucker (*Catostomus commersonii*), and red shiner (*Cyprinella lutrensis*), respectively (Bestgen, Compton, Zelasko and Alves 2003). All of these species are suspected to compete with or prey on the Rio Grande chub, although direct evidence is lacking.

## *Information Needs*

Seasonal patterns and basic life history information for the Rio Grande chub is sorely lacking. Furthermore, there is little information available on predation by non-native species, as well as the dietary habits of the species. More studies are also needed to better understand the impact of grazing on Rio Grande chub. Lastly, earlier studies on the impacts of non-native species on Rio Grande chub have been conducted in New Mexico (Calamusso and Rinne 1996), but more investigation is needed within Colorado.

## *Conservation Actions*

Provide additional security for existing populations where needed (e.g., through easements and other landownwer agreements, barriers). Identify opportunities to extend length of available habitat for existing popoulations and, especially, to restore presumed metapopulations by connecting populations that are currently isolated. Identify additional potential re-introduction sites within the species' historic range, and aggressively pursue re-introduction opportunities.

# **Rio Grande Cutthroat Trout** (*Oncorhynchus clarkii virginalis*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Conservation Agreement for Rio Grande Cutthroat Trout (*Oncorhynchus clarkii virginalis*) in the States of Colorado and New Mexico (2013); Rio Grande Cutthroat Trout (*Oncorhynchus clarkii virginalis*) Conservation Strategy (2013); Rio Grande Cutthroat Trout

(*Oncorhynchus clarkii virginalis*): a technical conservation assessment (2006); Conservation plan for Rio Grande Cutthroat Trout (*Oncorhynchus clarki virginalis*) in Colorado (2004) (links in Appendix D).

## *Threats*

The Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*) occurs in the Canadian, Pecos and Rio Grande river basins in New Mexico and Colorado (Behnke 2002). It is the southernmost subspecies of *O. clarkii* (Pritchard et al. 2009). Rio Grande cutthroat trout populations have suffered serious declines in distribution, and the species presently occupies an estimated 11% of its historic range (USFWS 2014c), and remaining populations are restricted to high elevations and short stream segments (Alves et al. 2008). It was considered "warranted" for federal listing under the Endangered Species Act in 2008 (USFWS 2008), but was then removed from the candidate list in 2014 (USFWS 2014c). In Colorado, it is a species of special concern (CPW 2014).

Recent genetic studies have called into question traditional concepts regarding the taxonomy and distribution of cutthroat trout in Colorado (Metcalf et al. 2007; Metcalf et al. 2012; Bestgen, Rogers, and Granger 2013). Rio Grande cutthroat trout, however, remain a distinct subspecies limited to the Rio Grande basin of Colorado and New Mexico (Metcalf et al. 2012; Bestgen, Rogers, and Granger 2013). Microsatellite data has revealed "clear genetic differentiation between populations in the Rio Grande River and the Canadian and Pecos River drainages" and prompted the recommendation that these populations be conserved as evolutionary significant units (Pritchard et al. 2009).

### 7 Natural System Modifications

Wildfires in the range of Rio Grande cutthroat trout have depressed or eliminated fish populations (Japhet et al. 2007; Patten and Sloane 2007). Ash flows and debris from wildfires can wash into streams and cause fish kills (Rinne 1996; Brown et al. 2001). The watersheds occupied by Rio Grande cutthroat trout have a high risk of burning and causing high amounts of debris flow (Miller and Bassett 2013). The Rio Grande headwaters, however, have only a moderate risk of fire and debris flow compared to the rest of the species' range (Miller and Bassett 2013).

### 8 Invasives, Problematic Native Species, & Pathogens

Non-native rainbow trout (*O. mykiss*) and other non-native cutthroat trout subspecies readily hybridize with Rio Grande cutthroat trout, resulting in introgression and loss of conservation populations (Pritchard and Cowley 2006; Alves et al. 2008). Other non-native fish species, including brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) have displaced or eliminated native cutthroat trout through competition and predation (Harig et al. 2000; Dunham et al. 2002; Peterson et al. 2004; Shemai et al. 2007).

Whirling disease has contributed to the collapse of wild trout populations in the western United States (Ayre et al. 2014). This disease damages the cartilage of infected fish, causes them to swim in a whirling motion. This altered state renders them incapable of feeding or avoiding predation (USFWS 2014c). Rio Grande cutthroat trout are predicted to have relatively low likelihood of infection (Ayre et al. 2014) compared to Colorado River cutthroat trout, but the disease is still considered a threat to the species (USFWS 2014c).

### 11 Climate Change & Severe Weather

Drought and increased stream temperatures have been identified as a major threat to Rio Grande cutthroat trout (Haak et al. 2010). Droughts in the southwestern United States are expected to increase in frequency and severity (Hoerling and Eischeid 2007). This could result in stream dewatering and a decrease in available habitat (Zeigler et al. 2012; USFWS 2014c). Average annual air temperature has increased across the range of Rio Grande cutthroat trout since the mid-20$^{th}$ century, and this trend could result in elevated stream temperatures that are unsuitable for Rio Grande cutthroat trout that rely on coldwater habitat to complete their life cycle (Williams et al. 2009; Ziegler et al. 2012; USFWS 2014c).

## *Information Needs*

Unlike many of the rare fish species in Colorado, there is a relatively rich amount of information available on the Rio Grande cutthroat trout. The distribution of the species is fairly well understood (Alves et al. 2008). However, more surveys are needed to identify Rio Grande cutthroat trout conservation populations and characterize their habitat (RGCTCT 2013). More information is needed on the life history of the species, including spawning patterns and sex ratios. It is unknown if spawning occurs every year (RGCTCT 2013). Movement patterns of the species within small streams are largely unknown (Alves et al. 2008). Future research should also focus on assessing the effectiveness of restoration activities in occupied habitat.

## *Conservation Actions*

Secure water availability and habitat quality for existing populations (e.g., through easements and other landowner agreements). Increase the number of populations through re-introduction into suitable habitat. Continue efforts to identify additional potential re-introduction sites within the species' presumptive native range, including larger drainages with tributary streams. Sites that remain relatively free of non-native predators are especially important. Rigorously evaluate factors affecting success of current stocking efforts, to inform future stocking. Continue survey efforts to identify additional populations. Identify opportunities for habitat improvement to create or restore suitable habitat.

# Rio Grande Sucker (*Catostomus plebeius*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Rio Grande Sucker (*Catostomus plebeius*): a technical conservation assessment (2005); State of Colorado Rio Grande Sucker Recovery Plan (1994) (links in Appendix D).

## *Threats*

The Rio Grande sucker (*Catostomus plebeius*) is endemic to the Rio Grande Basin. The largest part of its range is in New Mexico, with smaller portions extending into Colorado and Mexico. Populations in Colorado declined precipitously during the 20th century, until surveys in 1994 confirmed that only one population remained in Hot Creek in Conejos County (Rees and Miller 2005). It is now listed as a state endangered species in Colorado, and was petitioned for federal listing in 2014. The primary threats to the species are 1) habitat loss through the dewatering of streams, 2) habitat fragmentation and movement barriers caused by dams and diversions, 3) changes in stream temperatures, water chemistry, and channel geometry, and 4) competition and predation by non-native fish species.

### 7 Natural System Modifications

The construction of at least 56 large-scale dams along the entire length of Rio Grande River began in the late 1800s, and accelerated through the 1960s (Cowley 2006). These structures have homogenized and depleted flows, altered natural seasonal flow regimes (Molles et al. 1998), fragmented habitat, and interrupted fundamental processes such as sediment and nutrient transport (Ellis et al. 2001), causing a decline in the Rio Grande sucker and other native fish species.

### 8 Invasives, Problematic Native Species, & Pathogens

Non-native fish species compete with, prey on, and hybridize with Rio Grande sucker. In the last 40 years, the non-native white sucker (*Catostomus commersonii*) has largely replaced the Rio Grande sucker in Colorado (Langlois et al. 1994). It has been suggested that competition between these two species for food, spawning sites, and rearing areas has negatively impacted the Rio Grande sucker (Rees and Miller 2005). Hybrids between these two species have been documented at Hot Creek, but rates were low, and hybridization does not appear to be a major factor in the decline of Rio Grande sucker in Colorado (Zuckerman and Langlois 1990; Swift-Miller et al. 1999). Other non-native fish species such as the brown trout (*Salmo trutta*) and northern pike (*Esox lucius*) are predators of the Rio Grande sucker.

### Other Threats

The feeding habits of the Rio Grande sucker suggest a preference for streams with low turbidity and minimal sediment deposition (Swift-Miller et al. 1999a). However, land use changes such as

road construction, overgrazing, and timber harvest have led to increased sediment loads in Western streams (Judy et al. 1984; Rees and Miller 2005). There are no studies on the impact of these land use practices in occupied Rio Grande sucker habitat, but it is likely that high turbidity and sediment deposition from these activities has depleted and degraded the food supply for the species in Colorado (Swift-Miller et al. 1999b).

### *Information Needs*

Seasonal patterns and basic life history information for the Rio Grande sucker is sorely lacking. More studies are needed to understand the habitat use patterns, diel movements, and life history events of the species. Future studies should also focus on the impacts of grazing, road construction, and culverts on Rio Grande sucker habitat.

### *Conservation Actions*

Secure water availability and habitat quality for existing populations (e.g., through easements and other landownwer agreements, barriers). Continue efforts to identify additional potential re-introduction sites within the species' native range. Rigorously evaluate factors affecting success of current stocking efforts, to increase future success. Continue survey efforts to identify additional populations. Identify opportunities for habitat improvement to create or restore suitable habitat.

## **Roundtail Chub** (*Gila robusta*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: State of Colorado conservation and management plan for the Roundtail Chub (*Gila robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomus latipinnis*) (in development); Range-wide conservation agreement and strategy for Roundtail Chub (*Gila robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomus latipinnis*) (2006); Roundtail Chub (*Gila robusta robusta*): a technical conservation assessment (2005) (links in Appendix D).

### *Threats*

The roundtail chub (*Gila robusta*) was once common in the entire Colorado River Basin, but populations have declined in recent decades (Minckley and Deacon 1968; Carlson and Muth 1989; Osmundson 1999). In the portion of the upper Colorado River Basin located within Colorado, roundtail chub occupies approximately 55% of its historical range; it is declining or extirpated from sections of the Dolores, Gunnison, San Juan, and Green rivers (Bezzerides and Bestgen 2002; Bestgen et al. 2011). It is now considered a "species of special concern" in Colorado (CPW 2014). Population declines are more severe in the lower Colorado River Basin in Arizona and New Mexico, where the species is a Candidate for listing under the Endangered

Species Act (USFWS 2005). Budy et al. (2013) suggest that the roundtail chub is in grave decline in Utah. The primary threats to the species are flow alterations, physical habitat modifications, and the introduction of non-native fishes (USFWS 2002d; CPW 2014).

### 4 Transportation & Service Corridors

The Denver and Rio Grande Western railroad tracks parallel the Colorado River at Black Rocks and Westwater Canyon. Potential hazardous waste spills resulting from a train derailment threaten roundtail chub populations in these areas. A network of pipelines containing petroleum products cross or closely follow the Yampa River upstream of Yampa Canyon, none of which contain emergency shut-off valves (USFWS 2002d). Leaking or bursting pipes could result in deleterious effects to the fish community in the Yampa River.

### 7 Natural System Modifications

The construction of dams along the mainstem of the Colorado River and its tributaries has fragmented and inundated riverine habitat; released cold, clear waters; altered ecological processes and sediment regimes; affected seasonal availability of habitat; and blocked fish passage (Minckley and Deacon 1968; Valdez and Ryel 1995; Marsh and Douglas 1997; USFWS 2002d). Roundtail chub declines are common in impoundments after reservoir construction (Bezzerides and Bestgen 2002). Wolford Mountain Reservoir hosts the only reservoir-dwelling population of roundtail chub in Colorado (Ewert 2010). Fish passageways have been created for the roundtail chub and other native fish at dam sites in the Colorado River near Palisade and on the Gunnison River (Landers 2012). The Green River Dam in Utah is slated for rehabilitation, and the final plans for renovation include a fish passageway to allow for the upstream and downstream movement of native fishes, including roundtail chub (USDOA 2014).

Lowhead dams and constructed wetlands along Muddy Creek, a tributary of the Little Snake River in the Upper Colorado River basin, were shown to restrict downstream movement of roundtail chub and create novel wetland habitat favoring non-native fish species (Beatty et al. 2009). These dams and constructed wetlands, however, may have positive indirect effects as they create a barrier to the upstream spawning of non-native fish species that prey on, hybridize, and compete with the roundtail chub for resources. These findings highlight the complex impacts of dams on Colorado's native fish populations (Beatty et al. 2009).

The homogenization of flows in occupied roundtail chub habitat has led to an increase in continuous flatwater without the topographic and hydraulic heterogeneity required to create and support roundtail chub populations (Bestgen et al. 2011). Reductions in transport of fine sediment may also alter downstream geomorphic characteristics and availability of spawning sites and rearing habitat (Valdez and Ryel 1995; Van Steeter and Pitlick 1998; Douglas and Douglas 2000). Changes in discharge timing and magnitude may shift environmental cues

needed by fish for proper timing of migration and spawning, thereby preventing successful reproduction (Muth et al. 2000).

### 8 Invasives, Problematic Native Species, & Pathogens

Several non-native fish species are predators of the roundtail chub. A clear example was documented in the Yampa River between Hayden and Lily Park during 2000-2003, where the combined effects of drought conditions and increasing smallmouth bass (*Micropterus dolomieui*) and northern pike (*Esox lucius*) populations reduced habitat and recruitment of juvenile fish and increased predation on all size classes (Anderson and Stewart 2007). Negative effects of smallmouth bass on roundtail chub have also been documented in the Dolores River (White 2008; CPW 2010a). Non-native channel catfish (*Ictalurus punctatus*) were also abundant in eddies with roundtail chub in the Yampa and Green Rivers, and are likely predators of the chub (Karp and Tyus 1990).

The non-native Asian tapeworm (*Bothriocephalus acheilognathi*) has been implicated in the decline in the condition of humpback chub (*Gila cypha*) below Glen Canyon Dam (Meretsky et al. 2000). In 2005, an Asian tapeworm was documented for the first time in a roundtail chub (*Gila robusta*) in the Yampa River (Ward 2005). Potential impacts on the roundtail chub are unknown, though none have been observed.

Several members of the genus *Gila* reside in the Colorado River including humpback chub (*G. cypha*), roundtail chub (*G. robusta*), and bonytail chub (*G. elegans*). Recent research suggests that extensive introgressive hybridization has occurred within this group prior to the creation of dams and diversions (Gerber et al. 2001). However, it is also suggested that these human constructions have eliminated or compromised the realized niches of these species, and they now occur sympatrically (Douglas et al. 1998). Morphological characters can be used to separate out each taxon, but hybrids often possess intermediate characters. Hybrid intermediacy has led to inaccurate field identification. In Black Rocks and Westwater Canyon, researchers have documented higher proportions of roundtail chub during low flow years (Kaeding et al. 1990; Chart and Lentsch 2000). These low flow years result in increased sympatry between both chub species, and potentially increase the chances for hybridization (USFWS 2002d). Thus, it is necessary to mimic natural hydrological flow regimes to maintain natural proportions of *Gila* species and intergrades (USFWS 2002d).

## *Information Needs*

More population surveys and life history studies on roundtail chub are needed in the upper Colorado River Basin, especially in smaller streams (Bezzerides and Bestgen 2002). Efforts should also focus on identifying and protecting important tributary streams from further flow alterations and habitat degradation (Bezzerides and Bestgen 2002).

### *Conservation Actions*

Suppression of non-native predators, particularly northern pike and smallmouth bass, must continue throughout the basins where these species have invaded. Colorado's DRAFT Conservation and Management Plan for the 'three species,' which needs to be finalized, specifies additional conservation actions.

## **Southern Redbelly Dace** (*Phoxinus erythrogaster*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: South Platte Native Fish Conservation Plan & Arkansas Native Fish Conservation Plan (in development); Southern Redbelly Dace (*Phoxinus erythrogaster*): a Technical Conservation Assessment (2007) (link in Appendix D).

### *Threats*

The southern redbelly dace (*Phoxinus erythrogaster*) is a small fish species that occurs throughout the Missouri River basin (Stasiak 2007). In Colorado, only two known wild populations exist. These occur in small tributaries to the Arkansas River near Pueblo, Colorado (Bestgen, Crockett, and Foutz 2013). Major threats to the species in Colorado are loss of habitat due to dewatering; habitat degradation due to impoundments, nonpoint source pollution, channelization and siltation; and non-native species.

#### 2 Incompatible Agriculture

Excessive grazing in riparian zones can lead to erosion and siltation that compromises the cool, clear waters and clean gravels that are required habitat conditions for the southern redbelly dace (Platts 1991; Belsky et al. 1999). Increased turbidity from erosion and siltation interferes with the ability of the southern redbelly dace to spawn, feed, and recognize color patterns of potential mates (Rieman and Clayton 1997; Stasiak 2007).

#### 7 Natural System Modifications

In the Arkansas River basin, the southern redbelly dace prefers small, cool, clear streams that are often spring-fed (Bestgen, Crockett, and Foutz 2013). Impoundments, dams, and diversions could degrade habitat for southern redbelly dace by altering flows, water chemistry and channel morphology (Stasiak 2007). Studies have shown that the species has a low tolerance to silt (Poff and Allan 1995) and does not survive well in reservoirs (Mammoliti 2002).

#### 8 Invasives, Problematic Native Species, & Pathogens

Introduced predatory fish species may pose a serious threat to dace populations as they will consume even the largest adults (Stasiak 2007). The nonnative northern pike (*Esox lucius*), a large predatory fish, has been shown to reduce dace populations (He and Kitchell 1990).

#### 9 Pollution

The southern redbelly dace has been reported as very sensitive to changes in water quality (Stagliano 2001). Pollutants and pesticides from agricultural runoff can degrade water quality, and these have been suggested as possible threats to the dace (Stasiak 2007).

### *Information Needs*

More surveys are needed to discover new populations in Colorado, and to identify suitable habitat for re-introduction (Bestgen, Crockett, and Foutz 2013). Better characterize status, demographics and metapopulation dynamics of known populations, particularly the population nearest to the Arkansas River near Florence.

### *Conservation Actions*

Securing water availability and habitat quality for existing populations (e.g., through easements and other landownwer agreements) is a key priority. Continue efforts to identify additional potential re-introduction sites within the species' native range. Identify opportunities for habitat improvement to create or restore suitable habitat. Maintain the broodstock at NASRF and create additional populations through stocking when suitable habitat becomes available.

## **Stonecat** (*Noturus flavus*)

### *Threats*

The stonecat (*Noturus flavus*) is widespread throughout the northern and central Great Plains, the Great Lakes region, and parts of the eastern United States. In Colorado, it is poorly documented with only two known sites. It has been reported from St. Vrain Creek, a tributary to the South Platte River, near the Longmont Wastewater Treatment Plant (Platania et al. 1986). It has also been collected from the North Fork of the Republican River in Yuma County, Colorado (Cancalosi 1980).

#### 7 Natural System Modifications

Few studies have investigated threats to the species, but the dewatering of occupied streams, dams and diversions that block fish passage, and high sediment concentrations characteristic of Colorado's eastern plains streams are likely the primary threats to the species in Colorado (Woodling 1985).

### *Information Needs*

Basic information on the life history, habitat preferences, and range in Colorado is needed.

### *Conservation Actions*

Secure water availability and habitat quality for existing populations (e.g., through easements and other landownwer agreements) is a key priority, particularly in the Republican basin. Increased

fragmentation of the St. Vrain population by post-flood reconstruction needs to be avoided to the extent possible, and its impact evaluated. Identify potential re-introduction sites within the species' native range. Study metapopulation dynamics, to understand importance of barriers and seasonal connectivity in life history, to direct future conservation activities.

## **Suckermouth Minnow** (*Phenacobius mirabilis*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: South Platte Native Fish Conservation Plan & Arkansas Native Fish Conservation Plan (in development).

### *Threats*

The suckermouth minnow (*Phenacobius mirabilis*) is widespread throughout the Great Plains, the upper Midwest, and the Mississippi River basin. Historically, the species occurred on the eastern plains of Colorado in the South Platte, Arkansas River, and Republic River basins. The suckermouth minnow is presently rare in all of these basins, and may be extirpated from the Republican River in Colorado (Bestgen, Zelasko, and Compton 2003). In 2011, the suckermouth minnow was stocked into the Arkansas River near Rocky Ford, Colorado (CPW 2011). Few studies have investigated threats to the species, but the dewatering of occupied streams, as well dams and diversions that block fish passage, are likely the primary factors limiting the distribution and abundance of the species in Colorado (Bestgen, Zelasko, and Compton 2003).

#### 7 Natural System Modifications

Suckermouth minnows were commonly found in deep pools downstream of diversion dams on the South Platte River (Bestgen, Zelasko, and Compton 2003). Dewatering of streams has occurred on the Eastern Plains of Colorado, and naturally occurring deeper pools and runs have likely become rarer as a result. Presently, fish that rely on deep pools and eddies are often limited to those created by dams and impoundments. Therefore, dams likely have a complex effect on the species, at once blocking fish passage and creating deep pools that are favored by suckermouth minnow (Bestgen, Zelasko, and Compton 2003).

### *Information Needs*

More studies are needed on 1) movement dynamics, 2) the role of mainstem and tributarys in sustaining populations, 3) the effects of stream channel geometry and fluvial processes on habitat, 4) habitat use during drought, and 5) the effects of water management practices (Bestgen, Zelasko, and Compton 2003). Lastly, more information is needed on the impact of nonnative fish species on suckermouth minnow.

### *Conservation Actions*

Study movement and metapopulation dynamics, to understand importance of barriers and seasonal connectivity in life history, and to direct future conservation activities. Such studies are particularly important in the South Platte basin, to understand causes of dramatic population fluctuations not observed in the Arkansas basin. Identify potential re-introduction sites within the species' native range, emphasizing opportunities to protect or re-create mainstem-tributary connectivity, with availability of clean gravel substrate. Rigorously evaluate factors affecting success of current stocking to increase success of future efforts.

# TIER 1 MAMMALS

## **American Pika** (*Ochotona princeps*)

### *Threats*

#### 11 Climate Change & Severe Weather

CPW surveys in 2008 found that pika are well distributed in Colorado's high country. CPW's Predicted Range Model indicates extensive and largely contiguous suitable pika habitat in the state, suggesting that Colorado pika populations should have patch size and connectivity to maintain a metapopulation structure sufficient to preserve populations (Seglund 2008). The main concerns for climate change are that warming patterns could impact pika foraging rates, increase thermal stress on the animals, reduce snow cover used for insulation in winter, and alter plant communities impacting food availability and quality. Currently in Colorado, there is abundant alpine and subalpine habitat that may serve as a stronghold for the species as impacts from global climate change continue.

### *Information Needs*

Continued evaluation of pika distribution and population levels is warranted to monitor the impacts of climate change.

### *Conservation Actions*

Since baseline information has been collected, the next step is implementation of a long-term monitoring program that can evaluate changes in occupancy. This effort will allow managers to correlate changes in climate with changes in the distributions of pikas, vegetation, and thermal stress parameters.

# **Black-footed Ferret** (*Mustela nigripes*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: A Cooperative Plan for Black-footed Ferret Reintroduction and Management, Wolf Creek and Coyote Basin Management Areas, Moffat and Rio Blanco Counties (2001); Black-footed Ferret Recovery Plan (1988) (links in Appendix D).

## *Threats*

### 1 Residential & Commercial Development

The primary threat to black-footed ferrets is the loss of their prey base, prairie dogs (*Cynomys* spp.). There has been widespread conversion of native prairie dog habitat to residential and commercial development, particularly along the Front Range, but also throughout the ferret's historic range in Colorado.

### 2 Incompatible Agriculture

Approximately one-third of the overall historic range of ferrets has been converted to cropland that may accommodate ferrets but is inhospitable to prairie dogs (USFWS 2009). Prairie dogs have been lost to habitat conversion, rodenticide use and other eradication efforts, and disease (USFWS 2009).

### 8 Invasives, Problematic Native Species, & Pathogens

Sylvatic plague is a significant threat to remaining prairie dog colonies. Plague and canine distemper have impacted ferret re-introduction efforts and ferret prey populations. Both plague and canine distemper have motivated immunization strategies to improve success of re-introduction efforts.

### 14 Natural Factors

Ferrets are known to have undergone a genetic bottleneck when populations dwindled dramatically in the 1980s (Wisely et al. 2002). Despite re-introduction of 3,500 ferrets at 21 locations throughout the range (Black-footed Ferret Recovery Implementation Team, www.blackfootedferret.org), the species is still susceptible to genetic inbreeding limitations and stochastic demographic events that could impact populations.

## *Information Needs*

Being one of the most charismatic endangered species ever to receive conservation attention, the species has been well studied. In Colorado, the biggest information gap is where ferret populations could be re-established and successfully sustained. This requires an understanding of the health and stability of the prey base population to support ferrets.

### *Conservation Actions*

Conservation of the black-footed ferret in Colorado will depend on two main issues – control of disease and indentification of relocation sites. There is on-going research into the development of a vaccine for sylvatic plague which is effective at protecting prairie dogs in the wild. This work will increase the success of ferret re-introduction rangewide. At the same time, it is important to work with various agencies and private landowners to identify potential re-introduction sites throughout the state. This will include both public outreach on the importance of prairie ecosystems and support for participating landowners. Overcoming social intolerance of prairie dogs is a hurdle. This can generally be overcome with large enough financial incentives such as those currently offered in the black-footed ferret Environmental Quality Incentives Program project occurring currently in Colorado.

## **Fringed Myotis** (*Myotis thysanodes*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Colorado Bat Conservation Plan (2004); Fringed Myotis (*Myotis thysanodes*): a technical conservation assessment (2004) (links in Appendix D).

### *Threats*

#### 3 Energy Production & Mining

In Colorado, mines are used by the fringed myotis for day and night roosts (Armstrong et al. 2011) as well as maternity and transition roosts, which have been documented during the CPW's Bats and Inactive Mines Project. Any loss of roosting habitat is detrimental. Renewed mining in historic districts, especially for uranium, has the potential to displace this species from current roosting sites.

#### 6 Human Intrusions & Disturbance

The fringed myotis will use buildings, caves, and mines for maternity roosts, night roosts, and hibernacula (Keinath 2004; Armstrong et al. 2011). Disturbances to mines and caves, such as abandoned mine closure, recreational caving, and renewed mining, are a threat to this species and can take the form of. In some areas, the fringed myotis will use tree snags as roosts (Keinath 2004); thus, removal of these resources, especially on a large scale, could be detrimental to this species.

#### *Work & Other Activities*

As abandoned mines throughout Colorado are closed for hazard abatement, there is potential for loss of bat roosts. Improper gate designs or closure during the wrong season or with inadequate pre-closure survey has the potential to have large cumulative effects on fringed myotis.

### *Recreation*

Roosting bats are sensitive to disturbance and could leave roost sites following human visitation (Keinath 2004). Recreational caving can disrupt bats that use caves as roosts. Disturbance to roosting bats may not be intentional and may occur unbeknownst to the caver, but may cause abandonment of sites and the premature expenditure of critical fat reserves during hibernation (Thomas 1995).

### 8 Invasives, Problematic Native Species, & Pathogens

White-nose syndrome is a disease of hibernating bats caused by an introduced fungus (*Pseudogymnoascus destructans*) (Lorch et al. 2011; Warnecke et al. 2012) that has severely impacted bat populations in eastern North America (Frick et al. 2010). The fringed myotis could be susceptible to white-nose syndrome. White-nose syndrome has not been observed in Colorado, but because of the devastating impact to bat populations in eastern North America and its expansion across the continent as far west as the Kansas/Missouri border, this disease is a formidable threat to hibernating bat species. All indications are that many bat roosts in Colorado could provide the conditions suitable for *P. destructans*.

### 9 Pollution

The fringed myotis feeds on a wide variety of insects compared to many bat species (Keinath 2004; Armstrong et al. 2011). Large scale use of pesticides may reduce this species' prey base, but because of its broad diet, insect control programs focusing on one group of species may not have as severe of an effect. Bioaccumulation of toxins during foraging in bats may occur due to pesticide use. No studies have directly evaluated the effects of pesticide use on the fringed myotis, but work on other bat species in Colorado (O'Shea et al. 2001) and elsewhere have shown that bats accumulate high levels of contaminants in their tissues relative to other taxa (Clark and Shore 2001).

## *Information Needs*

In their list of suggested research needs for the bats of Colorado, Ellison et al. (1999) mention the need for an intraspecific genetic analysis of subspecies in addition to general information gaps for all bat species. Little is known regarding winter ecology at hibernacula, seasonal movements, and adult male life history for this species. Data specific to Colorado regarding distribution, population status, and trends are lacking.

## *Conservation Actions*

Protection of roosting bats from human disturbance, especially at significant winter hibernation sites and summer maternity sites, is important for the conservation of the fringed myotis. Developing a better understanding of the distribution and habitat use of the fringed myotis will better inform which sites are at greatest risk from human disturbance, as well as what threat white-nose syndrome presents to this species.

# **Gunnison's Prairie Dog** (*Cynomys gunnisoni*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Colorado Gunnison's and White-tailed Prairie Dog Conservation Strategy (2010); Gunnison's Prairie Dog Conservation Assessment (2005) (links in Appendix D).

## *Threats*

### 2 Incompatible Agriculture

Prior to agricultural conversion of habitats in Colorado, many Gunnison's prairie dog populations occurred in habitats that provided deep soils and high quality forage – the same sites that agricultural producers preferred. Settlement of Colorado in the early 20th century saw rapid development of irrigated crops. As the century progressed, alfalfa and hay crops began to dominate the landscape. Replacement of native arid landscapes with highly nutritious legume and grass crops allowed prairie dog colonies in these areas to reach artificially high densities. However, these areas also resulted in the creation of more widely distributed, small colonies due to active eradication efforts and development of barriers such as fences, irrigation, roads, and urban predators. Though Gunnison's prairie dog colonies are being maintained in this new biological arrangement, their ecological function has been impaired.

### 5 Biological Resource Use

Recreational shooting results in direct mortality of targeted prairie dogs. Effects within individual colonies can be significant, but recreational shooting activity is irregularly dispersed across the range of Gunnison's prairie dogs. As a result, it is not expected that shooting alone can have a sufficient population level effect to move Gunnison's prairie dogs towards extinction. Nevertheless, where recreational shooting activity occurs regularly or at high intensity, shooting has the potential to locally reduce prairie dog densities and slow recovery rates of colonies impacted by plague or other disturbances, especially in the case of isolated colonies. Seasonal shooting closures have been implemented on public land to maintain recreational shooting mortality within acceptable limits for conservation of prairie dog populations.

### 8 Invasives, Problematic Native Species, & Pathogens

The primary factor limiting Gunnison's prairie dog populations and distribution in Colorado is sylvatic plague, an introduced, flea-transmitted disease caused by the bacterium *Yersinia pestis* (Seglund and Schnurr 2009). Plague is thought to be the most critical threat to sustained conservation of prairie dog species (Cully and Williams 2001; Pauli et al. 2006). CPW is currently testing an oral plague vaccine that can help protect prairie dogs from devastating outbreaks. In addition, CPW is dusting prairie dog colonies that are of conservation concern with an insecticide to reduce the potential of epizootics.

#### 11 Climate Change & Severe Weather

Gunnison's prairie dogs evolved to live in arid areas that experience periodic droughts. However, human-facilitated changes in ecosystems in the west, including altered plant species composition, ecosystem function, and ecosystem structure (Fleischner 1994) may cause prairie dogs to be more susceptible to drought conditions. In addition, climate change may be increasing the number and duration of drought events, making it more difficult for prairie dogs to survive. When Colorado experienced an extreme drought in 2002, many Gunnison's prairie dog colonies were lost.

### *Information Needs*

Methods for how to manage plague at a landscape scale and at colonies or complexes that are of conservation concern are needed.

### *Conservation Actions*

The primary conservation actions needed include continued dusting of colonies to protect against plague events, continued work on the oral plague vaccine, and continued occupancy surveys to evaluate status of the species statewide. Strategies outlined in the Colorado Gunnison's and White-tailed Prairie Dog Conservation Strategy (Seglund and Schnurr 2009) should be implemented. Management of rangelands needs to consider the relative influence of climate change. While there are many uncertainties about how climate change will affect certain habitats, an overall management strategy that maintains a larger intact landscape, and thereby increases the ability of the given species to adjust their range, should be incorporated in the overall conservation of the species.

## **Little Brown Myotis** (*Myotis lucifugus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Colorado Bat Conservation Plan (2004) (link in Appendix D).

### *Threats*

#### 5 Biological Resource Use

Little brown myotis will use buildings and other structures during different times of the year (Armstrong et al. 2011), and are often found in close proximity to urban and suburban areas in Colorado. This is especially true during the maternity season, when nursery colonies are often found in the warm attics of buildings. Exclusion or extermination of bats from roost sites that are inhabited by humans and, if not done properly or during an appropriate time of year, can be a threat to this species.

### 8 Invasives, Problematic Native Species, & Pathogens

White-nose syndrome is a disease of hibernating bats caused by an introduced fungus (*Pseudogymnoascus destructans*) (Lorch et al. 2011; Warnecke et al. 2012) that has severely impacted bat populations in eastern North America (Frick et al. 2010). To date, the little brown myotis is one of the species most impacted by white-nose syndrome, and is at risk of local extinction in eastern North America (Frick et al. 2010). Local population declines at hibernacula of over 50% per year, with some reaching as high as 99%, have been reported (Frick et al. 2010). White-nose syndrome has not been observed in Colorado, but because of the devastating impact to bat populations in eastern North America and its expansion across the continent as far west as the Kansas/Missouri border, this disease is a formidable threat to hibernating bat species. All indications are that many bat roosts in Colorado could provide the conditions suitable for *P. destructans*.

## *Information Needs*

The little brown myotis is one of the better studied bat species in North America, but information is still lacking on population dynamics and populations status, especially within Colorado. Most of the known roosts in Colorado are maternity colonies, which are comprised primarily of females and their young and typically contain fewer than 100 adult females (Armstrong et al. 2011). Little information is known regarding male roosting habits. Data on seasonal movements and hibernacula locations and status are needed. Large hibernacula, as might be found in eastern North America, are not known from Colorado, and more information is needed on the winter ecology of this species.

## *Conservation Actions*

Protection of roosting bats from human disturbance and take, especially at significant winter hibernation sites and summer maternity sites, is important for the conservation of the little brown myotis. Developing a better understanding of the distribution and habitat use of the little brown myotis will better inform which sites are at greatest risk from human disturbance, as well as what threat white-nose syndrome presents to this species. Sustained monitoring of summer colonies and acoustic monitoring statewide are needed to provide surveillance of the potential arrival of white-nose syndrome into the state.

# **Lynx** (*Lynx canadensis*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Federal listing documents; Recovery outline (links in Appendix D).

## *Threats*

Lynx have successfully been re-established in Colorado and a self-sustaining population is believed to persist in the region. The management actions taken to re-establish the population to Colorado were done considering the landscape of the time – there is no intention of attempting to change, alter or remove historic and current land uses from the landscape. Many of these industries can and have developed practices that have the potential to allow the long term persistence of the lynx within the context of existing land use.

### 5 Biological Resource Use

The characteristics of vegetation structure that makes habitat suitable for lynx have been shaped by fire, insects and diseases in the western United States (Ruggiero et al. 1999). When lynx ecology is not taken into consideration, commercial timber harvest within the range occupied by lynx has the potential, when done at relevant scales, to disrupt this structure, rendering the post-harvest habitat unsuitable for lynx and/or their primary prey, snowshoe hares. The establishment of dense small tree and shrub cover is essential for hare populations to reoccupy harvested areas.

Forest harvesting may contribute to fragmentation of lynx habitat, as does construction of highways and associated infrastructure, and mineral or energy development (Ruggiero et al. 1999). Fragmentation can affect lynx by reducing their prey base and by creating patches of foraging habitat that are too small and too distant from each other to support viable populations of lynx (Buskirk et al. 2000).

### 7 Natural System Modifications

Natural wildfire has maintained a dynamic mosaic of varying age classes of forest stands that provides habitat for both snowshoe hare and lynx (Slough and Mowat 1996). In the Rocky Mountains, the historic fire regime was variable, with both frequent (35–100 years) stand-replacing or mixed-severity fires, and infrequent (200+ years) stand-replacement fires (Hardy et al. 1998). Starting about 100 years ago, this natural fire regime was disrupted by fire suppression efforts, leading to dense forests. This, combined with recent droughts and increasing temperatures, has resulted in a recent shift to uncharacteristically severe and intense wildfires in lower-elevation forests (Morgan et al. 1998). There is the potential for these fires to increase in frequency in the future and spread into adjacent areas occupied by lynx, causing the loss of large expanses of lynx habitat.

### 11 Climate Change & Severe Weather

The impact of climate change on lynx is uncertain and unquantified. The predicted effects of climate change in the West include a reduced snowpack and shorter periods of snow cover, snowmelt that occurs earlier in the season, a hydrologic cycle that is more dynamic as extreme rainfall events occur with greater frequency and overall warmer, drier, and more drought-like

conditions (Melillo 2014). While it is uncertain when these effects may take place and the magnitude of their impact on lynx, the effects of these changes may include changes in population distribution and size, amount of habitat, demographic rates, and predator prey relationships (Ruggiero et al. 1999). The extent to which any of these possible changes may impact the population as a whole is unknown. Management actions have little ability to alter the predicted impacts or even mitigate the effects of climate change. However, assessments to identify possible avenues for adaptive management strategies to climate change should be considered (Ruggiero et al. 1999).

### *Information Needs*

High priorities for research include continued monitoring of lynx populations in suitable habitat to verify population trends, distribution, and population viability, as well as to validate core areas classified and mapped as suitable habitat for lynx. Other research needs include assessing the effect of climate change on lynx, lynx habitat and snowshoe hare; further refinement of survey protocols; researching what effect vegetation management has on lynx distribution and density; examining the limits to lynx dispersal; investigating how silvicultural practices impact snowshoe hares, evaluating how winter recreational activities impact lynx behavior and habitat use; and determining what role secondary and peripheral areas have in the conservation of lynx.

### *Conservation Actions*

The primary action needed for the recovery of lynx is the drafting and implementation of a Federal Recovery Plan. Establishing recovery goals, objectives, and funding sources with the ultimate goal of delisting the species is paramount. Related, identifying and implementing survey protocols to assess occupancy trends for the species throughout the state is an important task. Identifying important movement corridors and implementing appropriate land management within those areas is important to allow for further dispersal and colonization throughout the state.

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

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Federal listing documents (link in Appendix D).

### *Threats*

#### 7 Natural System Modifications

The primary threat to New Mexico jumping mouse populations is the loss and fragmentation of habitat from human land uses, including: incompatible grazing, recreational development and activity, climatic variability and stochastic events (Frey and Malaney 2009), transportation development, suburban development, loss of beaver and beaver ponds, coalbed methane

development, and instream changes due to increased runoff and flood control efforts. These human land use activities affect this species by removing protective cover, nests, food resources, and hibernation sites; disrupting behavior; or acting as a barrier to movement (USFWS 2013b).

#### 14 Natural Factors

Isolation of populations may disrupt gene flow and create unpredictable genetic effects that could impact meadow jumping mouse persistence in a given area. The distribution of the New Mexico jumping mouse is so limited that they are already known to be susceptible to stochastic events, such as wildfire (Frey and Malaney 2009).

### *Information Needs*

There are limited data on the genetic diversity of New Mexico meadow jumping mouse populations in Colorado, and the degree of similarity between Colorado and New Mexico populations. Only two populations from one location each were assessed in Malaney et al. (2012). Additionally, there is little known about the overall distribution of this species in Colorado. Surveys to better document distribution in Colorado are needed, especially in the San Luis Valley.

### *Conservation Actions*

Further genetic comparisons would illustrate the divergence or lack thereof among Colorado populations. Continued surveying (especially in areas with high probability of occurrence), as well as revisits to known Colorado locations, would be valuable to document distribution and stability, and to conduct population monitoring. Protection of known habitat from both human disturbance and increased natural changes, such as fire, is important to the continued persistence of this species in Colorado.

## **Olive-backed Pocket Mouse** (*Perognathus fasciatus*)

There are two subspecies of olive-backed pocket mouse (*Perognathus fasciatus*) in Colorado. In the northwest corner of Moffat County, *P. f. calistus* is restricted to the area north of the Yampa River (Armstrong et al. 2011). *Perognathus f. infraluteus* is restricted to a narrow band that extends from the border of Wyoming in Larimer and Weld counties southward through Huerfano County (Armstrong et al. 2011). Through a targeted inventory, Siemers et al. (2003) were able to find two new populations of *P. f. infraluteus*, but did not find them to be particularly abundant in grassland habitats. *Perognathus f. calistus*' range is considerably smaller than *P. f. infraluteus*' only extending into the northeastern edge of Utah and the southwestern Wyoming. Finley and Bogan (1995) considered the *P. f. calistus* common at locales in northwestern Colorado; however, the range is restricted and alterations to grasslands and desert-scrub communities in this region may keep populations isolated.

### *Threats*

#### 1 Residential & Commercial Development

For *P. f. infraluteus*, much of the western range overlaps the urban corridor of the Front Range, and it is likely that much grassland habitat for this subspecies has been lost.

#### 2 Incompatible Agriculture

Little is known about either subspecies of *P. fasciatus* in Colorado, but conversion to cropland, prairie dog removal, and incompatible grazing patterns have likely altered grassland and desert-scrub habitats.

### *Information Needs*

Many less-common rodent species are poorly understood, but ecology and population structure data for *P. fasciatus* in Colorado is particularly scarce. Little to nothing is known about overall distribution, patterns in distribution, abundance and changes in abundance, and impacts from urban/suburban development, grazing, prairie dog removal, and grassland structure alterations (Manning and Knox 1988; Armstrong et al. 2011).

### *Conservation Actions*

The primary conservation actions needed for this species are development and implementation of a monitoring plan to improve understanding of population status, and protecting habitat from conversion to other uses.

## **Preble's Meadow Jumping Mouse** (*Zapus hudsonius preblei*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Draft Recovery Plan Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*) (2003) (link in Appendix D).

### *Threats*

#### 1 Residential & Commercial Development

The primary threat to Preble's meadow jumping mouse populations is the loss and fragmentation of habitat from human land uses, including urban, suburban, and recreational development; highway and bridge construction; water development; instream changes due to increased runoff and flood control efforts; sand and gravel mining; and overgrazing. These human land use activities affect this species by directly destroying its protective cover, nests, food resources, and hibernation sites; disrupting behavior; or acting as a barrier to movement (PMJM Recovery Plan Draft 2010).

### 14 Natural Factors

#### *Scarcity*

Isolation of populations may disrupt gene flow and create unpredictable genetic effects that could impact Preble's meadow jumping mouse persistence in a given area. While stochastic events are not known to be an immediate threat to jumping mouse populations, the tendency for Preble's numbers to vary widely over time heightens concern for small and isolated populations (PMJM Recovery Plan Draft 2010).

#### *Competition*

The relative ranges, abundances, and relationship between Preble's meadow jumping mouse and native and non-native small mammals may lead to competitive disadvantages for Preble's meadow jumping mouse. Being greatly outnumbered in abundance by North American deer mice (*Peromyscus maniculatus*) and meadow voles (*Microtus pennsylvanicus*), the jumping mouse may experience competitive disadvantages as habitats are altered (Schorr 2012). Additionally, as habitats are fragmented and encroached upon, there will likely be greater influx of non-native mammals, such as house mice (*Mus musculus*) and Norway rats (*Rattus norvegicus*), that may compete for resources.

#### *Predation*

As urban and suburban development encroaches on Preble's meadow jumping mouse habitat, there will be an increase in domesticated predators (domestic cats) and urban-associated meso-predators, such as red fox (*Vulpes vulpes*) and raccoon (*Procyon lotor*) (Woods et al. 2003, Ditchkoff et al. 2006). Increased predation from domestic and urban-associated carnivores diminishes the stability of jumping mouse populations.

## *Information Needs*

There are few studies that have investigated the impacts to Preble's meadow jumping mouse populations when habitat is removed by either human (e.g., development) or natural (e.g., floods) means. Most threats are attributed to the loss of habitat because jumping mouse populations are no longer found or are constricted in areas that have been impacted. Multi-year studies that assess the impacts to Preble's meadow jumping mouse populations when habitat is removed would clarify how habitat alterations change jumping mouse populations.

## *Conservation Actions*

Protection and improvement of existing habitat, especially through Best Management Practices, zoning, conservation easements, and habitat restoration, will improve the outlook for this species in Colorado. The revised recovery plan (currently in development and scheduled for completion in 2015) will inform the specific actions necessary for the long-term protection of individual populations throughout the state.

# **Spotted Bat** (*Euderma maculatum*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Spotted Bat (*Euderma maculatum*): a technical conservation assessment (2007); Colorado Bat Conservation Plan (2004) (links in Appendix D).

Very little is known about the ecology and distribution of the spotted bat in Colorado. Spotted bats are difficult to capture and are often under-sampled in mist net surveys. Most information is from acoustic surveys of foraging sites (Navo et al. 1992; Storz 1995), but recent captures of this species have been made (Siemers and Schorr 2006; Bogan and Mollhagen 2010) and maternity colonies have been documented (O'Shea et al. 2011) in Colorado. Threats listed below are primarily speculative and based on potential activities that may adversely affect this apparently rare species. Roost sites are typically in remote locations that are isolated from most human activities. However, this species forages over many different habitat types that are adjacent to cliff and canyon roosting habitat, and the species is known to travel great distances during nightly foraging bouts. Therefore, potential threats to these other habitat types can potentially be impacting this species.

## *Threats*

### 2 Incompatible Agriculture

Large scale use of pesticides for control of grasshoppers or Mormon crickets may reduce the prey base for spotted bats. Additionally, bioaccumulation of toxins during foraging in spotted bats may occur due to pesticide use. No studies have directly evaluated the effects of pesticide use on spotted bats, but work on other bat species in Colorado (O'Shea et al. 2001) and elsewhere have shown that bats accumulate high levels of contaminants in their tissues relative to other taxa (Clark and Shore 2001).

### 6 Human Intrusions & Disturbance

Rock climbing may affect this species on a local level. Cliff faces and rock crevices where this species roosts could be disturbed by recreational activity. This species has been reported to abandon roosts because of noise (Easterala 1973), and continued disturbance near climbing routes that receive frequent use may cause spotted bats to abandon roosts.

## *Information Needs*

Basic life history and distributional information on the spotted bat is needed for Colorado. More information on reproduction, habitat use, seasonal movement patterns and abundance, among other factors, is needed for this species. Clarification of winter distribution is particularly needed.

### *Conservation Actions*

The primary conservation action needed for the spotted bat is research into the distribution, habitat use, and population parameters in Colorado. This information will better inform which roost sites are at greatest risk from human disturbance, as well as what other threats may arise for this species.

## **Townsend's Big-eared Bat** (*Corynorhinus townsendii pallescens*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Townsend's Big-eared Bat (*Corynorhinus townsendii*): a technical conservation assessment (2006); Colorado Bat Conservation Plan (2004) (links in Appendix D).

### *Threats*

#### 3 Energy Production & Mining

Because mines are a critical resource for this species and loss of roosts is thought to be a limiting factor (Pierson et al. 1999), any loss of roosting habitat is detrimental. Hibernacula, maternity, day, night, and transition roosts have all been documented in mines and caves in Colorado. Renewed mining in historic districts, especially for uranium, has the potential to displace Townsend's big-eared bats from current roosting sites.

#### 6 Human Intrusions & Disturbance

Townsend's big-eared bat is most often associated with caves and mines, although it has been found to roost in abandoned buildings and rock crevices during some times of the year (Armstrong et al. 2011). Disturbances to mines and caves are the primary threat to this species, and can take the form of abandoned mine closure, renewed mining, and recreational caving.

##### *Work & Other Activities*

As abandoned mines throughout Colorado are closed for hazard abatement, there is potential for loss of bat roosts. Mines are a critical resource for Townsend's big-eared bats in Colorado. Improper gate design, and closure during the wrong season or with inadequate pre-closure survey, have the potential to have large cumulative effects on this species.

##### *Recreation*

This species is sensitive to disturbance and will leave roost sites following human visitation (Armstrong et al. 2011, Pierson et al. 1999). Disturbance to roosting bats may not be intentional and may occur unbeknownst to the caver, but can cause abandonment of maternity sites (Pierson et al. 1999 and references therein) and the premature expenditure of critical fat reserves during hibernation (Thomas 1995).

### 8 Invasives, Problematic Native Species, & Pathogens

White-nose syndrome is a disease of hibernating bats caused by an introduced fungus (*Pseudogymnoascus destructans*) (Lorch et al. 2011; Warnecke et al. 2012) that has severely impacted bat populations in eastern North America (Frick et al. 2010). The Townsend' big-eared bat could be susceptible to white-nose syndrome. White-nose syndrome has not been observed in Colorado, but because of the devastating impact to bat populations in eastern North America and its expansion across the continent as far west as the Kansas/Missouri border, this disease is a formidable threat to hibernating bat species. All indications are that many bat roosts in Colorado could provide the conditions suitable for *P. destructans*.

### 9 Pollution

Townsend's big-eared bat is a moth specialist (Pierson et al. 1999); thus, large scale use of pesticides for control of lepidopterans such as spruce budworms or gypsy moths, may reduce this species' prey base. Additionally, bioaccumulation of toxins during foraging in bats may occur due to pesticide use. No studies have directly evaluated the effects of pesticide use on Townsend's big-eared bat, but work on other bat species in Colorado (O'Shea et al. 2001) and elsewhere have shown that bats accumulate high levels of contaminants in their tissues relative to other taxa (Clark and Shore 2001).

## *Information Needs*

The identification and protection of significant roost sites, especially maternity roosts and hibernacula, are needed for this species. Basic life history information such as foraging requirements, roost switching, and seasonal movement patterns within Colorado is also lacking. Of the known maternity and hibernation sites in Colorado, most support relatively few individuals (less than 25) (Pierson et al. 1999), which makes population monitoring a challenge. Information on trends and population status in Colorado is needed.

## *Conservation Actions*

Protection of roosting bats from human disturbance and take, especially at significant winter hibernation sites and summer maternity sites, is important for the conservation of the Townsend's big-eared bat. Developing a better understanding of the distribution, habitat use, and population trend of the Townsend's big-eared bat will better inform which sites are at greatest risk from human disturbance, as well as what threat white-nose syndrome presents to this species. The development of a coordinated monitoring strategy/plan by relevant state and federal agencies for the protected mines and caves should be considered. There are currently over 800 bat gates installed in the state, under stewardship of state and federal agencies, which need to be monitored for conditions and status. Without this coordinated and cooperative conservation action, the benefit of past conservation actions could be lost.

# **White-tailed Prairie Dog** (*Cynomys leucurus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Colorado Gunnison's and White-tailed Prairie Dog Conservation Strategy (2010); White-tailed Prairie Dog (*Cynomys leucurus*): a technical conservation assessment (2006) (links in Appendix D).

## *Threats*

### 1 Residential & Commercial Development

Urbanization causes direct eradication and permanent loss of prairie dogs and their colonies, resulting in fragmentation and isolation of populations. Indirect effects of urbanization are poisoning or other control efforts deemed appropriate for human health and safety, predation from domestic pets, and increased vigilance and concealment behavior by prairie dogs in response to recurring disturbance in and around colonies (Magle et al. 2005).

### 3 Energy Production & Mining

Impacts due to energy development, particularly oil and gas, on white-tailed prairie dogs are not fully understodd. It is thought, however, that there can be both indirect and direct impacts to the species from energy development activities, and that entire localized prairie dog systems may be affected. Due to the pace of energy development and the potential risk to the species, management actions need to be developed and implemented to protect these species and their habitats. Adaptive management will be needed to determine if management actions are effective or if modifications need to be made to ensure maintenance of the species and system health. See Colorado Gunnison's and White-tailed Prairie Dog Conservation Strategy (Seglund and Schnurr 2009) for a detailed list of strategies to implement for oil and gas.

### 5 Biological Resource Use

Recreational shooting results in direct mortality of targeted prairie dogs. Effects within individual colonies can be significant, but recreational shooting activity is irregularly dispersed across the range of white-tailed prairie dogs. As a result, it is not expected that shooting alone can have a sufficient population level effect to move white-tailed prairie dogs towards extinction. Nevertheless, where recreational shooting activity occurs regularly or at high intensity, shooting has the potential to locally reduce prairie dog densities and slow recovery rates of colonies impacted by plague or other disturbances, especially in the case of isolated colonies. Seasonal shooting closures have been implemented on public land to maintain recreational shooting mortality within acceptable limits for conservation of prairie dog populations.

### 7 Natural System Modifications

Alteration in fire regimes within the range of the white-tailed prairie dogs has produced changes in structure and function of plant communities. Fire is thought to be beneficial for prairie dogs because it can: (1) reduce the shrub component of shrub-steppe communities, leading to more open tracts of habitat and increased visibility; (2) release plant nutrients, temporarily increasing the nutrient content of forage; (3) stimulate fruit and seed production and increase the yield and quality of herbaceous vegetation; and (4) remove unwanted vegetative litter, which can increase the suitability of an area for prairie dogs (CNHP 2000; BLM 2001b; NRCS 2001; BLM 2002d *in* Buys and Associates Inc. 2005).

### 8 Invasives, Problematic Native Species, & Pathogens

The primary factor limiting white-tailed prairie dog populations and distribution in Colorado is sylvatic plague, an introduced, flea-transmitted disease caused by the bacterium *Yersinia pestis* (Seglund and Schnurr 2009). Plague is thought to be the most critical threat to sustained conservation of prairie dog species (Cully and Williams 2001; Pauli et al. 2006b).

Rangeland condition has been altered due to the introduction of non-native plant species including, but not limited to, cheatgrass. Cheatgrass is an aggressive species that can become a monoculture due to its ability to deplete soil moisture and out-compete native perennials. The proliferation of cheatgrass over native perennial grasses and forbs may impact the ability of prairie dogs to meet their dietary needs, resulting in increased mortality rates and decreased productivity (Ritchie 1999). Cheatgrass may not provide sufficient above- or below-ground forage or water stores, which white-tailed prairie dogs need to subsist. In addition, the early green-up of cheatgrass may be beneficial to prairie dogs in spring, but as it goes to seed and dries out, prairie dogs may have few options to supplement their diets. During drought conditions, vast monocultures of cheatgrass may be detrimental to prairie dog populations. This is because cheatgrass seeds will remain dormant during dry years, and thus prairie dog colonies located in cheatgrass-dominated sites will have their forage severely depleted, resulting in an inability to develop fat stores to survive over the winter or to produce litters.

### 11 Climate Change & Severe Weather

White-tailed prairie dogs evolved to live in arid areas that experience periodic droughts. However, human-facilitated changes in ecosystems in the west, including plant species composition, ecosystem function, and ecosystem structure (Fleischner 1994), may cause prairie dogs to be more susceptible to drought conditions. In addition, climate change may be increasing the number and duration of drought events, making it more difficult for prairie dogs to survive. Management of rangelands needs to consider the relative influence of climate change. While there are many uncertainties about how climate change will affect certain habitats, an overall management strategy that maintains a larger landscape, and thereby increases the ability

of the given species to adjust their range, should be incorporated in the overall conservation of the species.

### *Information Needs*

Methods for managing plague on a landscape level, and at complexes and colonies important for conservation, are needed.

### *Conservation Actions*

Continue dusting colonies to protect against plague events, continue work on the oral plague vaccine, and continue using occupancy surveys to evaluate status of the species statewide. Implement strategies from the Colorado Gunnison's and White-tailed Prairie Dog Conservation Strategy (Seglund and Schnurr 2009).

## **Wolverine** (*Gulo gulo*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Federal listing documents (link in Appendix D).

### *Threats*

#### 4 Transportation & Service Corridors

Transportation corridors including interstates and secondary roads, although uncommon in wolverine habitat, are known to negatively impact wolverine movements and can cause mortality from vehicle collisions (Austin 1998; Krebs et al. 2004). Increasing road and housing development continue to fragment mountain landscapes, disrupting wolverine dispersal corridors. Preserving connectivity corridors for wolverine movement will be critical for their rangewide long-term conservation (Inman et al. 2013).

#### 6 Human Intrusions & Disturbance

Wolverines occupy alpine environments because, among other factors, physiologically they require colder temperatures, and because they face less competition from other large mammals that are absent from these environs in the winter. The impact that winter alpine recreation has on wolverines is unknown, but such recreation is increasing and may be affecting wolverine productivity (Krebs et al. 2007). However, studies in Idaho indicate that there may not be a negative relationship at the home range scale (Heinemeyer and Squires 2013). The incidental loss of wolverines in the United States to trapping targeting other furbearers is not currently considered a threat to wolverine population viability (USFWS 2013c).

### 11 Climate Change & Severe Weather

Uncertainty persists around the relationship between climate change and wolverine ecology. The predicted effects of climate change in the West include a reduced snowpack and shorter periods of snow cover, snowmelt that occurs earlier in the season, a hydrologic cycle that is more dynamic as extreme rainfall events occur with greater frequency, and overall warmer, drier, and more drought-like conditions (Melillo 2014). These predicted changes could impact the wolverine given their presumed association with, and reliance on, persistent spring snow cover as a consistent component of reproductive denning habitat, and their need for low summer temperatures to maintain thermoneutrality (Copeland et al. 2010). These physiographic changes are thought to be less severe in the southern Rockies portion of the historic range of the species.

The effects of climate change on wolverine include the potential for a decrease in area of suitable habitat, increased isolation of remaining habitat, and the disruption of ability of wolverines to disperse between patches of suitable habitat (McKelvey et al. 2011). It has been postulated that Colorado may retain some of the higher quality wolverine habitat in the lower 48 states. This has been described and further examined through USFWS processes including a proposed rule to list the species, and a subsequent withdrawl of the proposed rule[14].

### 14 Natural Factors

There is evidence that wolverines in the Rocky Mountains of the U.S. exist in small semi-isolated subpopulations without enough movement between subpopulations to maintain genetic diversity (Cegelski et al. 2006). Currently, no deleterious effects have been documented to the U.S. wolverine population from this genetic isolation, but low genetic diversity is still a concern (IDFG 2014).

## *Information Needs*

Given that wolverines are potentially at risk due to changes in climate, a better understanding of the ecology, behavior, and physiology of wolverines with respect to temperature thresholds and dependence on snow cover and/or depth is needed (IDFG 2014). Research is also needed on wolverine distribution and abundance; natal and maternal den selection; and on how landscape scale disturbances including wildfire, insect outbreaks, timber harvest, forest seral stages, and travel corridor location impact the wolverines use of forests (IDFG 2014). Additionally, stand-level studies on wolverine habitat use are needed in order to understand if it is necessary to develop management recommendations for forest harvest prescriptions, road densities, and human footprint thresholds (IDFG 2014).

[14] https://www.fws.gov/mountain-prairie/species/mammals/wolverine

### *Conservation Actions*

Currently, there is not a population of wolverine in Colorado. Prior to the recent (2009) exploration of an individual male, the last confirmed wolverine sighting in Colorado was in 1919. We believe that the state had a population in the late 1800–early 1900's, but that it was extirpated in the early 1900's. Through geographical and biological analyses, it is felt that Colorado offers a substantial amount of suitable, previously occupied habitat (CPW 2010b). Preliminary discussions regarding the potential for a wolverine re-introduction to Colorado have occurred with wildlife managers, conservation partners and stakeholders. The social and political aspects of restoring a population of wolverine to the Southern Rockies have been discussed, but are not currently satisfactorily addressed. At this point in time, the primary conservation action for this species is to continue these discussions when appropriate, and then to develop the tools and social and political support necessary to undertake a restoration with the ultimate goal of re-establishing a self-sustaining population of wolverine to the state.

# TIER 1 REPTILES

## Colorado Checkered Whiptail (*Aspidoscelis neotesselata*)

### *Threats*

#### 1 Residential & Commercial Development

Expanding urban zones within the vicinity of Pueblo, Colorado, has caused the loss of suitable habitat for the Colorado checkered whiptail and resulted in its extirpation from, or greatly reduced populations in, some areas as a result (Walker et al. 1996, 1997). Within the distribution of the whiptail (Sovell 2007), continued urbanization in the vicinity of Pueblo and Cañon City, and along the Arkansas River and its tributaries, has potential to cause future loss of habitat for the whiptail.

#### 2 Incompatible Agriculture

For other species of *Aspidoscelis*, habitat alteration and conversion to cropland, excessive grazing, chemical brush control, alteration of riparian habitat, invasion of non-native plant species and mining are threats (NMGFD 2012; BLM 2013). This species has been extirpated from, or has greatly declined in, some areas around Pueblo, Colorado, as a result of conversion of habitat to agricultural uses (Walker et al. 1996, 1997). The activities affecting other *Aspidoscelis* species also occur within the distribution of the Colorado checkered whiptail, but their impacts on this subspecies require further investigation. However, Colorado checkered whiptails can tolerate some disturbance and populations are known to exist in moderately or heavily disturbed areas, including around buildings in parks, at rural landfills, and on flats above floodplains that are dominated by kochia (*Kochia scoparia*) (Walker et al. 1996, 1997, 2012).

#### 7 Natural System Modifications

Throughout much of its range in Colorado, the Colorado checkered whiptail is often associated with pinyon-juniper woodlands dominated by *Pinus edulis* and/or *Juniperus monosperma*, and shrublands with sagebrush (*Artimesia tridentata*), fourwing saltbush (*Atriplex canescens*) or rabbitbrush (*Ericameria nauseosa*) (Sovell 2007). Any increase in the frequency and intensity of fire in these habits could threaten persistence of this subspecies. There are studies suggesting that *Aspidoscelis* lizards tolerate fire well (Rochester et al. 2010; Brown et al. 2014), but what impact fire has on this subspecies requires further research.

### *Information Needs*

Further research is required on distribution of Colorado checkered whiptail populations and how they respond to landscape scale changes to habitat structure from activities including grazing, urbanization, fire, conversion of habitat to cropland, and invasion of non-native plant species. Improved understanding of how alterations to riparian habitat affect Colorado checkered whiptail population stability is also needed.

### *Conservation Actions*

The primary conservation action needed for the Colorado checkered whiptail is research into the distribution, habitat use, and population parameters in Colorado. This information will better inform which areas are at greatest risk from habitat loss, as well as what other threats may arise for this species.

## **Massasauga** (*Sistrurus catenatus*)

For detailed information on threats and conservation actions needed for this species, refer to the following resources: Desert Massasauga Rattlesnake (*Sistrurus catenatus edwardsii*): a technical conservation assessment (2005) (link in Appendix D).

### *Threats*

#### 2 Incompatible Agriculture

In Colorado, large expanses of suitable habitat within the massasauga's range have been converted to cropland, while other areas have been degraded by incompatible grazing (Mackessy 2005). Grazing can lead to changes in vegetation structure, including altered plant species composition, percent of vegetative cover, and physical habitat structure, which can cause declines in animal abundance and diversity (Bock et al. 1984). Declines in rodent and lizard populations in grazed grasslands deprive massasauga of important populations of their prey. Water withdrawal for agricultural and urban uses lowers water tables, causing temporal ponds and streams to become even more ephemeral, which can further depress prey populations (Mackessy

2005). Ultimately, such xerification might stress massasauga beyond their tolerances for dry landscapes, causing the loss of some populations (Mackessy 2005).

### 4 Transportation & Service Corridors

Massasauga are particularly susceptible to mortality from vehicular strikes because they use road surfaces for warming, tend to sit for long periods on road surfaces, and are active during the night (Holycross 2003). The mortality of massasauga from vehicle strikes can be a significant cause of mortality (USFWS 2012), particularly during periods of migration to (autumn) and from (spring) hibernacula. Approximately 39 percent of massasaugas encountered by researchers are road-killed individuals (Mackessy 2005).

### 5 Biological Resource Use

The massasauga is a venomous rattlesnake, which encourages persecution by humans. The mortality associated from direct human take can have an impact on population sizes, but because massasauga are cryptically colored, small, and somewhat secretive, human encounter rates are limited. Subsequently, the impact suffered by massasauga populations from human persecution is probably limited (Mackessy 2005).

### 11 Climate Change & Severe Weather

Climate change scenarios predict increasing drought and temperatures (Melillo et al. 2014) within the range of the massasauga in the West, which could accelerate xerification processes, further facilitating declines in massasauga populations (Mackessy 2005).

### Other Threats

Suitable habitat within the range of the massasuaga has been lost to urbanization, desertification, water diversion and depletion and proliferation of noxious weeds (Mackessy 2005).

## *Information Needs*

Additional information on many aspects of massasauga ecology, biology, natural history and biogeography are needed, including presence/absence and relative abundance surveys; long-term monitoring of existing populations; sensitivity and threshold levels to habitat disturbance; birthing habitat requirements, mating phenology; whether foraging and hibernating habitat availability is limiting; what factors are important to successful re-establishment of recovered habitats; and population age structure and longevity.

## *Conservation Actions*

Protection and improvement of existing and historic habitat, especially through Best Management Practices, conservation easements, and habitat restoration, will improve the outlook for massasauga in Colorado. Development of a recovery plan for massasauga will better inform the specific actions necessary for the long-term protection of individual populations through out the state.

**Table 7. Species of Greatest Conservation Need Threats and Conservation Actions**
**Vertebrates and Mollusks.**

Sorted by priority (Tier 1 and 2), then by Taxonomic Group, then by Common Name.

## Tier 1 Amphibians

**Boreal toad (Southern Rocky Mountain Population)**
*Anaxyrus boreas boreas*
Tier 1 Amphibians

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Lakes | ☑ |
| Mountain Streams | ☑ |
| Riparian Woodlands and Shrublands | ☑ |
| Wetlands | ☑ |
| Aspen | ☐ |
| Lodgepole Pine | ☐ |
| Mixed Conifer | ☐ |
| Spruce - Fir | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Altered native vegetation (loss of riparian zone cottonwood and aspen due to encroachment of coniferous forest) | 2.3 Habitat & Natural Process Restoration | Restore riparian vegetation (deciduous hardwoods) | H |
| 08.4 Pathogens | Pathogen - chytrid fungus | 2.2 Invasive/Problematic Species Control | Follow established protocols for species research to avoid spread of pathogens | H |
| 08.4 Pathogens | Pathogen - chytrid fungus | 3.4 Ex-situ Conservation | Create captive breeding program | H |
| 08.4 Pathogens | Pathogen - chytrid fungus | 3.4 Ex-situ Conservation | Create gene-banking program | H |
| 08.4 Pathogens | Pathogen - chytrid fungus | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | H |
| 08.4 Pathogens | Pathogen - chytrid fungus | 8.0 Research & Monitoring | Research chytrid transmission mechanisms and factors conferring chytrid resistance | H |
| 11.2 Droughts | Drying out of breeding habitat | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 11.3 Temperature Extremes | Alteration of breeding phenology | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 14.1 Scarcity (leading to inbreeding depression) | Low population numbers | 3.3 Species Re-Introduction | Re-introduce locally extirpated native species | H |
| 06.1 Recreational Activities | Campsite and hiking or ORV trail development and use | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | M |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |
| 07.3 Other Ecosystem Modifications | Altered animal community (loss of beaver) | 2.3 Habitat & Natural Process Restoration | Maintain and restore natural ponds and small mountain lakes | M |
| 02.3 Livestock Farming & Ranching | Altered native riparian and wetland vegetation | 2.1 Site/Area Management | Implement compatible grazing practices | L |
| 04.1 Roads & Railroads | Local impacts from roadkill | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |
| 07.2 Dams & Water Management/Use | Altered hydrological regime - siltation and sedimentation | 2.3 Habitat & Natural Process Restoration | Improve excess sedimentation conditions | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Northern leopard frog**

*Lithobates pipiens*

Tier 1 Amphibians

| Population Status and Trend | | | |
|---|---|---|---|
| Low | X | Declining | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Lakes | ☑ |
| Mountain Streams | ☑ |
| Riparian Woodlands and Shrublands | ☑ |
| Transition Streams | ☑ |
| Wetlands | ☑ |
| Mixed Conifer | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - bullfrogs | 2.2 Invasive/Problematic Species Control | Control bullfrogs using accepted integrated pest management techniques for aquatic habitats | H |
| 08.4 Pathogens | Pathogen - chytrid fungus | 2.2 Invasive/Problematic Species Control | Follow established protocols for species research to avoid spread of pathogens | H |
| 08.4 Pathogens | Pathogen - chytrid fungus | 8.0 Research & Monitoring | Research Bd transmission mechanisms and factors conferring Bd resistance | H |
| 02.3 Livestock Farming & Ranching | Altered native riparian and wetland vegetation | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 04.1 Roads & Railroads | Local impacts from roadkill | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) and water management infrastructure | 2.3 Habitat & Natural Process Restoration | Restore habitat and maintain suitable hydrological regime | M |
| 09.5 Air-Borne Pollutants | Air and water pollution | 2.3 Habitat & Natural Process Restoration | Identify and control point-source and non-point source pollution | M |
| 11.2 Droughts | Drying out of breeding habitat | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 11.3 Temperature Extremes | Alteration of breeding phenology | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 03.1 Oil & Gas Drilling | Fragmentation of habitat (roads, culverts, etc.); impact on quality, impact on ground water availability; sedimentation of ponds; loss of habitat | 2.1 Site/Area Management | Work with state and federal partners to limit oil/gas leasing and development | L |
| 06.1 Recreational Activities | Potential for localized impacts (behavioral avoidance, habitat degradation) near high-use trails | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | L |
| 08.1 Invasive Non-Native/Alien Species | Predaceous game fish | 2.2 Invasive/Problematic Species Control | Avoid stocking predaceous game fish in occupied habitat | L |
| 13.1 Complete distribution in Colorado unknown | Identification of occupied wetlands needed to guide conservation easement and land protection | 8.0 Research & Monitoring | Conduct additional inventory for occupied wetland habitats. | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Tier 1 Birds**

**Brown-capped rosy-finch**

*Leucosticte australis*

Tier 1 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Alpine | ☑ |
| Cliffs and Canyons | ☐ |
| Desert Shrub | ☐ |
| Sagebrush | ☐ |
| Saltbush | ☐ |
| Upland Shrub | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status, including threats at both summer breeding and wintering sites. | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status; develop and implement monitoring plan | H |
| 02.3 Livestock Farming & Ranching | Destruction of shrubland understory (winter habitat) due to sheep grazing | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |
| 06.1 Recreational Activities | Rock climbing, hiking near cliffs and crevices | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | L |

**Burrowing owl**

*Athene cunicularia*

Tier 1 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |
| Sandsage | ☑ |
| Shortgrass Prairie | ☑ |
| Mixed and Tallgrass Prairies | ☐ |
| Sagebrush | ☐ |
| Saltbush | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.4 Pathogens | Loss of prairie dog colonies due to sylvatic plague | 8.0 Research & Monitoring | Research and develop effective vaccine and delivery system for prairie dogs | H |
| 08.4 Pathogens | Loss of prairie dog colonies due to sylvatic plague | 8.0 Research & Monitoring | Research species/habitat response to plague management | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Loss of habitat (prairie dog colonies) due to plague and prairie dog control | 3.1 Species Management | Write and implement management/recovery plan | M |
| 02.3 Livestock Farming & Ranching | Poisoning (indirect effect of prairie dog control) | 4.3 Awareness & Communications | Implement landowner outreach/education program | L |
| 06.1 Recreational Activities | Recreational shooting of prairie dogs | 2.1 Site/Area Management | Implement shooting closures/seasons where local conditions warrant | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Columbian sharp-tailed grouse**

*Tympanuchus phasianellus columbianus*

Tier 1 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Conservation Reserve Program | ☑ |
| Oak and Mixed Mountain Shrublands | ☑ |
| Sagebrush | ☑ |
| Agriculture | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Riparian Woodlands and Shrublands | ☐ |
| Upland Shrub | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Restore historic cropland and Conservation Reserve Program lands, including native understory species and sagebrush | H |
| 02.1 Annual & Perennial Non-Timber Crops | Loss of compatible Conservation Reserve Program lands | 5.2 Policies & Regulations | Encourage use of Farm Bill programs - optimize incentives for maintaining CRP that is compatible with habitat requirements | H |
| 02.1 Annual & Perennial Non-Timber Crops | Poor quality Conservation Reserve Program lands | 5.2 Policies & Regulations | Encourage use of Farm Bill programs - require existing CRP within species range to meet specific habitat standards; renovate poor quality fields | H |
| 07.3 Other Ecosystem Modifications | Loss of mountain shrub and grassland habitats | 5.2 Policies & Regulations | Establish mitigation requirements for developments and other projects that impact species/habitats | H |
| 07.3 Other Ecosystem Modifications | Rangewide species decline | 3.3 Species Re-Introduction | Re-introduce extirpated native species; translocate species to historic range | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | H |
| 08.1 Invasive Non-Native/Alien Species | Weeds on the State's A list | 2.2 Invasive/Problematic Species Control | Control non-native plants using accepted techniques appropriate to site-specific conditions | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 2.1 Site/Area Management | Employ grazing as a tool for compatible vegetation cover, structure, composition | M |
| 02.3 Livestock Farming & Ranching | Grazing intensity on reclaimed mine lands | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 02.3 Livestock Farming & Ranching | Grazing intensity on reclaimed mine lands | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for livestock grazing | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation, proximal non-recreation disturbance on leks | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

| | | | | |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Loss of mountain shrub and grassland habitats | 7.3 Conservation Finance | Provide economic assistance for private land habitat improvements and/or species conservation | M |
| 08.2 Problematic Native Species | Grazing impacts from deer and elk | 3.1 Species Management | Maintain deer and elk populations within carrying capacity for healthy habitat | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Golden eagle**

*Aquila chrysaetos*

Tier 1 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Foothill and Mountain Grasslands | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Oak and Mixed Mountain Shrublands | ☑ |
| Pinyon - Juniper | ☑ |
| Sagebrush | ☑ |
| Shortgrass Prairie | ☑ |
| Alpine | ☐ |
| Aspen | ☐ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Conservation Reserve Program | ☐ |
| Desert Shrub | ☐ |
| Eastern Plains Rivers | ☐ |
| Eastern Plains Streams | ☐ |
| Greasewood | ☐ |
| Lodgepole Pine | ☐ |
| Mixed Conifer | ☐ |
| Mountain Streams | ☐ |
| Playas | ☐ |
| Ponderosa Pine | ☐ |
| Saltbush | ☐ |
| Sandsage | ☐ |
| Spruce - Fir | ☐ |
| Subalpine Limber - Bristlecone Pine | ☐ |
| Transition Streams | ☐ |
| Upland Shrub | ☐ |
| Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 8.0 Research & Monitoring | Develop and prioritize standardized raptor nest monitoring with pre- and post-development data | M |
| 03.3 Renewable Energy | Collision with wind turbines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Mortality and prey reduction through rodent control | 4.3 Awareness & Communications | Implement landowner outreach/education program | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Secondary poisoning (anticoagulants, lead shot) | 5.2 Policies & Regulations | Monitor for potential impacts and respond as warranted by local conditions | M |
| 06.1 Recreational Activities | Recreational climbing, hiking, and biking trails | 2.1 Site/Area Management | Implement seasonal closures | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Greater sage-grouse**

*Centrocercus urophasianus*

Tier 1 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Increasing | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |
| Colorado Plateau | O |

| Habitat | Primary |
|---|---|
| Sagebrush | ☑ |
| Agriculture | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | H |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.2 Policies & Regulations | Work with state and federal partners to limit density of oil/gas leasing and development | H |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining, including reduction of infrastructure and associated traffic and noise | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 2.1 Site/Area Management | Employ grazing as a tool for compatible vegetation cover, structure, composition | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime and include treatment of pinyon-juniper to restore sagebrush habitat | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.3 Habitat & Natural Process Restoration | Restore native understory species | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity (e.g., seasonal closures, managed lek viewing) | L |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Greater sandhill crane**

*Grus canadensis tabida*

Tier 1 Birds

| Population Status and Trend | |
|---|---|
| Medium D | Stable D |
| Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed. | |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |
| Colorado Plateau | O |

| Habitat | Primary |
|---|---|
| Agriculture | ☑ |
| Wetlands | ☑ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Mountain Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 04.2 Utility & Service Lines | Collision with wind turbines and utility lines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and utility line development/placement | M |
| 07.2 Dams & Water Management/Use | Loss or degradation of wetland habitat | 2.3 Habitat & Natural Process Restoration | Maintain wetlands in San Luis Valley that support migrating cranes | M |
| 07.3 Other Ecosystem Modifications | Natural system modification - wetland filling | 5.4 Compliance & Enforcement | Enforce 404 wetlands regulations | M |
| 13.1 Complete distribution in Colorado unknown | Need improved knowledge of breeding distribution | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 02.1 Annual & Perennial Non-Timber Crops | Reduction in food resources - loss of small grain fields | 3.1 Species Management | Develop collaborative management agreements | L |
| 02.1 Annual & Perennial Non-Timber Crops | Reduction in food resources - loss of small grain fields | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | L |
| 02.1 Annual & Perennial Non-Timber Crops | Reduction in food resources - loss of small grain fields | 7.2 Alliance & Partnership Development | Develop partnerships to help maintain small grain farming in the Yampa Valley | L |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity, including seasonal closures where necessary | L |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |
| 14.2 Low annual recruitment | Low annual recruitment | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Gunnison sage-grouse**

*Centrocercus minimus*

Tier 1 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Stable | D |

Rangewide population is stable, but some satellite populations have declined. Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Conservation Reserve Program | ☑ |
| Sagebrush | ☑ |
| Agriculture | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation, urban development, landscaping, etc. | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Restore historic cropland and Conservation Reserve Program lands, including native understory species and sagebrush | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | H |
| 02.1 Annual & Perennial Non-Timber Crops | Loss of compatible Conservation Reserve Program lands | 5.2 Policies & Regulations | Encourage use of Farm Bill programs - optimize incentives for maintaining CRP that is compatible with habitat requirements | H |
| 02.1 Annual & Perennial Non-Timber Crops | Poor quality Conservation Reserve Program lands | 5.2 Policies & Regulations | Encourage use of Farm Bill programs - optimize incentives for maintaining CRP that is compatible with habitat requirements | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 2.1 Site/Area Management | Employ grazing as a tool for compatible vegetation cover, structure, composition | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.2 Policies & Regulations | Work with state and federal partners to limit density of oil/gas leasing and development | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining, including reduction of infrastructure and associated traffic and noise | M |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Restore sagebrush | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

| | | | | |
|---|---|---|---|---|
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity (e.g., seasonal closures, managed lek viewing) | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime and include treatment of pinyon-juniper to restore sagebrush habitat | M |
| 07.3 Other Ecosystem Modifications | Habitat degradation from a variety of sources | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.2 Invasive/Problematic Species Control | Control non-native plants using accepted techniques appropriate to site-specific conditions | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.3 Habitat & Natural Process Restoration | Restore native understory species | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Lesser prairie-chicken**

*Tympanuchus pallidicinctus*

Tier 1 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Increasing | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Conservation Reserve Program | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Sandsage | ☑ |
| Agriculture | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Restore historic cropland and Conservation Reserve Program lands, including native understory species and sagebrush | H |
| 02.1 Annual & Perennial Non-Timber Crops | Loss of compatible Conservation Reserve Program lands | 5.2 Policies & Regulations | Encourage use of Farm Bill programs - optimize incentives for maintaining CRP that is compatible with habitat requirements | H |
| 02.1 Annual & Perennial Non-Timber Crops | Poor quality Conservation Reserve Program lands | 5.2 Policies & Regulations | Encourage use of Farm Bill programs - require existing CRP within species range to meet specific habitat standards; renovate poor quality fields | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation | 8.0 Research & Monitoring | Research species/habitat response to management | H |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | H |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | H |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 8.0 Research & Monitoring | Research species/habitat response to management | H |
| 02.3 Livestock Farming & Ranching | Reduced grass/forb diversity | 8.0 Research & Monitoring | Research species/habitat response to management | H |
| 03.1 Oil & Gas Drilling | Behavioral avoidance of oil & gas development and associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.1 Oil & Gas Drilling | Fragmentation of native habitat due to oil & gas development and associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.2 Policies & Regulations | Establish mitigation requirements for developments and other projects that impact species/habitats | H |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.3 Renewable Energy | Behavioral avoidance of renewable energy development and associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.3 Renewable Energy | Fragmentation of native habitat due to renewable energy development and associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.3 Renewable Energy | Renewable energy development | 5.2 Policies & Regulations | Establish mitigation requirements for developments and other projects that impact species/habitats | H |
| 11.2 Droughts | Lack of water for habitat | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | H |
| 14.1 Scarcity (leading to inbreeding depression) | Small number of birds left in Colorado | 3.3 Species Re-Introduction | Re-introduce extirpated native species | H |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

| | | | | |
|---|---|---|---|---|
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | M |
| 03.3 Renewable Energy | Wind farms | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 03.3 Renewable Energy | Wind farms | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 08.2 Problematic Native Species | Predation and parasites | 8.0 Research & Monitoring | Research impact of parasites on bird survival | M |
| 08.2 Problematic Native Species | Predation and parasites | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 11.2 Droughts | Reduced production and survival | 2.3 Habitat & Natural Process Restoration | Restore native habitats adapted to drought conditions where possible | M |
| 11.4 Storms & Flooding | Blizzards and impact of hail and flooding on chicks and adults | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 02.3 Livestock Farming & Ranching | Egg trampling | 8.0 Research & Monitoring | Research species/habitat response to management | L |
| 04.2 Utility & Service Lines | Transport of energy & resources (e.g., electrical and phone wires, oil and gas pipelines, electrocution of wildlife) | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |
| 04.2 Utility & Service Lines | Transport of energy & resources (e.g., electrical and phone wires, oil and gas pipelines, electrocution of wildlife) | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | L |
| 08.2 Problematic Native Species | Predation and parasites | 3.2 Species Recovery | Reduce nest predators | L |
| 14.4 Predation | Nest predation | 3.1 Species Management | Reduce nest predators | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Mountain plover**

*Charadrius montanus*

Tier 1 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Shortgrass Prairie | ☑ |
| Agriculture | ☐ |
| Desert Shrub | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Mixed and Tallgrass Prairies | ☐ |
| Playas | ☐ |
| Saltbush | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.4 Pathogens | Loss of prairie dog colonies due to sylvatic plague | 8.0 Research & Monitoring | Research and develop effective vaccine and delivery system for prairie dogs | H |
| 08.4 Pathogens | Loss of prairie dog colonies due to sylvatic plague | 8.0 Research & Monitoring | Research species/habitat response to plague management | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Farm equipment running on fallow fields late in season (e.g. sunflower and millet fields) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (degradation of native shortgrass prairie) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 03.1 Oil & Gas Drilling | Fragmentation of native habitat due to oil & gas development and associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Loss of habitat (prairie dog colonies) due to plague and prairie dog control | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Loss of habitat (prairie dog colonies) due to plague and prairie dog control | 3.1 Species Management | Develop collaborative management agreements | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Loss of habitat (prairie dog colonies) due to plague and prairie dog control | 4.3 Awareness & Communications | Implement landowner outreach/education program | M |
| 07.1 Fire & Fire Suppression | Lack of fire to create bare ground | 2.3 Habitat & Natural Process Restoration | Conduct controlled burns where and when appropriate to create beneficial habitat | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | L |
| 02.1 Annual & Perennial Non-Timber Crops | Accidental nest destruction from tillage of crop fields | 4.3 Awareness & Communications | Implement landowner outreach/education program | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Plains sharp-tailed grouse**

*Tympanuchus phasianellus jamesi*

Tier 1 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Conservation Reserve Program | ☑ |
| Sandsage | ☑ |
| Mixed and Tallgrass Prairies | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | H |
| 02.1 Annual & Perennial Non-Timber Crops | Loss of compatible Conservation Reserve Program lands | 5.2 Policies & Regulations | Encourage use of Farm Bill programs - optimize incentives for maintaining CRP that is compatible with habitat requirements | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 03.1 Oil & Gas Drilling | Altered native vegetation | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 03.3 Renewable Energy | Collision with wind turbines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 04.1 Roads & Railroads | Roads associated with energy development - collision and fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Southern white-tailed ptarmigan**

*Lagopus leucura altipetens*

Tier 1 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Alpine | ☑ |
| Riparian Woodlands and Shrublands | ☐ |
| Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Continue monitoring species and habitat responses to changing climate | H |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Continue primary research on species and habitat responses to changing climate | H |
| 02.3 Livestock Farming & Ranching | Degradation of alpine habitats from sheep grazing & disturbance by guard dogs | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 06.1 Recreational Activities | Hiking, destruction of willows by ATVs and snowmobiles, and roads that affect hydrological system | 2.3 Habitat & Natural Process Restoration | Restore and/or close overused trails and tracks | M |
| 08.2 Problematic Native Species | Elk grazing/browsing in alpine & subalpine willow habitat | 2.3 Habitat & Natural Process Restoration | Manage natural herbivory | M |
| 01.3 Tourism & Recreation Areas | Recreation area developments | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |
| 06.1 Recreational Activities | Hiking, destruction of willows by ATVs and snowmobiles, and roads that affect hydrological system | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |

**Southwestern willow flycatcher**

*Empidonax traillii extimus*

Tier 1 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Riparian Woodlands and Shrublands | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | River flow management and riverbank protection | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (cottonwood/willow degradation) | 2.3 Habitat & Natural Process Restoration | Remove invasive species (tamarisk, Russian olive) and restore natural willow and cottonwood riparian systems, using techniques that are sensitive to temporary impacts to flycatchers inhabiting degraded woodlands | M |
| 12.1 Lack of coordination | Continued collaboration among stakeholders is warranted | 3.1 Species Management | Implement existing management/recovery plan | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Western yellow-billed cuckoo**

*Coccyzus americanus occidentalis*

Tier 1 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type | Habitat | Primary |
|---|---|---|---|
| Colorado Plateau | P | Riparian Woodlands and Shrublands | ☑ |
| Colorado Plateau | P | | |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 07.2 Dams & Water Management/Use | River flow management and riverbank protection | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (cottonwood/willow degradation) | 2.3 Habitat & Natural Process Restoration | Remove invasive species (tamarisk, Russian olive) and restore natural willow and cottonwood riparian systems, using techniques that are sensitive to temporary impacts to cuckoos inhabiting degraded woodlands | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk, leafy spurge | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 07.2 Dams & Water Management/Use | Dam construction | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | L |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |

## Tier 1 Fish

**Arkansas darter**

*Etheostoma cragini*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type | Habitat | Primary |
|---|---|---|---|
| Central Shortgrass Prairie | P | Eastern Plains Streams | ☑ |
| Front Range | O | Eastern Plains Rivers | ☐ |
| | | Transition Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - altered flow and fluctuating temperature | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - groundwater pumping and surface water diversions | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural use (irrigation) | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - stream dewatering | 2.3 Habitat & Natural Process Restoration | Attain adequate flows; Restore or maintain suitable hydrological regime | H |
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 1.2 Resource & Habitat Protection | Maintain habitat; Acquire water rights or instream flow rights, limit water use | H |
| 12.2 Lack of funding | Lack of funding/resource | 3.1 Species Management | Implement existing management/recovery plan | H |
| 02.3 Livestock Farming & Ranching | Wetland degradation primarily from livestock grazing | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |
| 14.6 Loss of species from suitable habitat | Loss of species from suitable habitat | 3.3 Species Re-Introduction | Stock species into previously occupied or suitable habitat | M |
| 02.3 Livestock Farming & Ranching | Wetland degradation primarily from livestock grazing | 2.1 Site/Area Management | Implement compatible grazing practices | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Bluehead sucker**

*Catostomus discobolus*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Unknown | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type | Habitat | Primary |
|---|---|---|---|
| Colorado Plateau | P | Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Southern Rocky Mountains | P | | |
| Utah High Plateau | O | Colorado Plateau - Wyoming Basins Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - dewatering | 2.3 Habitat & Natural Process Restoration | Adjust operation of dam | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - aquatic predators (smallmouth bass, northern pike, walleye, burbot) | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - white sucker | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - siltation and sedimentation | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | M |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - Altered hydrological regime (surface or aquifer) – altered flow and/or temperature regimes | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |
| 02.3 Livestock Farming & Ranching | Alteration of stream channel flows, increased sediment loads, degraded riparian habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |
| 04.1 Roads & Railroads | Alteration of stream channel flows, increased sediment loads, degraded riparian habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |
| 05.3 Logging & Wood Harvesting | Alteration of stream channel flows, increased sediment loads, degraded riparian habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |

**Bonytail chub**

*Gila elegans*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Increasing | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type | Habitat | Primary |
|---|---|---|---|
| Colorado Plateau | P | Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Southern Rocky Mountains | P | | |
| Utah High Plateau | O | | |
| Utah-Wyoming Rocky Mountains | O | | |
| Wyoming Basin | O | | |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Habitat fragmentation due to water diversion structures lacking fish passage | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences, fish passages) | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Adjust operation of dam | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - aquatic predators (smallmouth bass, northern pike, walleye, burbot) | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 13.2 Critical life history/habitat components unknown | Critical life history/habitat components unknown | 8.0 Research & Monitoring | Research critical life history/habitat components | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 3.3 Species Re-Introduction | Re-introduce extirpated native species | H |
| 04.1 Roads & Railroads | Potential for hazardous materials spills | 2.1 Site/Area Management | Coordinate efforts to prevent or minimize hazardous materials spills with existing state and federal emergency-response plans | M |
| 03.2 Mining & Quarrying | Potential for toxic discharges from uranium mining | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |
| 09.3 Agricultural & Forestry Effluents | Pollutants from agricultural runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Brassy minnow**

*Hybognathus hankinsoni*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Eastern Plains Streams | ☑ |
| Transition Streams | ☑ |
| Eastern Plains Rivers | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - groundwater pumping and surface water diversions | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural use (irrigation) | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - stream dewatering | 2.3 Habitat & Natural Process Restoration | Attain adequate flows; Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam, diversion, or drop structure construction or modification | 2.3 Habitat & Natural Process Restoration | Remove, modify or retrofit barriers to fish migration (improve fish passage, e.g., rock ramps or fish passage structures) | H |
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 1.2 Resource & Habitat Protection | Maintain habitat; Acquire water rights or instream flow rights, limit water use | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, monitoring) | M |
| 02.3 Livestock Farming & Ranching | Altered hydrological regime (surface or aquifer) - siltation and sedimentation | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |

**Colorado pikeminnow**

*Ptychocheilus lucius*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Declining | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | O |
| Utah-Wyoming Rocky Mountains | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Habitat fragmentation due to water diversion structures lacking fish passage | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences, fish passages) | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Adjust operation of dam | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - aquatic predators (smallmouth bass, northern pike, walleye, burbot) | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 03.2 Mining & Quarrying | Potential for toxic discharges from uranium mining | 2.1 Site/Area Management | Coordinate efforts to prevent or minimize hazardous materials spills with existing state and federal emergency-response plans | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Colorado River cutthroat trout**

*Oncorhynchus clarkii pleuriticus*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Increasing | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Lakes | ☑ |
| Mountain Streams | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Habitat fragmentation due to water diversion structures lacking fish passage | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences, fish passages) | H |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Hunting, trapping, fishing | 5.4 Compliance & Enforcement | Enforce hunting, fishing, collecting regulations | M |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences) | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |
| 02.3 Livestock Farming & Ranching | Alteration of stream channel flows, increased sediment loads, degraded riparian habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |
| 03.2 Mining & Quarrying | Heavy metal pollution | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |
| 04.1 Roads & Railroads | Increased sediment loads, fish barriers (culverts) | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |

**Common shiner**

*Luxilus cornutus*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Front Range | P |
| Central Shortgrass Prairie | O |

| Habitat | Primary |
|---|---|
| Transition Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - siltation and sedimentation | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 02.3 Livestock Farming & Ranching | Altered hydrological regime (surface or aquifer) - siltation and sedimentation | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Flannelmouth sucker**

*Catostomus latipinnis*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Unknown | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Colorado Plateau | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Lakes | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 2.3 Habitat & Natural Process Restoration | Adjust operation of dam | H |
| 07.2 Dams & Water Management/Use | Habitat fragmentation due to water diversion structures lacking fish passage | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences, fish passages) | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - aquatic predators (smallmouth bass, northern pike, walleye, burbot) | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 08.3 Introduced Genetic Material | Invasive animals - white sucker | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 02.3 Livestock Farming & Ranching | Alteration of stream channel flows, increased sediment loads, degraded riparian habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |
| 04.1 Roads & Railroads | Alteration of stream channel flows, increased sediment loads, degraded riparian habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |

**Flathead chub**

*Platygobio gracilis*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Transition Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - dam, diversion, or drop structure construction or modification | 2.3 Habitat & Natural Process Restoration | Remove, modify or retrofit barriers to fish migration (improve fish passage, e.g., rock ramps or fish passage structures) | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - dewatering | 2.3 Habitat & Natural Process Restoration | Attain adequate flows; Restore or maintain suitable hydrological regime | H |
| 03.1 Oil & Gas Drilling | Wastewater from coalbed methane production reducing water quality & altering flows | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 03.2 Mining & Quarrying | Heavy metal contamination of streams | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 11.4 Storms & Flooding | Altered flows primarily from urban runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for storm water management to minimize extreme peak flows | M |
| 11.4 Storms & Flooding | Altered flows primarily from urban runoff | 7.2 Alliance & Partnership Development | Engage in collaborative, proactive planning and conservation programs to minimize extreme peak flows | M |
| 02.3 Livestock Farming & Ranching | Overgrazing leading to decreased channel depth, increased stream width & intermittency, waste altering O2 concentrations & ammonia | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Greenback cutthroat trout**

*Oncorhynchus clarkii stomias*

Tier 1 Fish

| Population Status | and Trend |
|---|---|
| Medium D | Increasing D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Lakes | ☑ |
| Mountain Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Habitat fragmentation due to water diversion structures lacking fish passage | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences, fish passages) | H |
| 13.3 Genetic relationship with other species and/or subspecies unknown | Taxonomic & status assessments of lineages are needed | 8.0 Research & Monitoring | Complete ongoing taxonomic assessments | H |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Hunting, trapping, fishing | 5.4 Compliance & Enforcement | Enforce hunting, fishing, collecting regulations | M |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences) | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |
| 02.3 Livestock Farming & Ranching | Alteration of stream channel flows, increased sediment loads, degraded riparian habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |
| 03.2 Mining & Quarrying | Heavy metal pollution, altered channel geometry, increased sedimentation | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |
| 06.1 Recreational Activities | Erosion, sedimenation, loss of vegetation along heavily-used trails | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |

**Humpback chub**

*Gila cypha*

Tier 1 Fish

| Population Status | and Trend |
|---|---|
| Low D | Declining D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Utah High Plateau | P |
| Wyoming Basin | P |
| Utah-Wyoming Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Habitat fragmentation due to water diversion structures lacking fish passage | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences, fish passages) | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - aquatic predators (smallmouth bass, northern pike, walleye, burbot) | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 04.1 Roads & Railroads | Potential for hazardous materials spills from railroads | 2.1 Site/Area Management | Coordinate efforts to prevent or minimize hazardous materials spills with existing state and federal emergency-response plans | M |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Adjust operation of dam | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native invertebrates using integrated pest management techniques for aquatic habitats | M |
| 04.2 Utility & Service Lines | Potential for hazardous materials spills from oil pipelines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |
| 09.3 Agricultural & Forestry Effluents | Pollutants from agricultural runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Mountain sucker**

*Catostomus platyrhynchus*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |
| Colorado Plateau | O |
| Utah High Plateau | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Mountain Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Adjust operation of dam | H |
| 08.3 Introduced Genetic Material | Invasive animals - competition, predation, and hybridization | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |
| 04.1 Roads & Railroads | Potential for hazardous materials spills | 2.1 Site/Area Management | Coordinate efforts to prevent or minimize hazardous materials spills with existing state and federal emergency-response plans | L |

**Northern redbelly dace**

*Chrosomus eos*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Front Range | P |

| Habitat | Primary |
|---|---|
| Transition Streams | ☑ |
| Lakes | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Decreased water quality | 5.2 Policies & Regulations | Monitor water quality standards | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements | M |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |

**Orangespotted sunfish**

*Lepomis humilis*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Lakes | ☐ |
| Transition Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Housing, urban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Orangethroat darter**

*Etheostoma spectabile*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Streams | ☑ |
| Eastern Plains Rivers | ☐ |
| Transition Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - altered flow and fluctuating water temperature | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - groundwater pumping and surface water diversions | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural use (irrigation) | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - stream dewatering | 2.3 Habitat & Natural Process Restoration | Attain adequate flows; Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam, diversion, or drop structure construction or modification | 2.3 Habitat & Natural Process Restoration | Remove, modify or retrofit barriers to fish migration (improve fish passage, e.g., rock ramps or fish passage structures) | H |
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 1.2 Resource & Habitat Protection | Maintain habitat; Acquire water rights or instream flow rights, limit water use | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |

**Plains minnow**

*Hybognathus placitus*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - stream dewatering | 2.3 Habitat & Natural Process Restoration | Attain adequate flows; Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam, diversion, or drop structure construction or modification | 2.3 Habitat & Natural Process Restoration | Remove, modify or retrofit barriers to fish migration (improve fish passage, e.g., rock ramps or fish passage structures) | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - Altered flow and fluctuating water temperature | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |
| 14.6 Loss of species from suitable habitat | Loss of species from suitable habitat | 3.3 Species Re-Introduction | Stock species into previously occupied or suitable habitat | M |
| 02.3 Livestock Farming & Ranching | Alteration of stream channel flows, increased sediment loads, degraded riparian habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Plains topminnow**

*Fundulus sciadicus*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Transition Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - altered flow and fluctuating water temperature | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - groundwater pumping and surface water diversions | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural use (irrigation) | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - stream dewatering | 2.3 Habitat & Natural Process Restoration | Attain adequate flows; Restore or maintain suitable hydrological regime | H |
| 01.1 Housing & Urban Areas | Housing, urban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |
| 02.3 Livestock Farming & Ranching | Alteration of stream channel flows, increased sediment loads, degraded riparian habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |

**Razorback sucker**

*Xyrauchen texanus*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Increasing | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Colorado Plateau | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Habitat fragmentation due to water diversion structures lacking fish passage | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences, fish passages) | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Adjust operation of dam | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - aquatic predators (smallmouth bass, northern pike, walleye, burbot) | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 03.2 Mining & Quarrying | Heavy metal contamination of streams | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 04.1 Roads & Railroads | Potential for hazardous materials spills from railroads | 2.1 Site/Area Management | Coordinate efforts to prevent or minimize hazardous materials spills with existing state and federal emergency-response plans | M |
| 09.3 Agricultural & Forestry Effluents | Elevated selenium concentrations | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff and sources associated with resource extraction | 2.3 Habitat & Natural Process Restoration | Identify and control point-source and non-point source pollution | M |
| 04.2 Utility & Service Lines | Potential for hazardous materials spills from oil pipelines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Rio Grande chub**

*Gila pandora*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Rio Grande Valley Rivers | ☑ |
| Rio Grande Valley Streams | ☑ |
| Lakes | ☐ |
| Mountain Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Groundwater removal from center pivot irrigation systems | 8.0 Research & Monitoring | Study impact of groundwater removal on stream flow in closed basin and impacts to native fish | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - stream dewatering | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - fathead minnow, white sucker, red shiner | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 03.2 Mining & Quarrying | Heavy metals & cyanide contamination | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 02.3 Livestock Farming & Ranching | Potential for elimination of microhabitats (woody debris, overhanging vegetation, aquatic macrophytes) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |

**Rio Grande cutthroat trout**

*Oncorhynchus clarkii virginalis*

Tier 1 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Increasing | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Lakes | ☑ |
| Mountain Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Altered native vegetation (streambank cover reduction) primarily from livestock grazing | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements | H |
| 11.2 Droughts | De-watering & elevated stream temperature | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | H |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Hunting, trapping, fishing | 5.4 Compliance & Enforcement | Enforce hunting, fishing, collecting regulations | M |
| 07.1 Fire & Fire Suppression | Ash flows & debris from wildfire | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences) | M |
| 07.3 Other Ecosystem Modifications | Fragmentation | 3.2 Species Recovery | Maintain genetic connection/integrity within and between populations | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - brook trout, brown trout | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |
| 08.4 Pathogens | Whirling disease | 8.0 Research & Monitoring | Research and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Rio Grande sucker**

*Catostomus plebeius*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Increasing | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Mountain Streams | ☑ |
| Rio Grande Valley Rivers | ☑ |
| Rio Grande Valley Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Groundwater removal from center pivot irrigation systems | 8.0 Research & Monitoring | Study impact of groundwater removal on stream flow in closed basin and impacts to native fish | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - dewatering | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - sedimentation | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - white sucker | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |

**Roundtail chub**

*Gila robusta*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Declining | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Colorado Plateau | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Habitat fragmentation due to water diversion structures lacking fish passage | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences, fish passages) | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Adjust operation of dam | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - aquatic predators (smallmouth bass, northern pike, walleye, burbot) | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | H |
| 04.1 Roads & Railroads | Potential for hazardous materials spills from railroads | 2.1 Site/Area Management | Coordinate efforts to prevent or minimize hazardous materials spills with existing state and federal emergency-response plans | L |
| 08.4 Pathogens | Asian tapeworm (Bothriocephalus acheilognathi) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Southern redbelly dace**

*Chrosomus erythrogaster*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Declining | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Transition Streams | ☑ |
| Eastern Plains Streams | ☐ |
| Lakes | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - altered flow and fluctuating water temperature | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - groundwater pumping and surface water diversions | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural use (irrigation) | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - siltation and sedimentation | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions; retore proper stream hydromorphology | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - stream dewatering | 2.3 Habitat & Natural Process Restoration | Attain adequate flows; Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Decreased water quality | 5.2 Policies & Regulations | Monitor water quality standards | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements | H |
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 1.2 Resource & Habitat Protection | Maintain habitat; Acquire water rights or instream flow rights, limit water use | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |
| 14.6 Loss of species from suitable habitat | Loss of species from suitable habitat | 3.3 Species Re-Introduction | Stock species into previously occupied or suitable habitat | M |
| 02.3 Livestock Farming & Ranching | Wetland degradation primarily from livestock grazing | 2.1 Site/Area Management | Implement compatible grazing practices | L |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Identify and control point-source and non-point source pollution | L |

**Stonecat**

*Noturus flavus*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Streams | ☑ |
| Transition Streams | ☑ |
| Eastern Plains Rivers | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - altered flow and fluctuating water temperature | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - groundwater pumping and surface water diversions | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural use (irrigation) | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - siltation | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - stream dewatering | 2.3 Habitat & Natural Process Restoration | Attain adequate flows; Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, monitoring) | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Suckermouth minnow**

*Phenacobius mirabilis*

Tier 1 Fish

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Transition Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - dewatering | 2.3 Habitat & Natural Process Restoration | Attain adequate flows; Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - siltation and sedimentation | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions; restore proper stream hydromorphology | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam, diversion, or drop structure construction or modification | 2.3 Habitat & Natural Process Restoration | Remove, modify or retrofit barriers to fish migration (improve fish passage, e.g., rock ramps or fish passage structures) | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural use | M |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, monitoring) | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research critical life history/habitat components | M |
| 14.6 Loss of species from suitable habitat | Loss of species from suitable habitat | 3.3 Species Re-Introduction | Re-introduce species in suitable habitat | M |

## Tier 1 Mammals

**American pika**

*Ochotona princeps*

Tier 1 Mammals

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | X | Stable | D |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Alpine | ☑ |
| Aspen | ☐ |
| Lodgepole Pine | ☐ |
| Mixed Conifer | ☐ |
| Spruce - Fir | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 11.1 Habitat Shifting & Alteration | Habitat shifting & alteration due to climate change | 8.0 Research & Monitoring | Continue monitoring species and habitat responses to changing climate | H |
| 11.3 Temperature Extremes | Temperature extremes and precipitation changes | 8.0 Research & Monitoring | Continue monitoring species and habitat responses to changing climate | H |
| 06.1 Recreational Activities | Hiking, ORVs, and domestic animals | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Black-footed ferret**

*Mustela nigripes*

Tier 1 Mammals

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

Status of released ferrets is unknown. Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Shortgrass Prairie | ☑ |
| Desert Shrub | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Mixed and Tallgrass Prairies | ☐ |
| Sagebrush | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Loss of habitat (prairie dog colonies) due to plague and prairie dog control | 3.1 Species Management | Work with partner agencies, NGOs and private landowners to develop incentives and agreements for conservation benefit | H |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Morality and prey reduction through rodent control | 5.2 Policies & Regulations | Continue implementing existing regulations at re-introduction sites | H |
| 08.4 Pathogens | Pathogen - sylvatic plague | 3.1 Species Management | Develop and implement an active disease management program | H |
| 08.4 Pathogens | Pathogen - sylvatic plague | 8.0 Research & Monitoring | Research and develop effective vaccine and delivery system | H |
| 13.4 Population status unknown | Lack of data on population status of released ferrets | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 3.3 Species Re-Introduction | Re-introduce extirpated native species | H |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Loss of habitat (prairie dog colonies) due to plague and prairie dog control | 2.3 Habitat & Natural Process Restoration | Manage for predator/prey balance | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Loss of habitat (prairie dog colonies) due to plague and prairie dog control | 4.3 Awareness & Communications | Implement landowner outreach/education and incentive programs | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Loss of habitat (prairie dog colonies) due to plague and prairie dog control | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Loss of habitat (prairie dog colonies) due to plague and prairie dog control | 6.4 Conservation Payments | Implement the NRCS Black-footed Ferret Initiative program | M |
| 08.4 Pathogens | Pathogen - sylvatic plague | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 12.1 Lack of coordination | Lack of coordination | 3.1 Species Management | Implement existing management/recovery plan | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Fringed myotis**

*Myotis thysanodes*

Tier 1 Mammals

| Population Status and Trend | | | |
|---|---|---|---|
| Unknown | D | Unknown | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Front Range | P |
| Wyoming Basin | P |
| Central Shortgrass Prairie | O |
| Southern Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Mixed Conifer | ☑ |
| Oak and Mixed Mountain Shrublands | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Aspen | ☐ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Desert Shrub | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Lodgepole Pine | ☐ |
| Mountain Streams | ☐ |
| Sagebrush | ☐ |
| Spruce - Fir | ☐ |
| Transition Streams | ☐ |
| Upland Shrub | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.3 Work & Other Activities | Proximal non-recreation disturbance | 2.1 Site/Area Management | Manage to limit disturbance, especially to roost sites, maternity colonies, and hibernacula | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 03.2 Mining & Quarrying | Uranium mining | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 07.3 Other Ecosystem Modifications | Cave/mine closures and grating | 2.3 Habitat & Natural Process Restoration | Employ appropriate site-specific and/or species-specific techniques for closures and safety enhancements | M |
| 08.4 Pathogens | Potential for White-nose Syndrome | 2.2 Invasive/Problematic Species Control | Manage recreation, research, management, and other human disturbances to control the spread of pathogens | M |
| 09.3 Agricultural & Forestry Effluents | Prey reduction from herbicide/pesticide spraying or runoff | 2.3 Habitat & Natural Process Restoration | Reduce herbicide/pesticide use | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Gunnison's prairie dog**

*Cynomys gunnisoni*

Tier 1 Mammals

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |
| Foothill and Mountain Grasslands | ☑ |
| Sagebrush | ☑ |
| Greasewood | ☐ |
| Oak and Mixed Mountain Shrublands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining as per Colorado Gunnison's and White-tailed Prairie Dog Conservation Strategy for Oil and Gas | H |
| 08.4 Pathogens | Pathogen - sylvatic plague | 3.1 Species Management | Develop and implement an active disease management program | H |
| 08.4 Pathogens | Pathogen - sylvatic plague | 8.0 Research & Monitoring | Research and develop effective vaccine and delivery system | H |
| 08.4 Pathogens | Pathogen - sylvatic plague | 8.0 Research & Monitoring | Research species/habitat response to plague management | H |
| 07.3 Other Ecosystem Modifications | Loss and degradation of habitat | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 07.3 Other Ecosystem Modifications | Loss and degradation of habitat | 1.2 Resource & Habitat Protection | Maintain healthy colonies on public lands and on private land with large acreage | M |
| 07.3 Other Ecosystem Modifications | Loss and degradation of habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat and wet areas (controlled burning, weed control) | M |
| 11.2 Droughts | Potential for increasing number and duration of drought events | 2.3 Habitat & Natural Process Restoration | Maintain landscape connectivity to allow for species movement | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Poisoning | 4.3 Awareness & Communications | Implement landowner outreach/education program | L |
| 06.1 Recreational Activities | Recreational shooting of prairie dogs | 2.1 Site/Area Management | Implement shooting closures/seasons where local conditions warrant | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Little brown myotis**

*Myotis lucifugus*

Tier 1 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Central Shortgrass Prairie | O |

| Habitat | Primary |
|---|---|
| Mixed Conifer | ☑ |
| Ponderosa Pine | ☑ |
| Aspen | ☐ |
| Cliffs and Canyons | ☐ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Desert Shrub | ☐ |
| Eastern Plains Rivers | ☐ |
| Eastern Plains Streams | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Lodgepole Pine | ☐ |
| Mountain Streams | ☐ |
| Oak and Mixed Mountain Shrublands | ☐ |
| Pinyon - Juniper | ☐ |
| Riparian Woodlands and Shrublands | ☐ |
| Sagebrush | ☐ |
| Transition Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | Proximal non-recreation disturbance | 2.1 Site/Area Management | Manage to limit disturbance, especially to roost sites, maternity colonies, and hibernacula | H |
| 08.4 Pathogens | Potential for White-nose Syndrome | 2.2 Invasive/Problematic Species Control | Manage recreation, research, management, and other human disturbances to control the spread of pathogens | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research critical life history/habitat components | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status; conduct surveillance for potential arrival of white-nose syndrome | H |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Exterminations/evictions in urban settings | 2.3 Habitat & Natural Process Restoration | Develop alternative roost sites | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Exterminations/evictions in urban settings | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Exterminations/evictions in urban settings | 5.2 Policies & Regulations | Provide incentives for homeowners to increase tolerance of bats | M |
| 09.3 Agricultural & Forestry Effluents | Prey reduction from herbicide/pesticide spraying or runoff | 2.3 Habitat & Natural Process Restoration | Reduce herbicide/pesticide use | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Lynx**

*Lynx canadensis*

Tier 1 Mammals

| Population Status and Trend | | | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Medium | X | Unknown | X | Southern Rocky Mountains | P | Lodgepole Pine | ☑ |
| Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed. | | | | | | Mixed Conifer | ☑ |
| | | | | | | Spruce - Fir | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 12.3 Lack of common goals | Lack of Recovery Plan | 3.1 Species Management | Write and implement management/recovery plan | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences) | M |
| 05.3 Logging & Wood Harvesting | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain habitat connectivity so that natural movement between occupied and unoccupied habitat can be maintained to support a naturally expanding population | M |
| 06.1 Recreational Activities | Unregulated backcountry winter recreation | 8.0 Research & Monitoring | Research species/habitat response to management | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 11.1 Habitat Shifting & Alteration | Loss of snow | 2.3 Habitat & Natural Process Restoration | Maintain connectivity and improve resilience | M |

**New Mexico jumping mouse**

*Zapus hudsonius luteus*

Tier 1 Mammals

| Population Status and Trend | | | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Low | X | Unknown | X | Central Shortgrass Prairie | O | Eastern Plains Streams | ☑ |
| Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed. | | | | Colorado Plateau | O | Mountain Streams | ☑ |
| | | | | Southern Rocky Mountains | O | Riparian Woodlands and Shrublands | ☑ |
| | | | | | | Eastern Plains Rivers | ☐ |
| | | | | | | Transition Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.2 Critical life history/habitat components unknown | Biology, ecology, and habitat poorly known | 8.0 Research & Monitoring | Research critical life history/habitat components | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 07.1 Fire & Fire Suppression | Wildfires exacerbated by climate change | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 07.2 Dams & Water Management/Use | Scouring floods | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (streambank cover reduction) | 2.3 Habitat & Natural Process Restoration | Restore riparian vegetation | M |
| 12.1 Lack of coordination | Lack of management/recovery plan | 3.1 Species Management | Write and implement management/recovery plan | M |
| 12.1 Lack of coordination | Lack of management/recovery plan | 7.2 Alliance & Partnership Development | Coordinate with related agencies to align goals, policies, measures of success, etc. | M |
| 12.2 Lack of funding | Lack of dedicated funding source | 7.2 Alliance & Partnership Development | Coordinate with related agencies to identify and secure funding | M |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 3.2 Species Recovery | Maintain genetic connection/integrity within and between populations | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Olive-backed pocket mouse**

*Perognathus fasciatus*

Tier 1 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Foothill and Mountain Grasslands | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Shortgrass Prairie | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Develop and implement monitoring plan | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |

**Prebles meadow jumping mouse**

*Zapus hudsonius preblei*

Tier 1 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Declining | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Front Range | P |
| Central Shortgrass Prairie | O |
| Southern Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Eastern Plains Streams | ☑ |
| Mountain Streams | ☑ |
| Riparian Woodlands and Shrublands | ☑ |
| Transition Streams | ☑ |
| Eastern Plains Rivers | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | H |
| 07.2 Dams & Water Management/Use | Habitat degradation from alteration of flows | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements, restore riparian vegetation and hydrological regime | H |
| 12.1 Lack of coordination | Lack of USFWS conservation plan | 3.1 Species Management | Write and implement management/recovery plan | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | M |
| 12.1 Lack of coordination | Lack of USFWS conservation plan | 7.2 Alliance & Partnership Development | Engage in collaborative, proactive planning and conservation programs | M |
| 12.3 Lack of common goals | Lack of USFWS conservation plan | 7.2 Alliance & Partnership Development | Coordinate with related agencies to align goals, policies, measures of success, etc. | M |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 3.2 Species Recovery | Maintain genetic connection/integrity within and between populations | M |
| 07.3 Other Ecosystem Modifications | Altered animal community - change in predator/prey balance (domestic cat & bullfrog predation) | 2.3 Habitat & Natural Process Restoration | Manage for predator/prey balance | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Spotted bat**

*Euderma maculatum*

Tier 1 Mammals

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Aspen | ☐ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Desert Shrub | ☐ |
| Mixed Conifer | ☐ |
| Pinyon - Juniper | ☐ |
| Ponderosa Pine | ☐ |
| Upland Shrub | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown; information on winter distribution is needed | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 13.2 Critical life history/habitat components unknown | Biology, ecology, and habitat poorly known | 8.0 Research & Monitoring | Research critical life history/habitat components | M |
| 09.3 Agricultural & Forestry Effluents | Prey reduction from herbicide/pesticide spraying or runoff | 2.3 Habitat & Natural Process Restoration | Reduce herbicide/pesticide use | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Townsend's big-eared bat ssp.**

*Corynorhinus townsendii pallescens*

Tier 1 Mammals

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Mixed Conifer | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Aspen | ☐ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Desert Shrub | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Mountain Streams | ☐ |
| Oak and Mixed Mountain Shrublands | ☐ |
| Sagebrush | ☐ |
| Spruce - Fir | ☐ |
| Transition Streams | ☐ |
| Upland Shrub | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.2 Mining & Quarrying | Uranium mining | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 06.1 Recreational Activities | Recreational caving | 2.1 Site/Area Management | Manage to limit disturbance, especially to roost sites, maternity colonies, and hibernacula | H |
| 06.3 Work & Other Activities | Proximal non-recreation disturbance | 2.1 Site/Area Management | Manage to limit disturbance, especially to roost sites, maternity colonies, and hibernacula | H |
| 07.3 Other Ecosystem Modifications | Cave/mine closures and grating | 2.3 Habitat & Natural Process Restoration | Employ appropriate site-specific and/or species-specific techniques for closures and safety enhancements | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 08.4 Pathogens | Potential for White-nose Syndrome | 2.2 Invasive/Problematic Species Control | Manage recreation, research, management, and other human disturbances to control the spread of pathogens | M |
| 13.2 Critical life history/habitat components unknown | Biology, ecology, and habitat poorly known | 8.0 Research & Monitoring | Research critical life history/habitat components | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | L |
| 09.3 Agricultural & Forestry Effluents | Prey reduction from herbicide/pesticide spraying or runoff | 2.3 Habitat & Natural Process Restoration | Reduce herbicide/pesticide use | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

| **White-tailed prairie dog** | Population Status and Trend | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|
| | Medium D | Stable D | Colorado Plateau | P | Desert Shrub | ☑ |
| *Cynomys leucurus* | Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed. | | Utah-Wyoming Rocky Mountains | P | Foothill and Mountain Grasslands | ☑ |
| Tier 1 Mammals | | | Wyoming Basin | P | Sagebrush | ☑ |
| | | | Southern Rocky Mountains | O | | |
| | | | Utah High Plateau | O | | |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.4 Pathogens | Pathogen - sylvatic plague | 3.1 Species Management | Develop and implement an active disease management program | H |
| 08.4 Pathogens | Pathogen - sylvatic plague | 8.0 Research & Monitoring | Research and develop effective vaccine and delivery system | H |
| 08.4 Pathogens | Pathogen - sylvatic plague | 8.0 Research & Monitoring | Research species/habitat response to plague management | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Maintain healthy colonies on public lands and on private land with large acreage | M |
| 02.3 Livestock Farming & Ranching | Historic grazing with incompatible timing, intensity, duration | 2.3 Habitat & Natural Process Restoration | Restore native habitat and wet areas (controlled burning, weed control) | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining as per Colorado Gunnison's and White-tailed Prairie Dog Conservation Strategy for Oil and Gas | M |
| 07.1 Fire & Fire Suppression | Altered fire regime (changes in fire frequency) and pinyon-juniper encroachment | 2.3 Habitat & Natural Process Restoration | Restore native habitat and wet areas (controlled burning, weed control) | M |
| 07.3 Other Ecosystem Modifications | Loss and degradation of habitat | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 07.3 Other Ecosystem Modifications | Loss and degradation of habitat | 1.2 Resource & Habitat Protection | Maintain healthy colonies on public lands and on private land with large acreage | M |
| 07.3 Other Ecosystem Modifications | Loss and degradation of habitat | 2.3 Habitat & Natural Process Restoration | Restore native habitat and wet areas (controlled burning, weed control) | M |
| 08.1 Invasive Non-Native/Alien Species | Non-native plants - cheatgrass | 2.3 Habitat & Natural Process Restoration | Restore native habitat and wet areas (controlled burning, weed control) | M |
| 11.2 Droughts | Potential for increasing number and duration of drought events | 2.3 Habitat & Natural Process Restoration | Maintain landscape connectivity to allow for species movement | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Poisoning | 4.3 Awareness & Communications | Implement landowner outreach/education program | L |
| 06.1 Recreational Activities | Recreational shooting of prairie dogs | 2.1 Site/Area Management | Implement shooting closures/seasons where local conditions warrant | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Wolverine**

*Gulo gulo*

Tier 1 Mammals

| Population Status and Trend | | | |
|---|---|---|---|
| Unknown | X | Unknown | X |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Alpine | ☑ |
| Aspen | ☐ |
| Lodgepole Pine | ☐ |
| Mixed Conifer | ☐ |
| Subalpine Limber - Bristlecone Pine | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 12.5 Legislation/policy changes | No tools to grant public assurances for support of re-introduction | 5.2 Policies & Regulations | Develop robust tool/policy to grant assurances | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 3.3 Species Re-Introduction | Initiatie roundtable discussions and develop a timeline | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 3.3 Species Re-Introduction | Re-introduce extirpated native species | H |
| 11.1 Habitat Shifting & Alteration | Habitat shifting due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 11.1 Habitat Shifting & Alteration | Loss of snow | 2.3 Habitat & Natural Process Restoration | Maintain connectivity and improve resilience | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

| Tier 1 | Reptiles |
|---|---|

**Colorado checkered whiptail**

*Aspidoscelis neotesselata*

Tier 1 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | X | Stable | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Greasewood | ☑ |
| Playas | ☑ |
| Conservation Reserve Program | ☐ |
| Shortgrass Prairie | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.2 Critical life history/habitat components unknown | Biology, ecology, and habitat poorly known | 8.0 Research & Monitoring | Research critical life history/habitat components | H |
| 13.3 Genetic relationship with other species and/or subspecies unknown | Genetic relationship with other subspecies unknown | 8.0 Research & Monitoring | Research genetic relation to other (sub)species | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 12.1 Lack of coordination | Lack of conservation plan | 3.1 Species Management | Develop proactive conservation program to prevent species from becoming a concern in the future | M |
| 12.1 Lack of coordination | Lack of management plan | 3.1 Species Management | Write and implement management/recovery plan | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

| **Massasauga** | Population Status and Trend | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|
| *Sistrurus catenatus* | Medium D | Stable D | Central Shortgrass Prairie | P | Mixed and Tallgrass Prairies | ☑ |
| Tier 1 Reptiles | Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed. | | | | Shortgrass Prairie | ☑ |
| | | | | | Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 04.1 Roads & Railroads | Collision (e.g., auto) | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 12.1 Lack of coordination | Lack of conservation effort coordination | 3.1 Species Management | Write and implement management/recovery plan | M |
| 12.3 Lack of common goals | Lack of common conservation goals | 7.2 Alliance & Partnership Development | Engage in collaborative, proactive planning and conservation programs | M |
| 04.1 Roads & Railroads | Collision (e.g., auto) | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | L |
| 13.2 Critical life history/habitat components unknown | Biology, ecology, and habitat poorly known | 8.0 Research & Monitoring | Research critical life history/habitat components | L |

## Tier 2 Amphibians

| **Blanchard's cricket frog** | Population Status and Trend | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|
| *Acris crepitans* | Low D | Declining D | Central Shortgrass Prairie | P | Eastern Plains Rivers | ☑ |
| Tier 2 Amphibians | Possibly extripated in CO (edge of range) | | | | Eastern Plains Streams | ☑ |
| | | | | | Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution unknown | 8.0 Research & Monitoring | Develop and implement monitoring plan | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for water resource development | L |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - bullfrogs | 2.2 Invasive/Problematic Species Control | Control bullfrogs using accepted integrated pest management techniques for aquatic habitats | L |
| 11.1 Habitat Shifting & Alteration | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts) | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Canyon tree frog**

*Hyla arenicolor*

Tier 2 Amphibians

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Southern Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Cliffs and Canyons | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status; develop and implement monitoring plan | H |
| 06.1 Recreational Activities | Non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 11.1 Habitat Shifting & Alteration | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts) | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - bullfrogs | 2.2 Invasive/Problematic Species Control | Control bullfrogs using accepted integrated pest management techniques for aquatic habitats | L |

**Couch's spadefoot**

*Scaphiopus couchii*

Tier 2 Amphibians

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | X | Stable | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Shortgrass Prairie | ☑ |
| Wetlands | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing); develop and implement monitoring plan | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - threat is not well understood | 8.0 Research & Monitoring | Research species/habitat response to management | M |
| 11.2 Droughts | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts) | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Great Basin spadefoot**

*Spea intermontana*

Tier 2 Amphibians

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | | Unknown | |

| Distribution | Type |
|---|---|
| Colorado Plateau | |
| Utah High Plateau | |
| Utah-Wyoming Rocky Mountains | |
| Wyoming Basin | |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |
| Pinyon - Juniper | ☑ |
| Sagebrush | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status; develop and implement monitoring plan | H |
| 03.1 Oil & Gas Drilling | Fragmentation of habitat (roads, culverts, etc.); impact on quality, impact on ground water availability; sedimentation of ponds; loss of habitat | 2.1 Site/Area Management | Work with state and federal partners to limit oil/gas leasing and development | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 11.1 Habitat Shifting & Alteration | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts) | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | L |

**Great Plains narrowmouth toad**

*Gastrophryne olivacea*

Tier 2 Amphibians

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Streams | ☑ |
| Wetlands | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status; develop and implement monitoring plan | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |
| 09.3 Agricultural & Forestry Effluents | Pesticide runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |
| 11.1 Habitat Shifting & Alteration | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts) | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | L |

**Green toad**

*Anaxyrus debilis*

Tier 2 Amphibians

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Streams | ☑ |
| Shortgrass Prairie | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status; develop and implement monitoring plan | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Plains leopard frog**

*Lithobates blairi*

Tier 2 Amphibians

| Population Status | | and Trend | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Medium | X | Declining | X | Central Shortgrass Prairie | P | Eastern Plains Rivers | ☑ |
| | | | | | | Eastern Plains Streams | ☑ |
| | | | | | | Riparian Woodlands and Shrublands | ☑ |
| | | | | | | Wetlands | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.6 Response to change, disturbance, & other threats poorly understood | Lack of monitoring plan | 8.0 Research & Monitoring | Develop and implement monitoring plan | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - threat is not well understood | 8.0 Research & Monitoring | Research species/habitat response to management | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - bullfrogs | 2.2 Invasive/Problematic Species Control | Control bullfrogs using accepted integrated pest management techniques for aquatic habitats | M |
| 09.3 Agricultural & Forestry Effluents | Water pollution | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 11.2 Droughts | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

**Wood frog**

*Lithobates sylvatica*

Tier 2 Amphibians

| Population Status | | and Trend | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Medium | D | Stable | D | Southern Rocky Mountains | P | Lakes | ☑ |
| | | | | | | Mountain Streams | ☑ |
| | | | | | | Riparian Woodlands and Shrublands | ☑ |
| | | | | | | Wetlands | ☑ |
| | | | | | | Aspen | ☐ |
| | | | | | | Lodgepole Pine | ☐ |
| | | | | | | Mixed Conifer | ☐ |
| | | | | | | Spruce - Fir | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.6 Response to change, disturbance, & other threats poorly understood | Lack of monitoring plan | 8.0 Research & Monitoring | Develop and implement monitoring plan | H |
| 02.3 Livestock Farming & Ranching | Incompatible grazing | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 05.3 Logging & Wood Harvesting | | 2.1 Site/Area Management | Implement compatible forest management practices | M |
| 11.2 Droughts | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts) | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

## Tier 2 Birds

### American bittern

*Botaurus lentiginosus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type | Habitat | Primary |
|---|---|---|---|
| Central Shortgrass Prairie | P | Wetlands | ☑ |
| Southern Rocky Mountains | P | | |
| Colorado Plateau | | | |
| Front Range | | | |
| Utah High Plateau | | | |
| Utah-Wyoming Rocky Mountains | | | |
| Wyoming Basin | | | |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 07.3 Other Ecosystem Modifications | Natural system modification - wetland filling, eutrophication, siltation | 2.3 Habitat & Natural Process Restoration | Restore native habitat (wetlands) | M |
| 07.3 Other Ecosystem Modifications | Natural system modification - wetland filling, eutrophication, siltation | 5.4 Compliance & Enforcement | Enforce 404 wetlands regulations | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

### American peregrine falcon

*Falco peregrinus anatum*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Increasing | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Eastern Plains Rivers | ☐ |
| Eastern Plains Streams | ☐ |
| Mountain Streams | ☐ |
| Pinyon - Juniper | ☐ |
| Playas | ☐ |
| Ponderosa Pine | ☐ |
| Transition Streams | ☐ |
| Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | Rock climbing, hiking near cliffs and crevices | 2.1 Site/Area Management | Establish exclusionary/boundary fencing, formal wildlife viewing stations/areas, signage to raise public awareness, seasonal closures | M |
| 06.1 Recreational Activities | Rock climbing, hiking near cliffs and crevices | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**American white pelican**

*Pelecanus erythrorhynchos*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Reservoirs and Shorelines | ☑ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Eastern Plains Rivers | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (fluctuating water levels) | 3.1 Species Management | Develop collaborative management agreements | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 14.4 Predation | Nest predation | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

**Bald eagle**

*Haliaeetus leucocephalus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Increasing | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Riparian Woodlands and Shrublands | ☑ |
| Transition Streams | ☑ |
| Agriculture | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Mixed and Tallgrass Prairies | ☐ |
| Mountain Streams | ☐ |
| Playas | ☐ |
| Shortgrass Prairie | ☐ |
| Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 03.3 Renewable Energy | Collision with wind turbines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 1.2 Resource & Habitat Protection | Establish exclusionary/boundary fencing, formal wildlife viewing stations/areas, signage to raise public awareness, seasonal closures | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 2.1 Site/Area Management | Coordinate on ecologically sensitive design of recreational facilities | M |
| 06.3 Work & Other Activities | Flight paths, proximal non-recreation disturbance | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (loss of shoreline nesting,roosting, and perching habitat) | 2.3 Habitat & Natural Process Restoration | Plant native trees/shrubs | L |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

## Band-tailed pigeon

*Patagioenas fasciata*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Front Range | P |
| Southern Rocky Mountains | P |
| Colorado Plateau | |
| Utah High Plateau | |
| Utah-Wyoming Rocky Mountains | |
| Wyoming Basin | |

| Habitat | Primary |
|---|---|
| Mixed Conifer | ☑ |
| Oak and Mixed Mountain Shrublands | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Agriculture | ☐ |
| Aspen | ☐ |
| Lodgepole Pine | ☐ |
| Spruce - Fir | ☐ |
| Subalpine Limber - Bristlecone Pine | ☐ |
| Upland Shrub | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion of grain crops to alfalfa | 7.2 Alliance & Partnership Development | Develop partnerships to help maintain small grain farming | M |
| 07.3 Other Ecosystem Modifications | Habitat degradation | 2.3 Habitat & Natural Process Restoration | Restore native habitat (mountain shrublands) | M |
| 05.3 Logging & Wood Harvesting | Forest and woodland management | 2.1 Site/Area Management | Implement compatible forest management practices | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

## Barrow's goldeneye

*Bucephala islandica*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Stable | D |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Lakes | ☑ |
| Wetlands | ☑ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Mountain Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation (salvage logging removing cavity trees) | 2.1 Site/Area Management | Implement compatible forest management practices | L |

## Black rosy-finch

*Leucosticte atrata*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | O |
| Utah-Wyoming Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Alpine | ☑ |
| Sagebrush | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.2 Mining & Quarrying | Mining operations | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 07.3 Other Ecosystem Modifications | Habitat degradation | 2.3 Habitat & Natural Process Restoration | Restore mixed conifer winter habitat, including fire mitigation and insect outbreak mitigation | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 14.4 Predation | Nest predation (increased by Common Ravens drawn above treeline by trash) | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Black swift**

*Cypseloides niger*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Stable | D |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Mountain Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | Rock climbing | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 11.1 Habitat Shifting & Alteration | Potential for degradation of nesting habitat related to climate impacts on water resources | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 13.6 Response to change, disturbance, & other threats poorly understood | Lack of monitoring plan | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |

**Black tern**

*Chlidonias niger*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | X | Stable | X |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Wetlands | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Drainage of wetlands for agriculture | 5.4 Compliance & Enforcement | Enforce 404 wetlands regulations | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |

**Bobolink**

*Dolichonyx oryzivorus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Agriculture | ☑ |
| Foothill and Mountain Grasslands | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Decrease in hay field area, earlier/more frequent hay-cropping, shift in vegetative structure | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context (e.g., delayed haying) | M |

**Boreal owl**

*Aegolius funereus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | X | Declining | X |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Lodgepole Pine | ☑ |
| Spruce - Fir | ☑ |
| Aspen | ☐ |
| Pinyon - Juniper | ☐ |
| Ponderosa Pine | ☐ |
| Subalpine Limber - Bristlecone Pine | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 11.1 Habitat Shifting & Alteration | Potential for heat stress & habitat degradation related to increased temperatures, worsening wildfires | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 13.4 Population status unknown | Status estimated as medium, but additional data are needed | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Brewer's sparrow**

*Spizella breweri*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Abundant | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Sagebrush | ☑ |
| Agriculture | ☐ |
| Conservation Reserve Program | ☐ |
| Desert Shrub | ☐ |
| Greasewood | ☐ |
| Saltbush | ☐ |
| Sandsage | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (burning, herbicide, or mechanical sagebrush removal) | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 2.1 Site/Area Management | Employ grazing as a tool for compatible vegetation cover, structure, composition | H |
| 07.3 Other Ecosystem Modifications | Habitat degradation from a variety of sources | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 03.1 Oil & Gas Drilling | Oil & Gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 07.3 Other Ecosystem Modifications | Habitat degradation from a variety of threats | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 02.3 Livestock Farming & Ranching | Range improvement operations | 2.1 Site/Area Management | Implement compatible grazing practices | L |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Cassin's finch**

*Peucaea cassinii*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Declining | D |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Central Shortgrass Prairie | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Aspen | ☑ |
| Lodgepole Pine | ☑ |
| Mixed Conifer | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Spruce - Fir | ☑ |
| Subalpine Limber - Bristlecone Pine | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.6 Response to change, disturbance, & other threats poorly understood | Threats are poorly understood | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |

**Cassin's sparrow**

*Aimophila cassinii*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Mixed and Tallgrass Prairies | ☑ |
| Sandsage | ☑ |
| Shortgrass Prairie | ☑ |
| Agriculture | ☐ |
| Conservation Reserve Program | ☐ |
| Sagebrush | ☐ |
| Upland Shrub | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | L |

**Chestnut-collared longspur**

*Calcarius ornatus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Mixed and Tallgrass Prairies | ☑ |
| Shortgrass Prairie | ☑ |
| Agriculture | ☐ |
| Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 11.4 Storms & Flooding | Climate variability (prolonged rain events and cold weather can cause nest failure) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 14.4 Predation | Predation | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

## Ferruginous hawk

*Buteo regalis*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |
| Colorado Plateau | O |
| Front Range | O |
| Southern Rocky Mountains | O |
| Utah High Plateau | O |

| Habitat | Primary |
|---|---|
| Foothill and Mountain Grasslands | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Shortgrass Prairie | ☑ |
| Agriculture | ☐ |
| Cliffs and Canyons | ☐ |
| Conservation Reserve Program | ☐ |
| Desert Shrub | ☐ |
| Greasewood | ☐ |
| Pinyon - Juniper | ☐ |
| Sagebrush | ☐ |
| Saltbush | ☐ |
| Sandsage | ☐ |
| Upland Shrub | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Secondary poisoning (anticoagulants, lead shot) | 5.2 Policies & Regulations | Monitor for potential impacts and respond as warranted by local conditions | M |
| 08.4 Pathogens | Loss of prairie dog colonies due to sylvatic plague | 8.0 Research & Monitoring | Research species/habitat response to plague management | M |
| 03.3 Renewable Energy | Collision with wind turbines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Mortality and prey reduction through rodent control | 4.3 Awareness & Communications | Implement landowner outreach/education program | L |
| 06.1 Recreational Activities | Motorized and non-motorized recreation, proximal non-recreation disturbance of nest locations | 4.3 Awareness & Communications | Implement landowner outreach/education program | L |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass, Russian thistle | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | L |

## Flammulated owl

*Otus flammeolus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Front Range | O |
| Utah-Wyoming Rocky Mountains | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Aspen | ☑ |
| Ponderosa Pine | ☑ |
| Mixed Conifer | ☐ |
| Spruce - Fir | ☐ |
| Subalpine Limber - Bristlecone Pine | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation (salvage logging removing cavity trees) | 2.1 Site/Area Management | Implement compatible forest management practices | L |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals - European starlings | 2.2 Invasive/Problematic Species Control | Maintain appropriate patch size and habitat mosaic | L |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 14.3 Low reproductive rate | Low reproductive rate | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Grace's warbler**

*Setophaga graciae*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Oak and Mixed Mountain Shrublands | ☑ |
| Ponderosa Pine | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 07.1 Fire & Fire Suppression | Altered fire regime (fire suppression leading to high intensity fires) | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime and mountain shrub/ponderosa pine habitats | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation (clearcutting) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for forestry | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

**Grasshopper sparrow**

*Ammodramus savannarum*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Conservation Reserve Program | ☑ |
| Shortgrass Prairie | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |

**Gray vireo**

*Vireo vicinior*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Utah High Plateau | P |
| Southern Rocky Mountains | O |
| Utah-Wyoming Rocky Mountains | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Pinyon - Juniper | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity, tree/shrub clearing) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 05.3 Logging & Wood Harvesting | Natural system modification - illegal firewood cutting | 5.4 Compliance & Enforcement | Enforce hunting, fishing, collecting regulations | L |
| 08.2 Problematic Native Species | Habitat loss due to insect damage and fire | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Greater prairie-chicken**

*Tympanuchus cupido*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Agriculture | ☑ |
| Sandsage | ☑ |
| Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | H |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | H |
| 03.1 Oil & Gas Drilling | Behavioral avoidance of oil & gas development and associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.1 Oil & Gas Drilling | Fragmentation of native habitat due to oil & gas development and associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.2 Policies & Regulations | Establish mitigation requirements for developments and other projects that impact species/habitats | H |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.3 Renewable Energy | Behavioral avoidance of renewable energy development and associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.3 Renewable Energy | Fragmentation of native habitat due to renewable energy development and associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 03.3 Renewable Energy | Renewable energy development | 5.2 Policies & Regulations | Establish mitigation requirements for developments and other projects that impact species/habitats | H |
| 03.3 Renewable Energy | Renewable energy development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 07.3 Other Ecosystem Modifications | Fragmentation of native prairie | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 08.2 Problematic Native Species | Predation and parasites | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Juniper titmouse**

*Baeolophus ridgwayi*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Pinyon - Juniper | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity, tree/shrub clearing) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 05.3 Logging & Wood Harvesting | Natural system modification - illegal firewood cutting, commercial pinon nut collecting | 5.4 Compliance & Enforcement | Enforce hunting, fishing, collecting regulations | L |
| 08.2 Problematic Native Species | Habitat loss due to insect damage and fire | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |

**Lark bunting**

*Calamospiza melanocorys*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Wyoming Basin | P |
| Colorado Plateau | O |
| Utah-Wyoming Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Agriculture | ☑ |
| Desert Shrub | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Shortgrass Prairie | ☑ |
| Conservation Reserve Program | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Playas | ☐ |
| Sagebrush | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Intensive agricultural operations | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff (grasshopper control) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 02.3 Livestock Farming & Ranching | Mortality at stock tanks from drowning | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for livestock grazing | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Lazuli bunting**

*Passerina amoena*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Oak and Mixed Mountain Shrublands | ☑ |
| Pinyon - Juniper | ☑ |
| Riparian Woodlands and Shrublands | ☑ |
| Sagebrush | ☑ |
| Upland Shrub | ☑ |
| Aspen | ☐ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Eastern Plains Rivers | ☐ |
| Eastern Plains Streams | ☐ |
| Mountain Streams | ☐ |
| Transition Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Altered native vegetation | 2.3 Habitat & Natural Process Restoration | Plant native trees/shrubs | L |

**Least tern**

*Sterna antillarum*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Playas | ☑ |
| Reservoirs and Shorelines | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk | 2.2 Invasive/Problematic Species Control | Remove tamarisk through biological, chemical, mechanical means and prevent re-establishment via water management and physical/chemical control | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 02.3 Livestock Farming & Ranching | Egg trampling | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for water resource development | M |
| 09.1 Household Sewage & Urban Waste Water | Water pollution | 5.2 Policies & Regulations | Monitor water quality standards | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |
| 07.2 Dams & Water Management/Use | Decreased water quality and/or quanity (water level, desalination projects) | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | L |
| 14.4 Predation | Predation | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Lewis's woodpecker**

*Melanerpes lewis*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Declining | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah-Wyoming Rocky Mountains | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Riparian Woodlands and Shrublands | ☑ |
| Transition Streams | ☑ |
| Agriculture | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation (removal of snags) | 2.1 Site/Area Management | Implement compatible forest management practices | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 07.3 Other Ecosystem Modifications | Habitat degradation | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 2.1 Site/Area Management | Implement compatible grazing practices | L |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk | 2.2 Invasive/Problematic Species Control | Control non-native plants using accepted techniques appropriate to site-specific conditions | L |

**Loggerhead shrike**

*Lanius ludovicianus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |
| Foothill and Mountain Grasslands | ☑ |
| Greasewood | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Sagebrush | ☑ |
| Saltbush | ☑ |
| Sandsage | ☑ |
| Shortgrass Prairie | ☑ |
| Agriculture | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Long-billed curlew**

*Numenius americanus*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | O |
| Southern Rocky Mountains | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Playas | ☑ |
| Shortgrass Prairie | ☑ |
| Agriculture | ☐ |
| Eastern Plains Rivers | ☐ |
| Eastern Plains Streams | ☐ |
| Mixed and Tallgrass Prairies | ☐ |
| Sandsage | ☐ |
| Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection. Playa conservation would benefit this species. | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (degradation of native shortgrass prairie) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 09.3 Agricultural & Forestry Effluents | General water pollution, herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |

**McCown's longspur**

*Rhynchophanes mccownii*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Shortgrass Prairie | ☑ |
| Agriculture | ☐ |
| Conservation Reserve Program | ☐ |
| Playas | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (degradation of native shortgrass prairie) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 14.4 Predation | Nest predation | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Mexican spotted owl**

*Strix occidentalis lucida*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Central Shortgrass Prairie | O |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Mixed Conifer | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Transition Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.2 Mining & Quarrying | Rock mining in nesting & winter habitat in El Paso and Fremont counties | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 04.4 Flight Paths | Low-flying military jets and helicopters | 7.2 Alliance & Partnership Development | Engage in collaborative, proactive planning and conservation programs - work with the Army on Integrated Natural Resource Management Plan | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation (even-age timber management) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for forestry | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Northern bobwhite**

*Colinus virginianus*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | X | Declining | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Agriculture | ☑ |
| Riparian Woodlands and Shrublands | ☑ |
| Sandsage | ☑ |
| Conservation Reserve Program | ☐ |
| Eastern Plains Streams | ☐ |
| Mixed and Tallgrass Prairies | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Altered native vegetation | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 02.3 Livestock Farming & Ranching | Reduced grass/forb diversity | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk, cheatgrass, Canada thistle, leafy spurge | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | H |
| 11.2 Droughts | Lack of water for habitat | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | H |
| 11.4 Storms & Flooding | Blizzards and impact of hail and flooding on chicks and adults | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation | 8.0 Research & Monitoring | Research species/habitat response to management | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 02.3 Livestock Farming & Ranching | Incompatible timing, intensity, duration of grazing or improved range | 8.0 Research & Monitoring | Research species/habitat response to management | M |
| 02.3 Livestock Farming & Ranching | Reduced grass/forb diversity | 8.0 Research & Monitoring | Research species/habitat response to management | M |
| 07.2 Dams & Water Management/Use | Seral state imbalance - suppression of early seral stages | 2.3 Habitat & Natural Process Restoration | Employ grazing as a tool for compatible vegetation cover, structure, composition | M |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (riparian area deforestation, denuding of wetland vegetation) | 2.3 Habitat & Natural Process Restoration | Plant native trees/shrubs | M |
| 08.2 Problematic Native Species | Predation and parasites | 8.0 Research & Monitoring | Research impact of parasites on bird survival | M |
| 02.3 Livestock Farming & Ranching | Egg trampling | 8.0 Research & Monitoring | Research species/habitat response to management | L |
| 08.2 Problematic Native Species | Predation and parasites | 3.2 Species Recovery | Reduce nest predators | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

## Northern goshawk

*Accipiter gentilis*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah-Wyoming Rocky Mountains | P |
| Central Shortgrass Prairie | O |
| Utah High Plateau | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Aspen | ☑ |
| Lodgepole Pine | ☑ |
| Mixed Conifer | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | Trails in drainages near nests | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 05.3 Logging & Wood Harvesting | Forest and woodland management | 2.1 Site/Area Management | Implement compatible forest management practices | L |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 14.4 Predation | | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

## Northern harrier

*Circus cyaneus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Agriculture | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Foothill and Mountain Grasslands | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Playas | ☑ |
| Sagebrush | ☑ |
| Shortgrass Prairie | ☑ |
| Transition Streams | ☑ |
| Wetlands | ☑ |
| Conservation Reserve Program | ☐ |
| Desert Shrub | ☐ |
| Greasewood | ☐ |
| Saltbush | ☐ |
| Sandsage | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 07.3 Other Ecosystem Modifications | Natural system modification - wetland degradation | 5.4 Compliance & Enforcement | Enforce 404 wetlands regulations | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

## Olive-sided flycatcher

*Contopus cooperi*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Front Range | O |
| Utah High Plateau | O |

| Habitat | Primary |
|---|---|
| Aspen | ☑ |
| Lodgepole Pine | ☑ |
| Mixed Conifer | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Spruce - Fir | ☑ |
| Subalpine Limber - Bristlecone Pine | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation (removal of snags) | 2.1 Site/Area Management | Implement compatible forest management practices | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

## Pinyon jay

*Gymnorhinus cyanocephalus*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Front Range | O |
| Utah-Wyoming Rocky Mountains | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Subalpine Limber - Bristlecone Pine | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Altered native vegetation (incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 02.3 Livestock Farming & Ranching | Tree removal | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 08.2 Problematic Native Species | Habitat loss due to insect damage and fire | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |

## Piping plover

*Charadrius melodus*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Low | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Playas | ☑ |
| Reservoirs and Shorelines | ☑ |
| Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk | 2.2 Invasive/Problematic Species Control | Remove tamarisk through biological, chemical, mechanical means and prevent re-establishment | H |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 3.1 Species Management | Implement existing management/recovery plan | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness (e.g., use beach-nesting bird signs | M |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for water resource development | M |
| 09.3 Agricultural & Forestry Effluents | General water pollution, herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 14.4 Predation | Predation | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

## Prairie falcon

*Falco mexicanus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Foothill and Mountain Grasslands | ☑ |
| Shortgrass Prairie | ☑ |
| Agriculture | ☐ |
| Alpine | ☐ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Conservation Reserve Program | ☐ |
| Desert Shrub | ☐ |
| Eastern Plains Rivers | ☐ |
| Eastern Plains Streams | ☐ |
| Greasewood | ☐ |
| Mixed and Tallgrass Prairies | ☐ |
| Mountain Streams | ☐ |
| Pinyon - Juniper | ☐ |
| Playas | ☐ |
| Sagebrush | ☐ |
| Saltbush | ☐ |
| Sandsage | ☐ |
| Transition Streams | ☐ |
| Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | M |
| 06.1 Recreational Activities | Rock climbing, hiking near cliffs and crevices | 2.1 Site/Area Management | Establish exclusionary/boundary fencing, formal wildlife viewing stations/areas, signage to raise public awareness, seasonal closures | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 03.3 Renewable Energy | Collision with wind turbines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

## Purple martin

*Progne subis*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Aspen | ☑ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Mountain Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.1 Oil & Gas Drilling | Altered native vegetation (loss of older aspen stands from gas development) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |
| 05.3 Logging & Wood Harvesting | Altered native vegetation (loss of older aspen stands from logging) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for forestry | L |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (loss of older aspen stands from logging and gas development) | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Rufous hummingbird**

*Selasphorus rufus*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Unknown | X |
| Non-breeding in Colorado | | | |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | O |
| Colorado Plateau | O |
| Front Range | O |
| Southern Rocky Mountains | O |
| Utah High Plateau | O |
| Utah-Wyoming Rocky Mountains | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Alpine | ☑ |
| Foothill and Mountain Grasslands | ☑ |
| Oak and Mixed Mountain Shrublands | ☑ |
| Upland Shrub | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

**Sage sparrow**

*Amphispiza belli*

Tier 2 Birds

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | X | Declining | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |

| Habitat | Primary |
|---|---|
| Greasewood | ☑ |
| Sagebrush | ☑ |
| Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (burning, herbicide, or mechanical sagebrush removal) | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 2.1 Site/Area Management | Employ grazing as a tool for compatible vegetation cover, structure, composition | H |
| 07.3 Other Ecosystem Modifications | Habitat degradation from variety of sources | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (sagebrush removal, incompatible timing, intensity, duration of grazing) | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Short-eared owl**

*Asio flammeus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Southern Rocky Mountains | P |
| Colorado Plateau | O |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Foothill and Mountain Grasslands | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Sagebrush | ☑ |
| Sandsage | ☑ |
| Shortgrass Prairie | ☑ |
| Upland Shrub | ☑ |
| Wetlands | ☑ |
| Agriculture | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for forestry | M |
| 14.5 Competition | Predation and competition (Barn owls) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (wetland loss) | 5.4 Compliance & Enforcement | Enforce 404 wetlands regulations | L |

**Swainson's hawk**

*Buteo swainsoni*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Wyoming Basin | P |
| Utah High Plateau | O |

| Habitat | Primary |
|---|---|
| Agriculture | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Desert Shrub | ☑ |
| Eastern Plains Streams | ☑ |
| Foothill and Mountain Grasslands | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Oak and Mixed Mountain Shrublands | ☑ |
| Playas | ☑ |
| Sagebrush | ☑ |
| Saltbush | ☑ |
| Sandsage | ☑ |
| Shortgrass Prairie | ☑ |
| Upland Shrub | ☑ |
| Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Implement landowner outreach/education program | M |
| 03.3 Renewable Energy | Collision with wind turbines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Mortality and prey reduction through rodent control | 4.3 Awareness & Communications | Implement landowner outreach/education program | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

## Upland sandpiper

*Bartramia longicauda*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Mixed and Tallgrass Prairies | ☑ |
| Agriculture | ☐ |
| Sandsage | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Early/often pasture and hayfield cutting (nest destruction) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

## Veery

*Catharus fuscescens*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Riparian Woodlands and Shrublands | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Habitat degradation | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-appropriate techniques and context | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

## Virginia's warbler

*Oreothlypis virginiae*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Central Shortgrass Prairie | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Mixed Conifer | ☑ |
| Oak and Mixed Mountain Shrublands | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Upland Shrub | ☑ |
| Aspen | ☐ |
| Subalpine Limber - Bristlecone Pine | ☐ |
| Transition Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Habitat degradation | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-appropriate techniques and context | M |
| 14.4 Predation | Predation | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |

## Western snowy plover

*Charadrius alexandrinus nivosus*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Reservoirs and Shorelines | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness (e.g., use beach-nesting bird signs | M |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for water resource development | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**White-faced ibis**

*Plegadis chihi*

Tier 2 Birds

| Population Status | | and Trend | |
|---|---|---|---|
| Low | D | Increasing | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah-Wyoming Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Agriculture | ☑ |
| Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Lakes | ☑ |
| Playas | ☑ |
| Reservoirs and Shorelines | ☑ |
| Wetlands | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | Motorized and non-motorized recreation | 4.3 Awareness & Communications | Implement landowner outreach/education program | M |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (fluctuating water levels) | 3.1 Species Management | Develop collaborative management agreements | M |
| 07.3 Other Ecosystem Modifications | Natural system modification - wetland degradation | 5.2 Policies & Regulations | Encourage use of Farm Bill programs for playas | M |
| 07.3 Other Ecosystem Modifications | Natural system modification - wetland degradation | 5.4 Compliance & Enforcement | Enforce 404 wetlands regulations | M |
| 09.1 Household Sewage & Urban Waste Water | Water pollution | 5.2 Policies & Regulations | Monitor water quality standards | M |

**Whooping crane**

*Grus americana*

Tier 2 Birds

| Population Status and Trend |
|---|
| Not known to have breeding population in Colorado (no primary habitat, status, or trends). |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | O |

| Habitat | Primary |
|---|---|
| Agriculture | ☑ |
| Wetlands | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 04.2 Utility & Service Lines | Collision with wind turbines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |

## Tier 2 Fish

**Iowa darter**

*Etheostoma exile*

Tier 2 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Transition Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - wetland drainage | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 2.3 Habitat & Natural Process Restoration | Identify and control point-source and non-point source pollution | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Lake chub**

*Couesius plumbeus*

Tier 2 Fish

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

| Distribution | Type |
|---|---|
| Front Range | P |
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Lakes | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - stream dewatering | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using integrated pest management techniques for aquatic habitats | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff and nonpoint source pollution | 2.3 Habitat & Natural Process Restoration | Identify and control point-source and non-point source pollution | M |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Gathering for bait or aquarium trade | 5.4 Compliance & Enforcement | Enforce hunting, fishing, collecting regulations | L |

## Tier 2 Mammals

**Abert's squirrel**

*Sciurus aberti*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | | Unknown | |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Colorado Plateau | O |

| Habitat | Primary |
|---|---|
| Ponderosa Pine | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 08.2 Problematic Native Species | Habitat loss / degradation due to beetle kill | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

**Allen's big-eared bat**

*Idionycteris phyllotis*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

Recently documented in Colorado.

| Distribution | Type |
|---|---|
| Colorado Plateau | |

| Habitat | Primary |
|---|---|
| Oak and Mixed Mountain Shrublands | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Cliffs and Canyons | ☐ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Mixed Conifer | ☐ |
| Sagebrush | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**American marten**

*Martes americana*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Lodgepole Pine | ☑ |
| Spruce - Fir | ☑ |
| Alpine | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 05.3 Logging & Wood Harvesting | Clearcutting and even-aged forest management | 2.1 Site/Area Management | Implement compatible forest management | M |
| 05.3 Logging & Wood Harvesting | Replacement of mature/old growth with younger, more even-aged stands | 2.1 Site/Area Management | Implement compatible forest management | M |
| 08.2 Problematic Native Species | Habitat loss / degradation due to beetle kill | 8.0 Research & Monitoring | Research species/habitat response to management | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |

**Big free-tailed bat**

*Nyctinomops macrotis*

Tier 2 Mammals

| Population Status | and Trend |
|---|---|
| Unknown | Unknown |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | O |
| Colorado Plateau | O |
| Front Range | O |
| Southern Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Desert Shrub | ☑ |
| Pinyon - Juniper | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Bighorn sheep**

*Ovis canadensis*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | D |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Central Shortgrass Prairie | O |
| Colorado Plateau | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Alpine | ☐ |
| Foothill and Mountain Grasslands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Transmission of pathogens by hobby livestock | 4.3 Awareness & Communications | Implement landowner outreach/education program | H |
| 01.1 Housing & Urban Areas | Transmission of pathogens by hobby livestock | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | H |
| 01.1 Housing & Urban Areas | Transmission of pathogens by hobby livestock | 5.2 Policies & Regulations | Promote zoning that concentrates use and prevents disease transmission | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.) | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 02.3 Livestock Farming & Ranching | Transmission of pathogens | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 08.4 Pathogens | Pathogen - respiratory disease caused by Pasteurellacea and Mycoplasma bacteria | 8.0 Research & Monitoring | Research and develop effective vaccine and delivery system | H |
| 02.3 Livestock Farming & Ranching | Transmission of pathogens | 5.2 Policies & Regulations | Allow authorities to remove stray domestic sheep and goats | M |
| 02.3 Livestock Farming & Ranching | Transmission of pathogens | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for livestock grazing | M |
| 06.1 Recreational Activities | Climbing, back country skiing | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 08.2 Problematic Native Species | Mountain lion predation | 2.3 Habitat & Natural Process Restoration | Manage for predator/prey balance | M |
| 14.5 Competition | Competition with other native ungulates | 2.3 Habitat & Natural Process Restoration | Manage natural herbivory | L |

**Bison**

*Bison bison*

Tier 2 Mammals

| Population Status and Trend |
|---|
| Wild populations extirpated. Currently classified as domestic species by Wildlife Commission Regulation – Ch. 11, Art. II, Sct 1103 A. US Fish & Wildlife Service lists possible re-introduction sites Baca NWR and Great Sand Dunes NP in Colorado. |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | |
| Southern Rocky Mountains | |

| Habitat | Primary |
|---|---|
| Foothill and Mountain Grasslands | ☑ |
| Shortgrass Prairie | ☑ |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Black-tailed prairie dog**

*Cynomys ludovicianus*

Tier 2 Mammals

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | D | Stable | D |

Refer to existing conservation, management, and recovery plans or assessments for detailed discussion of threats and conservation actions needed.

| Distribution | Type | Habitat | Primary |
|---|---|---|---|
| Central Shortgrass Prairie | P | Shortgrass Prairie | ☑ |
| Front Range | P | Mixed and Tallgrass Prairies | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.4 Pathogens | Pathogen - sylvatic plague | 3.1 Species Management | Develop and implement an active disease management program | H |
| 08.4 Pathogens | Pathogen - sylvatic plague | 8.0 Research & Monitoring | Research and develop effective vaccine and delivery system | H |
| 08.4 Pathogens | Pathogen - sylvatic plague | 8.0 Research & Monitoring | Research species/habitat response to plague management | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and exurban development | 6.4 Conservation Payments | Support development and implementation of statewide habitat mitigation tool | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 7.3 Conservation Finance | Provide economic assistance for private land habitat improvements and/or species conservation | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Poisoning | 3.1 Species Management | Develop collaborative management agreements | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Poisoning | 4.3 Awareness & Communications | Implement landowner outreach/education program | M |
| 08.4 Pathogens | Pathogen - sylvatic plague | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 12.3 Lack of common goals | Greater collaboration among state and local agencies, and private industry, is warranted | 5.2 Policies & Regulations | Improve alignment of conservation and management goals and practices across stakeholder groups | M |
| 06.1 Recreational Activities | Recreational shooting of prairie dogs | 2.1 Site/Area Management | Implement shooting closures/seasons where local conditions warrant | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Botta's pocket gopher (rubidus ssp)**

*Thomomys bottae rubidus*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Foothill and Mountain Grasslands | ☑ |
| Pinyon - Juniper | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.3 Genetic relationship with other species and/or subspecies unknown | Genetic relationship with other subspecies unknown | 8.0 Research & Monitoring | Research genetic relation to other (sub)species | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Poisoning | 4.3 Awareness & Communications | Implement landowner outreach/education program | L |

**Common hog-nosed skunk**

*Conepatus leuconotus*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | P |

| Habitat | Primary |
|---|---|
| Pinyon - Juniper | ☑ |
| Upland Shrub | ☑ |
| Desert Shrub | ☐ |
| Foothill and Mountain Grasslands | ☐ |
| Greasewood | ☐ |
| Oak and Mixed Mountain Shrublands | ☐ |
| Saltbush | ☐ |
| Sandsage | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research critical life history/habitat components | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

## Dwarf shrew

*Sorex nanus*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Colorado Plateau | O |
| Utah High Plateau | O |

| Habitat | Primary |
|---|---|
| Aspen | ☑ |
| Lodgepole Pine | ☑ |
| Mixed Conifer | ☑ |
| Ponderosa Pine | ☑ |
| Spruce - Fir | ☑ |
| Pinyon - Juniper | ☐ |
| Subalpine Limber - Bristlecone Pine | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research critical life history/habitat components | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |

## Gray wolf

*Canis lupus*

Tier 2 Mammals

| Population Status and Trend |
|---|
| Wild populations extirpated. See Gray Wolf Management Plan: http://wildlife.state.co.us/species_cons/GrayWolf/. |

| Habitat | Primary |
|---|---|
| Aspen | ☑ |
| Lodgepole Pine | ☑ |
| Mixed Conifer | ☑ |
| Oak and Mixed Mountain Shrublands | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Spruce - Fir | ☑ |
| Upland Shrub | ☑ |
| Foothill and Mountain Grasslands | ☐ |
| Sagebrush | ☐ |
| Subalpine Limber - Bristlecone Pine | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences) | H |
| 12.3 Lack of common goals | Lack of common goals | 4.3 Awareness & Communications | Implement landowner outreach/education program | M |

## Grizzly bear

*Ursus arctos*

Tier 2 Mammals

| Population Status and Trend |
|---|
| Not documented in Colorado since 1979 |

| Habitat | Primary |
|---|---|
| Alpine | ☑ |
| Aspen | ☑ |
| Foothill and Mountain Grasslands | ☑ |
| Lodgepole Pine | ☑ |
| Mixed Conifer | ☑ |
| Oak and Mixed Mountain Shrublands | ☑ |
| Ponderosa Pine | ☑ |
| Spruce - Fir | ☑ |
| Upland Shrub | ☑ |
| Mountain Streams | ☐ |
| Subalpine Limber - Bristlecone Pine | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

## Hoary bat

*Lasiurus cinereus*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Low | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | |
| Colorado Plateau | |
| Front Range | |
| Southern Rocky Mountains | |
| Utah High Plateau | |
| Utah-Wyoming Rocky Mountains | |
| Wyoming Basin | |

| Habitat | Primary |
|---|---|
| Aspen | ☑ |
| Mixed Conifer | ☑ |
| Pinyon - Juniper | ☑ |
| Ponderosa Pine | ☑ |
| Riparian Woodlands and Shrublands | ☑ |
| Spruce - Fir | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.3 Renewable Energy | Collision with wind turbines | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 08.2 Problematic Native Species | Loss of roost sites (localized) due to beetle kill | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 08.4 Pathogens | Potential for White-nose Syndrome | 2.2 Invasive/Problematic Species Control | Manage research, management, and recreation activities to control the spread of pathogens | M |
| 08.2 Problematic Native Species | Habitat loss / degradation due to loss of roost sites (localized) due to beetle kill | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for forestry | L |

## Kit fox

*Vulpes macrotis*

Tier 2 Mammals

Extensive surveys have failed to detect this species. It may be extirpated from the state.

| Distribution | Type |
|---|---|
| Colorado Plateau | P |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |
| Greasewood | ☑ |
| Sagebrush | ☑ |
| Saltbush | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | OHV use in Peach Valley | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | L |
| 07.3 Other Ecosystem Modifications | Decline of white-tailed prairie dogs, which provide den habitat and significant food source | 2.3 Habitat & Natural Process Restoration | Improve status of white-tailed prairie dogs | L |
| 14.1 Scarcity (leading to inbreeding depression) | Lack of wild populations | 8.0 Research & Monitoring | Conduct primary research on potential for habitat restoration | L |

## Preble's shrew

*Sorex preblei*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |
| Colorado Plateau | O |

| Habitat | Primary |
|---|---|
| Oak and Mixed Mountain Shrublands | ☑ |
| Foothill and Mountain Grasslands | ☐ |
| Sagebrush | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research critical life history/habitat components | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Pygmy rabbit**

| Population Status | and Trend | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|
| Unknown | Unknown | Wyoming Basin | P | Sagebrush | ☑ |

*Brachylagus idahoensis*

Tier 2 Mammals

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 02.3 Livestock Farming & Ranching | Reduced grass/forb diversity | 2.3 Habitat & Natural Process Restoration | Re-seed native species | L |
| 02.3 Livestock Farming & Ranching | Reduced grass/forb diversity | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for livestock grazing | L |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | L |
| 07.1 Fire & Fire Suppression | Altered fire regime and juniper encroachment | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |

**Pygmy shrew**

| Population Status | and Trend | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|
| Unknown | Unknown | Southern Rocky Mountains | P | Spruce - Fir | ☑ |
| | | | | Wetlands | ☑ |

*Sorex hoyi montanus*

Tier 2 Mammals

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |

**Red-backed vole**

| Population Status | and Trend | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|
| Unknown | Unknown | Southern Rocky Mountains | P | Lodgepole Pine | ☑ |
| | | Utah High Plateau | O | Mixed Conifer | ☑ |

*Clethrionomys gapperi*

Tier 2 Mammals

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**River otter**

*Lontra canadensis*

Tier 2 Mammals

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Increasing | D |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah-Wyoming Rocky Mountains | P |
| Central Shortgrass Prairie | O |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Mountain Streams | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☐ |
| Eastern Plains Rivers | ☐ |
| Eastern Plains Streams | ☐ |
| Transition Streams | ☐ |
| Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Potential for landowner "control" related to river otter impacts on fish ponds | 4.3 Awareness & Communications | Implement landowner outreach/education program | M |
| 07.2 Dams & Water Management/Use | Impact of reduced water quality on prey species (fish) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

**Sagebrush vole**

*Lemmiscus curtatus*

Tier 2 Mammals

| Population Status | and Trend |
|---|---|
| Unknown | Unknown |

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | |
| Utah High Plateau | |
| Utah-Wyoming Rocky Mountains | |
| Wyoming Basin | |

| Habitat | Primary |
|---|---|
| Sagebrush | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Habitat degradation from variety of sources | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 02.3 Livestock Farming & Ranching | Reduced grass/forb diversity | 2.3 Habitat & Natural Process Restoration | Re-seed native species | M |
| 02.3 Livestock Farming & Ranching | Reduced grass/forb diversity | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for livestock grazing | M |
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 07.1 Fire & Fire Suppression | Altered fire regime and juniper encroachment | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 07.3 Other Ecosystem Modifications | Habitat degradation from variety of sources | 2.3 Habitat & Natural Process Restoration | Restore native habitat, including restoration of understory species, sagebrush, and riparian vegetation, reseeding of native species, and maintenance of appropriate patch size and habitat mosaic | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Snowshoe hare**

*Lepus americanus*

Tier 2 Mammals

| Population Status and Trend | | | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Medium | X | Unknown | X | Southern Rocky Mountains | P | Lodgepole Pine | ☑ |
| | | | | | | Riparian Woodlands and Shrublands | ☑ |
| | | | | | | Spruce - Fir | ☑ |
| | | | | | | Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 05.3 Logging & Wood Harvesting | Clearcutting | 8.0 Research & Monitoring | Research species/habitat response to management | M |
| 05.3 Logging & Wood Harvesting | Clearcutting and even-aged forest management | 2.1 Site/Area Management | Implement compatible forest management | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 06.1 Recreational Activities | Unregulated backcountry winter recreation | 8.0 Research & Monitoring | Research species/habitat response to management | L |
| 08.2 Problematic Native Species | Habitat loss / degradation due to beetle kill | 8.0 Research & Monitoring | Research species/habitat response to management | L |

**Swift fox**

*Vulpes velox*

Tier 2 Mammals

| Population Status and Trend | | | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Medium | D | Stable | D | Central Shortgrass Prairie | P | Shortgrass Prairie | ☑ |
| | | | | Front Range | O | Agriculture | ☐ |
| | | | | | | Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation, urban development, landscaping, etc. | H |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences) | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 6.4 Conservation Payments | Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection) | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.2 Policies & Regulations | Encourage use of Farm Bill and other incentive programs | L |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |
| 08.4 Pathogens | Loss of prairie dog colonies due to sylvatic plague | 8.0 Research & Monitoring | Research species/habitat response to plague management | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**White-tailed jackrabbit**

*Lepus townsendii*

Tier 2 Mammals

| Population Status and Trend | | | |
|---|---|---|---|
| Medium | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Front Range | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |
| Utah-Wyoming Rocky Mountains | P |
| Wyoming Basin | P |
| Colorado Plateau | O |

| Habitat | Primary |
|---|---|
| Foothill and Mountain Grasslands | ☑ |
| Mixed and Tallgrass Prairies | ☑ |
| Shortgrass Prairie | ☑ |
| Desert Shrub | ☐ |
| Greasewood | ☐ |
| Oak and Mixed Mountain Shrublands | ☐ |
| Sagebrush | ☐ |
| Saltbush | ☐ |
| Sandsage | ☐ |
| Upland Shrub | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 14.5 Competition | Competition | 2.3 Habitat & Natural Process Restoration | Monitor/control competition with other species | M |

## Tier 2 Mollusks

**Cloche ancylid**

*Ferrissia walkeri*

Tier 2 Mollusks

| Population Status and Trend | | | |
|---|---|---|---|
| Unknown | X | Declining | X |

| Distribution | Type |
|---|---|
| Front Range | P |
| Utah High Plateau | P |

| Habitat | Primary |
|---|---|
| Lakes | ☑ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Reservoirs and Shorelines | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.2 Critical life history/habitat components unknown | Habitat affinities unknown | 8.0 Research & Monitoring | Research critical life history/habitat components | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 13.4 Population status unknown | Referenced in literature, but current populations are unknown. Colorado surveys conducted from 2001-2004 did not record this species. | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity (limited distribution) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native invertebrates using integrated pest management techniques for aquatic habitats | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Cockerell**

*Promenetus umbillicatellus*

Tier 2 Mollusks

| Population Status and Trend | | | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Low | X | Declining | X | Southern Rocky Mountains | P | Lakes | ☑ |
| | | | | | | Mountain Streams | ☐ |
| | | | | | | Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.) | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | H |
| 13.4 Population status unknown | Referenced in literature, but current populations are unknown. Colorado surveys conducted from 2001-2004 did not record this species. | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 07.3 Other Ecosystem Modifications | Natural system modification - wetland filling | 2.3 Habitat & Natural Process Restoration | Maintain and restore natural ponds and small mountain lakes | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native invertebrates using integrated pest management techniques for aquatic habitats | M |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity (limited distribution) | 3.1 Species Management | Develop collaborative management agreements | M |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity (limited distribution) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |

**Cylindrical papershell**

*Anodontoides ferussacianus*

Tier 2 Mollusks

| Population Status and Trend | | | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Low | D | Declining | D | Central Shortgrass Prairie | P | Eastern Plains Streams | ☑ |
| | | | | Front Range | O | Lakes | ☑ |
| | | | | Southern Rocky Mountains | O | | |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Nutrient loads (runoff from agricultural activities) | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements | H |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (riparian area) | 2.3 Habitat & Natural Process Restoration | Restore riparian vegetation | H |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 14.1 Scarcity (leading to inbreeding depression) | Known from only 2 locations in Colorado. Colorado surveys conducted from 1996-2004 recorded this species at Valmont Lake and the St. Vrain Creek in Boulder County. | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Restore native prairie | M |
| 02.3 Livestock Farming & Ranching | Decreased water quality (nutrient load from cattle) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native invertebrates using integrated pest management techniques for aquatic habitats | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Fragil ancylid**

*Ferrissia fragilis*

Tier 2 Mollusks

| Population Status and Trend | | | |
|---|---|---|---|
| Low | X | Declining | D |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Wyoming Basin | P |
| Front Range | O |

| Habitat | Primary |
|---|---|
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Colorado Plateau - Wyoming Basins Rivers | ☐ |
| Lakes | ☐ |
| Reservoirs and Shorelines | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.) | 2.3 Habitat & Natural Process Restoration | Employ grazing as a tool for compatible vegetation cover, structure, composition | H |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.) | 2.3 Habitat & Natural Process Restoration | Restore riparian vegetation | H |
| 13.1 Complete distribution in Colorado unknown | Known from only 3 locations in Colorado. Colorado surveys conducted from 2001-2004 recorded this species at Bear Canyon Creek and Sliver Lake Ditch in Boulder County, and Banner Lake No. 5 in Weld County, Colorado. | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 07.2 Dams & Water Management/Use | Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.) | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | M |
| 07.2 Dams & Water Management/Use | Decreased water quality | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements | M |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |

**Hot Springs physa**

*Physa cupreonitens*

Tier 2 Mollusks

| Population Status and Trend | | | |
|---|---|---|---|
| Low | X | Unknown | X |

The taxonomy of the North American Physidae both at the generic and specific level needs attention and revision. Validity of this species requires genetic verification.

| Distribution | Type |
|---|---|
| Southern Rocky Mountains | P |

| Habitat | Primary |
|---|---|
| Hot Springs | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.3 Work & Other Activities | Proximal non-recreation disturbance | 4.3 Awareness & Communications | Implement landowner outreach/education program | H |
| 13.3 Genetic relationship with other species and/or subspecies unknown | Clarification of taxonomy is needed | 8.0 Research & Monitoring | Research genetic relation to other (sub)species | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity (limited distribtion) physid snails have been reported from only 6 hot springs in Colorado | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native invertebrates using integrated pest management techniques for aquatic habitats | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Pondhorn**

*Uniomerus tetralasmus*

Tier 2 Mollusks

| Population Status | | and Trend | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Low | D | Declining | D | Central Shortgrass Prairie | P | Eastern Plains Streams | ☑ |
| | | | | | | Lakes | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Restore native prairie | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 09.3 Agricultural & Forestry Effluents | Nutrient loads (runoff from agricultural activities) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown. Colorado surveys conducted from 1996-2002 recorded this species at 1 location, Queens (Neeskah) Reservoir, Kiowa County. | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity (limited distribution) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native invertebrates using integrated pest management techniques for aquatic habitats | M |

**Rocky Mountain capshell**

*Acroloxus coloradensis*

Tier 2 Mollusks

| Population Status | | and Trend | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Low | D | Unknown | X | Southern Rocky Mountains | P | Lakes | ☑ |
| | | | | | | Mountain Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native invertebrates using integrated pest management techniques for aquatic habitats | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.4 Population status unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity (limited distribution) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |

**Sharp sprite**

*Promenetus exacuous*

Tier 2 Mollusks

| Population Status | | and Trend | | Distribution | Type | Habitat | Primary |
|---|---|---|---|---|---|---|---|
| Low | X | Declining | X | Southern Rocky Mountains | P | Lakes | ☑ |
| | | | | Wyoming Basin | O | Colorado Plateau - Wyoming Basins Rivers | ☐ |
| | | | | | | Mountain Streams | ☐ |
| | | | | | | Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.3 Other Ecosystem Modifications | Natural system modification - wetland filling | 2.3 Habitat & Natural Process Restoration | Maintain and Restore natural ponds and small mountain lakes | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown (reported only from 11 Colorado locations, Colorado surveys conducted from 2001-2004 did not record this species. | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native invertebrates using integrated pest management techniques for aquatic habitats | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Utah physa**

*Physa gyrina utahensis*

Tier 2 Mollusks

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

The taxonomy of the North American Physidae both at the generic and specific level needs attention and revision. Validity of this species requires genetic verification.

| Distribution | Type |
|---|---|
| Front Range | P |
| Utah High Plateau | P |

| Habitat | Primary |
|---|---|
| Lakes | ☑ |
| Transition Streams | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.3 Genetic relationship with other species and/or subspecies unknown | Clarification of taxonomy is needed | 8.0 Research & Monitoring | Research genetic relation to other (sub)species | H |
| 13.4 Population status unknown | Referenced in literature, but current populations are unknown. Colorado surveys conducted from 2001-2004 did not record this species. | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity (limited distribution) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native invertebrates using integrated pest management techniques for aquatic habitats | M |

## Tier 2 Reptiles

**Blacknecked gartersnake**

*Thamnophis cyrtopsis*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Low | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | O |

| Habitat | Primary |
|---|---|
| Colorado Plateau - Wyoming Basins Rivers | ☑ |
| Colorado Plateau - Wyoming Basins Streams | ☑ |
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Desert Shrub | ☐ |
| Oak and Mixed Mountain Shrublands | ☐ |
| Pinyon - Juniper | ☐ |
| Shortgrass Prairie | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | L |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | L |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**California kingsnake**

*Lampropeltis californiae*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Low | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |
| Mixed and Tallgrass Prairies | ☐ |
| Playas | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 04.1 Roads & Railroads | Collision (e.g., auto) | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

**Common gartersnake**

*Thamnophis sirtalis*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | X | Declining | X |

| Distribution | Type |
|---|---|
| Front Range | P |
| Central Shortgrass Prairie | O |
| Southern Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Eastern Plains Rivers | ☑ |
| Eastern Plains Streams | ☑ |
| Riparian Woodlands and Shrublands | ☑ |
| Wetlands | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.2 Policies & Regulations | Monitor water quality standards | M |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |

**Desert nightsnake**

*Hypsiglena chlorophaea*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Low | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Southern Rocky Mountains | |
| Utah High Plateau | |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |
| Greasewood | ☑ |
| Pinyon - Juniper | ☑ |
| Eastern Plains Streams | ☐ |
| Sagebrush | ☐ |
| Shortgrass Prairie | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | L |

**Desert spiny lizard**

*Sceloporus magister*

Tier 2 Reptiles

| Population Status | and Trend |
|---|---|
| Unknown | Unknown |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Long-nosed leopard lizard**

*Gambelia wislizenii*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |
| Greasewood | ☑ |
| Pinyon - Juniper | ☑ |
| Sagebrush | ☑ |
| Saltbush | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - cheatgrass | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | L |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |

**Long-nosed snake**

*Rhinocheilus lecontei*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Low | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Sandsage | ☑ |
| Shortgrass Prairie | ☑ |
| Conservation Reserve Program | ☐ |
| Eastern Plains Rivers | ☐ |
| Sagebrush | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |

**Midget faded rattlesnake**

*Crotalus oreganus concolor*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | P |
| Utah High Plateau | P |

| Habitat | Primary |
|---|---|
| Cliffs and Canyons | ☑ |
| Desert Shrub | ☑ |
| Pinyon - Juniper | ☑ |
| Greasewood | ☐ |
| Sagebrush | ☐ |
| Saltbush | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.1 Oil & Gas Drilling | Oil & gas development, pipelines, and infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 06.1 Recreational Activities | Off-road and trail development and use | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Illegal take | 5.4 Compliance & Enforcement | Enforce hunting, fishing, collecting regulations | L |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**New Mexico threadsnake**

*Rena dissectus*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

= Leptotyphlops dissectus

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Pinyon - Juniper | ☑ |
| Shortgrass Prairie | ☑ |
| Eastern Plains Streams | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |

**Round-tailed horned lizard**

*Phrynosoma modestum*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Pinyon - Juniper | ☑ |
| Shortgrass Prairie | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 09.3 Agricultural & Forestry Effluents | Poisoning (fire ant insecticides) | 4.3 Awareness & Communications | Implement landowner outreach/education program | M |
| 14.1 Scarcity (leading to inbreeding depression) | Scarcity (Colorado occurrences known only from two sites apparently disjuct from core range) | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Illegal take | 5.4 Compliance & Enforcement | Enforce hunting, fishing, collecting regulations | L |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

**Smith's black-headed snake**

*Tantilla horbartsmithi*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Unknown | X | Unknown | X |

| Distribution | Type |
|---|---|
| Colorado Plateau | P |
| Southern Rocky Mountains | O |

| Habitat | Primary |
|---|---|
| Desert Shrub | ☑ |
| Greasewood | ☑ |
| Pinyon - Juniper | ☑ |
| Sagebrush | ☑ |
| Saltbush | ☑ |
| Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 04.1 Roads & Railroads | Collision (e.g., auto) | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

**Table 7 - Continued.**

**Texas horned lizard**

*Phrynosoma cornutum*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Medium | D | Stable | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Mixed and Tallgrass Prairies | ☑ |
| Shortgrass Prairie | ☑ |
| Conservation Reserve Program | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | H |
| 09.3 Agricultural & Forestry Effluents | Poisoning (fire ant insecticides) | 4.3 Awareness & Communications | Implement landowner outreach/education program | M |
| 04.1 Roads & Railroads | Collision (e.g., auto) | 4.3 Awareness & Communications | Publish educational material/sponsor educational programs to raise public awareness | L |
| 05.1 Control of Nuisance Species & Collecting Terrestrial Animals | Illegal take | 5.4 Compliance & Enforcement | Enforce hunting, fishing, collecting regulations | L |

**Utah milksnake**

*Lampropeltis triangulum taylori*

Tier 2 Reptiles

| Population Status | and Trend |
|---|---|
| Unknown | Unknown |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |
| Colorado Plateau | P |
| Front Range | P |
| Southern Rocky Mountains | O |
| Wyoming Basin | O |

| Habitat | Primary |
|---|---|
| Oak and Mixed Mountain Shrublands | ☑ |
| Pinyon - Juniper | ☑ |
| Sandsage | ☑ |
| Shortgrass Prairie | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc. | M |
| 13.4 Population status unknown | Lack of data on population status | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |

**Yellow mud turtle**

*Kinosternon flavescens*

Tier 2 Reptiles

| Population Status | | and Trend | |
|---|---|---|---|
| Low | X | Unknown | X |

| Distribution | Type |
|---|---|
| Central Shortgrass Prairie | P |

| Habitat | Primary |
|---|---|
| Eastern Plains Streams | ☑ |
| Lakes | ☑ |
| Sandsage | ☑ |
| Wetlands | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 09.3 Agricultural & Forestry Effluents | Herbicide/pesticide spraying or runoff | 2.3 Habitat & Natural Process Restoration | Reduce herbicide/pesticide use | M |
| 13.5 Population trend unknown | Lack of data on population trend | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |



X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

# Chapter 6: Threats and Actions for Habitats

## Summary of Threats

Of 36[15] terrestrial and aquatic habitats, almost all are affected by residential/commercial development and natural systems modifications (including alteration of hydrological and fire regimes) (Figure 9). Conversion or degradation from incompatible agricultural activities, climate change, and invasive species are affecting more than two-thirds of Colorado's habitat types (Figure 9). All of our seven forest types are impacted by climate change, natural systems modifications, and invasive species. Of seven shrubland types, all are impacted by residential/commercial development and incompatible agricultural practices. All three grassland types and all three riparian/wetland types are affected by residential/commercial development, incompatible agricultural practices, natural system modifications, invasives, and climate change. Not surprisingly, the most significant issues for aquatic habitats are urbanization and natural system modification, specifically dams and water management/use (Figure 10). For descriptions of the threats represented in the figures below, refer to Chapter 4 and Table 5.

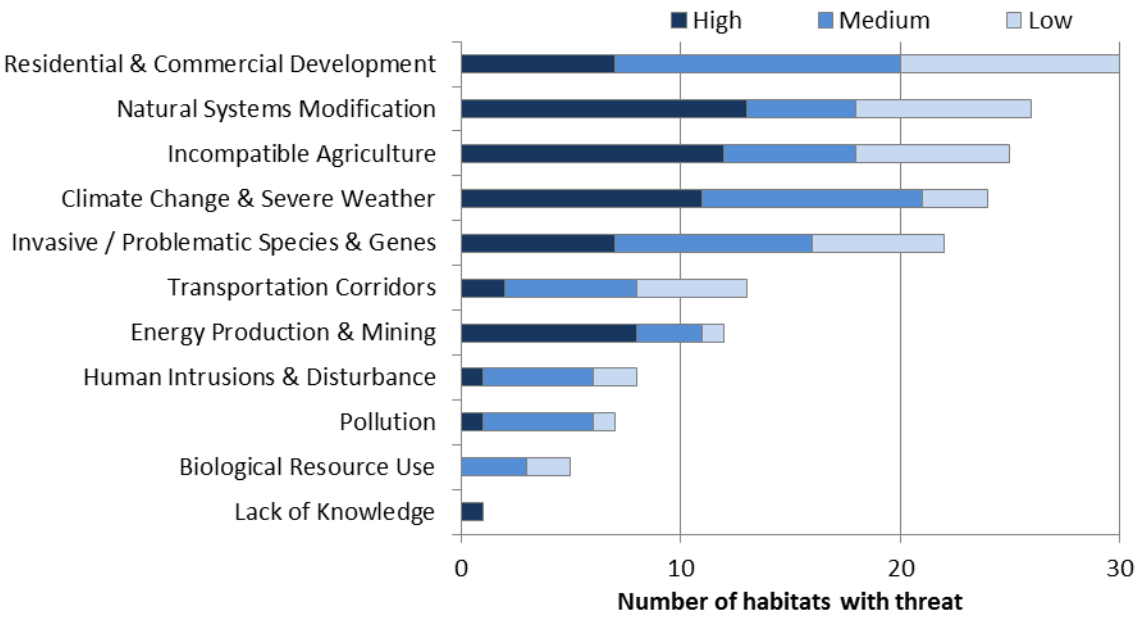



**Figure 9. Threats to habitats by priority.**

[15] Though the SWAP recognizes some habitat value in reservoirs, creation of these kinds of conditions are not compatible with most of Colorado's native biodiversity; therefore, this habitat is not included in consideration of threats or targeted for conservation action.

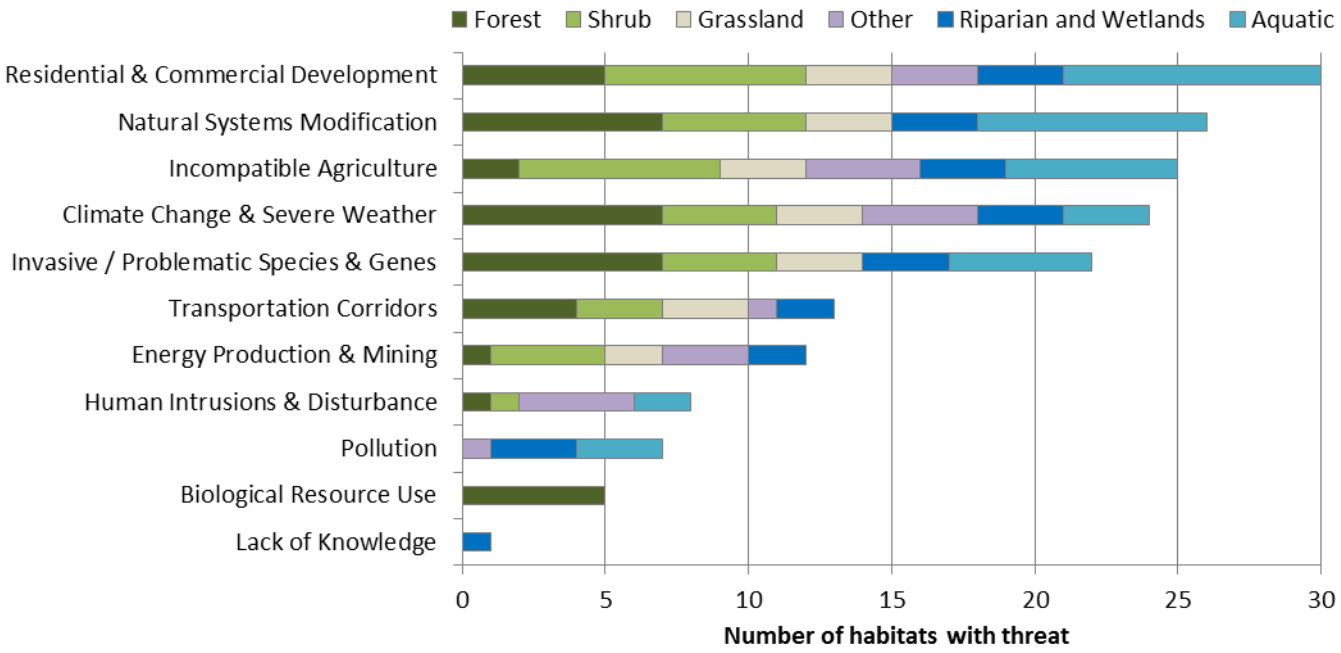



**Figure 10. Threats to habitats by habitat type.**

# Summary Conservation Actions Needed

Habitats are most in need of management and restoration (Figures 11 and 12). All forest, shrubland, grassland, riparian, and wetland habitats, and almost all aquatic habitats, are in need of restoration of specific habitat components and/or ecological processes. Some land uses, such as grazing and logging, can be used as management tools to help restore the species composition and structure of habitats, as well as to mimic disturbance regimes (fires and floods, for example) that are needed to maintain certain habitat types. Land and resource protection and management, and research are also significant needs, as are control of non-natives and implementation of compatible practices by private enterprise. Development and implementation of Best Management Practices for energy, agriculture, transportation, urban development, forestry, and water management industries could make significant contributions to improving habitat health. For descriptions of the conservation actions referenced in the figures below, refer to Chapter 4 and Table 6.

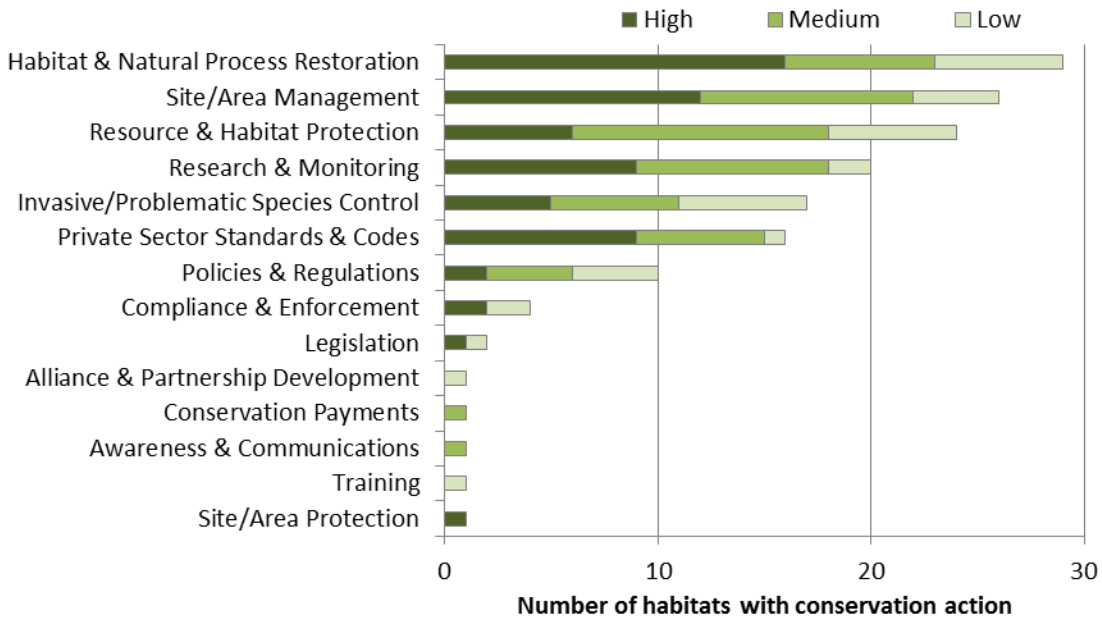



**Figure 11. Conservation actions needed for habitats by priority.**

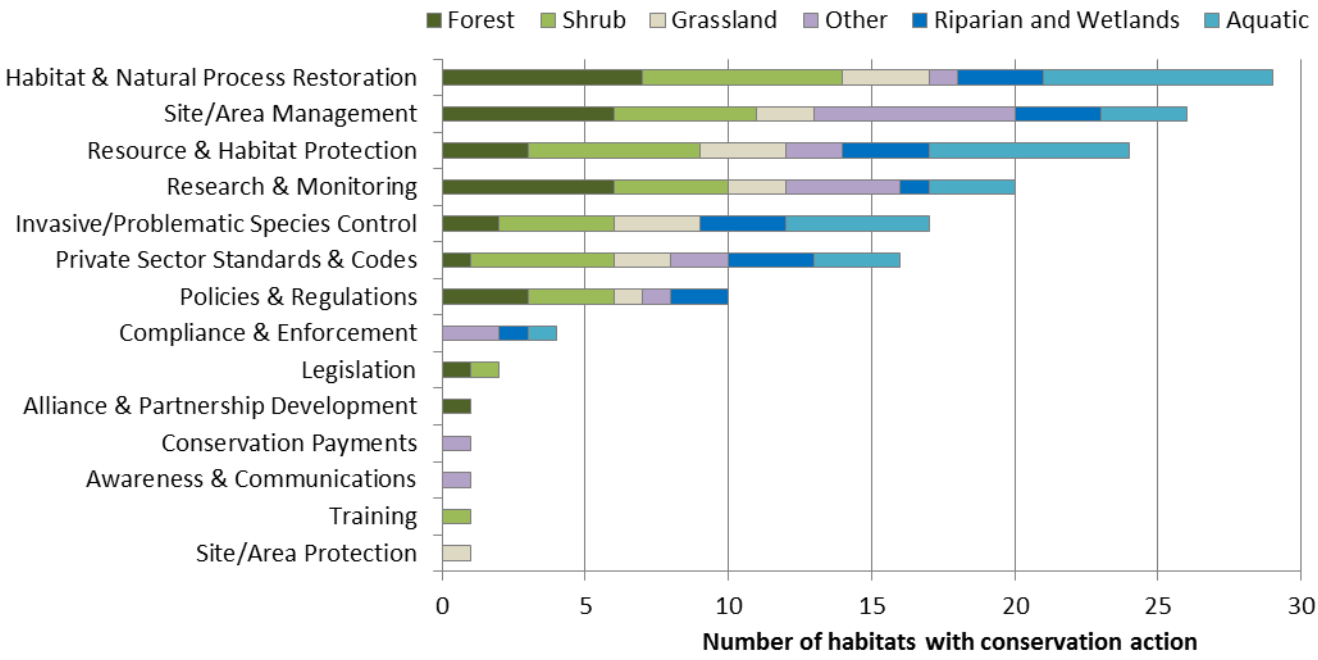



**Figure 12. Conservation actions needed for habitats by habitat type.**

# Threats and Actions Narratives for Habitats

For the purposes of the SWAP, the most crucial threats and highest priority conservation actions for habitats are briefly summarized in the following narratives. Habitats are grouped by type (e.g., forests, shrublands) and then listed alphabetically. Table 8 includes associated SGCN, threats, and prioritized conservation actions for each habitat. In order to avoid duplicating the content of Table 8 in Appendices A and B (rare plants and non-mollusk invertebrates), those taxa are included here, as is one plant-specific habitat (Barrens). See Appendix E for a key to the distribution field in Table 8.

# FORESTS AND WOODLANDS

## Aspen

### *Threats*

#### 1 Residential & Commercial Development

Aspen forests are threatened to some extent by exurban development, or development associated with recreation areas, primarily in the southwestern portion of the state, and at the lower end of the elevation range occupied by this habitat (below 8,500 ft.).

#### 2 Incompatible Agriculture

Threats from agricultural activities are primarily due to browsing by range cattle, which may change both aspen stand structure and understory composition.

#### 4 Transportation Corridors

Secondary roads and utility corridors are a typical coincident impact of exurban and recreational development and contribute to habitat fragmentation.

#### 5 Biological Resource Use

Potential threats include recreational use (e.g., firewood cutting and bark carving) and harvesting of wood products. Aspen is one of the few tree species which has seen increased harvest levels in the past several decades (Morgan et al. 2006), especially in southwest Colorado. Recreational use, hunting, and mining activity are minor sources of disturbance to aspen habitat, as is contamination from tailings and other mining practices.

#### 7 Natural System Modifications

Aspen forests are generally dependent on periodic fire to remove conifers and permit aspen regeneration from root sprouting. Fire suppression has changed the extent and availability of

patches suitable for aspen colonization (CSFS 2005), with a consequent reduction in forage and habitat for dependent species. In addition, the occurrence of Sudden Aspen Decline (SAD) has decreased the abundance of aspen in some areas, which may concentrate ungulate use in remaining patches and further decrease the ability of these habitats to regenerate (Keane et al. 2002).

#### 8 Invasives, Problematic Native Species, & Pathogens

Browsing by native herbivores such as elk can be a significant contributor to changes in stand structure and diversity.

#### 11 Climate Change & Severe Weather

Aspen stands in warm, dry conditions at lower elevations are more threatened by episodic decline, which appears to be tied to drought stress (Rehfeldt et al. 2009). Projected increases in temperature throughout the range of aspen habitat in Colorado are likely to have the greatest impact on these stands, while stands at higher, cooler and wetter elevations are more likely to persist.

### *Information Needs*

Landscape scale analysis of aspen condition class is needed to ascertain appropriate level of heterogeneity and resiliency.

### *Conservation Actions*

Protect privately owned aspen stands through education and conservation easements to limit permanent forest type conversion. Grazing education (both domestic and wildlife) is needed to help promote aspen regeneration through proper grazing management. Reduction in stocking rates of domestic livestock and reduction of native ungulate herds will aid in aspen regeneration. Fencing and hunting in heavily used aspen stands to reduce or exclude herbivory will help regenerate aspen stands. Conduct aspen management education and programs to promote aspen stand management to setback aspen successional stages. Promote the use of characteristic wildfire and prescribed fire to help encourage aspen regeneration and colonization. Promote the use of appropriate silvicultural practices in appropriate stand conditions to help with stand level heterogeneity and stand resiliency. Promote landscape scale analysis of aspen condition class to ascertain appropriate level of heterogeneity and resiliency. Prioritize lower elevation aspen protection and management through education, grant funding and conservation easements.

# Lodgepole

## *Threats*

### 1 Residential & Commercial Development

Development of exurban or recreational areas is a minor source of disturbance and fragmentation in lodgepole forests.

### 4 Transportation Corridors

Roads and utility corridors associated with exurban or recreational development are a source of fragmentation in lodgepole habitats.

### 5 Biological Resource Use

Timber harvest in Colorado's lodgepole forests has declined significantly since the late 19th century, but a recent increase in the use of beetle-kill wood has maintained a small market for this species. Wood harvest activities are a minor source of disturbance in this habitat type, but extensive salvage logging and thinning may have local impacts.

### 7 Natural System Modifications

Fire suppression effects in lodgepole pine forests are evident at a landscape level in an overall lack of variety in successional stages. Individual lodgepole stands may not be outside the natural range of variation, but at a landscape level fire suppression has probably led to larger, denser, more homogenous patches that are more favorable for large fire and heavy infestations of mountain pine beetle (Keane et al. 2002).

### 8 Invasives, Problematic Native Species, & Pathogens

The scope and visibility of the most recent mountain pine beetle outbreak in lodgepole habitat has complicated policy and management responses to the extensive mortality. There is uneasiness about whether the outbreak is a climate-change driven crisis (e.g., "a major threat to regional economics and public safety," USFS Medicine Bow-Routt National Forest website) or merely an example within the natural range of variation for such outbreaks, or both. The current outbreak appears to be subsiding, leaving the potential for large fires with extreme behavior to occur in the killed forests (Kaufmann et al. 2008). Warmer winters and drought can facilitate mountain pine beetle outbreaks, but mortality is already widespread, so the population of host trees has been greatly reduced. Although large, intact patches of lodgepole forest persist in Colorado, this may change as the effects of extensive mountain pine beetle mortality and increased fire extent and frequency reshape the lodgepole matrix. In combination with climate change, the aftermath of the recent severe outbreak of mountain pine beetle is likely to lead to forms of lodgepole forest that are different from those seen in past, pre-outbreak years.

#### 11 Climate Change & Severe Weather

Our climate change vulnerability analysis (Appendix F) indicated that lodgepole pine forests in Colorado are moderately vulnerable to the effects of climate change by mid-century. The vulnerability of this habitat to forest disturbances affected by climate conditions (mountain pine beetle and fire) and the fact that it is at the southern edge of its distribution in Colorado are primary factors contributing to this assessment result.

### *Information Needs*

Promote landscape scale analysis of lodgepole pine condition class to ascertain appropriate level of heterogeneity and resiliency.

### *Conservation Actions*

Limit the footprint of permanent development within lodgepole pine forests through education and conservation easement. Additionally, provide education on the threat of wildfire to communities and landowners, along with realistic, outcome-based approaches to reduce wildfire risk. Timber harvesting within lodgepole pine at the appropriate sites and scale is needed to maintain pure lodgepole pine stands for lodgepole obligate wildlife species. Continuing to increase stand heterogeneity to reduce large, continuous even-aged stands will help reduce risk of uncharacteristic wildfire and large scale pine beetle outbreaks in the future. Promoting management to mimic natural range of forest disturbances to increase stand heterogeneity may reduce potential negative impacts from management intervention.

## Mixed Conifer

### *Threats*

#### 1 Residential & Commercial Development

Exurban development and recreational area development are a threat to mixed conifer forests along the Front Range and I-70 corridor in mountain areas.

#### 4 Transportation Corridors

Roads and utility corridors are a source of disturbance and fragmentation in mixed conifer forests statewide, but these stands naturally occur in smaller patches than some other forest types, so threats are low.

#### 5 Biological Resource Use

A number of tree species in mixed conifer are suitable for timber harvest, so logging is a source of disturbance in these forests. Threats from livestock grazing and human disturbances (e.g., hunting, recreational activities) are minimal for mixed conifer forests. Mining and mine tailings are a small source of disturbance in mixed conifer forests.

### 7 Natural System Modifications

In areas adjacent to development, mixed conifer stands may be part of the wildland-urban interface, where they are most likely to be threatened by the effects of by inappropriate management intervention or fire suppression. The absence of a natural fire regime in these forests has resulted in increased tree density and the buildup of duff and litter, which may increase the severity of fire when it does occur.

### 8 Invasives, Problematic Native Species, & Pathogens

Stands in the southern part of Colorado have been impacted by the western spruce budworm and drought. Budworm outbreaks are part of a natural cycle in mixed conifer forests, but may be intensified by increasing drought frequency and the generally higher temperatures projected in coming decades.

### 11 Climate Change & Severe Weather

The diversity of species within mixed conifer forests may increase its flexibility in the face of climate change. Changing climate conditions are likely to alter the relative dominance of overstory species, overall species composition and relative cover, primarily through the action of fire, insect outbreak, and drought. Drought and disturbance tolerant species will be favored over drought vulnerable species. Species that are infrequent and have a narrow bioclimatic envelope (e.g., blue spruce) are likely to decline or move up in elevation. Abundant species that have a wide bioclimatic envelope (e.g., aspen) are likely to increase. Outcomes for particular stands will depend on current composition and location. Current stands of warm, dry mixed conifer below 8,500 ft. may be at higher risk or may convert to pure ponderosa pine stands as future precipitation scenarios favor rain rather than snow. Upward migration into new areas may be possible.

## *Information Needs*

Promote landscape scale analysis of mixed conifer condition class to ascertain appropriate level of heterogeneity and resiliency. Better definition of mixed conifer and understanding historic range of variability along with the ecological drivers may aid in the conservation of this habitat type.

## *Conservation Actions*

Limit the footprint of permanent development in mixed conifer forests through education and conservation easement. Additionally, provide education on the threat of wildfire to communities and landowners, along with realistic, outcome-based approaches to reduce wildfire risk. Promoting management actions that mimic the natural range of forest disturbances to increase stand heterogeneity may reduce potential negative impacts from management intervention. Increasing landscape level heterogeneity may reduce size and intensity of wildfires or disease outbreaks.

# Pinyon-Juniper

## *Threats*

### 1 Residential & Commercial Development

Ongoing but limited threats from urban, exurban, and commercial development are primarily in the south central and southwestern portions of Colorado, where towns, roads, and utility corridors are often in close proximity to pinyon-juniper woodlands. As with other habitats in the wildland-urban interface, areas near developed areas are most likely to be threatened by the effects of fire suppression, while more remote areas are generally in good condition.

### 2 Incompatible Agriculture

Livestock grazing has degraded the understory grasses of some stands, and invasive cheatgrass has become established in some areas. Tree removal by chaining is a minor source of disturbance within these woodlands, but dramatically changes the habitat where it has occurred.

### 3 Energy Production & Mining

Oil and gas development, with associated roads, pipeline corridors, and infrastructure, is an ongoing source of disturbance and fragmentation for most pinyon-juniper habitats.

### 6 Human Intrusions & Disturbance

Military training activities are a source of disturbance to this habitat at Fort Carson and Pinyon Canyon Maneuver Site. Increased recreational use of pinyon-juniper forests is also of concern in areas adjacent to growing urban centers in the southeast and southwest portions of the state. These lower elevations often remain accessible year-round and are increasingly utilized for horseback riding, hiking, ATV's, bicycling, and other recreational activities that degrade habitat and disturb wildlife during vulnerable periods.

### 7 Natural System Modifications

In areas adjacent to development, pinyon-junper stands may be part of the wildland-urban interface, where they are most likely to be threatened by the effects of by inappropriate management intervention or fire suppression. In addition, efforts to secure residential and commercial developments from the threat of wildfire often result in the severe alteration or complete removal of pinyon-juniper stands within the designated wildland-urban interface. These activities interrupt the natural seral progression of the impacted stands and may degrade the usefulness of the remaining habitat for wildlife.

### 8 Invasives, Problematic Native Species, & Pathogens

Pinyon are susceptible to the fungal pathogen *Leptographium wageneri* var. *wageneri*, which causes black stain root disease, and to infestations of the pinyon ips bark beetle (*Ips*

*confusus*)(Kearns and Jacobi 2005), which has caused extensive mortality in pinyon-juniper habitats in southern Colorado. Extended drought can increase the frequency and intensity of both insect outbreaks and wildfire. Some recently burned pinyon-juniper habitats do not appear to be regenerating (e.g., burns at Mesa Verde), perhaps due to a lack of suitable precipitation conditions and few available seed sources (Floyd et al. 2000; Barger et al. 2009).

### 11 Climate Change & Severe Weather

Variable disturbance and site conditions across the distribution of this ecosystem have resulted in a dynamic mosaic of interconnected communities and successional stages across the landscape that can be naturally resilient. Since the last major glacial period, the distribution and relative abundance of pinyon and juniper has fluctuated dynamically with changing climatic conditions. Warming conditions during the past two centuries, together with changing fire regime, livestock grazing, and atmospheric pollution, increased the ability of this ecosystem to expand into neighboring communities, at both higher and lower elevations (Tausch 1999). However, precipitation and temperature patterns are projected to change in a direction that is less favorable for pinyon, so that juniper may become more dominant, and these habitats may be unable to persist or expand in their current form.

Our climate change vulnerability analysis (Appendix F) indicated that pinyon-juniper woodlands in Colorado are moderately vulnerable to the effects of climate change by mid-century. The vulnerability of this habitat to stressors affected by climate conditions (Ips beetle, drought, and fire) and widespread effects on anthropogenic disturbance are primary factors contributing to this assessment result.

## *Information Needs*

An improved understanding of the potential impacts of climate change and options for adaptation strategies is needed.

## *Conservation Actions*

Less than 1% of the Pinyon-Juniper woodlands in Colorado are directly managed by Colorado Parks & Wildlife (unpublished CPW GIS analysis). On these properties, our goal will be to maintain a diversity of age classes with a focus on maintaining stands of old growth (>250 years) trees. Mid and some late-seral stands may be thinned to push succession forward, or removed to reset succession. Tree thinning or removal may also be undertaken to protect infrastructure on State Parks or in adjacent communities. In those areas where past management activities such as fire suppression have facilitated the establishment of young trees into sagebrush parks, treatments may be implemented to remove the encroaching trees and restore the integrity of the sagebrush community. In those habitats where CPW lacks direct administrative oversight, we will work with the managing agency (generally BLM) or private landowner to ensure that a proper balance of age and understory characteristics are maintained across the landscape.

# Ponderosa Pine

## *Threats*

### 1 Residential & Commercial Development

Urban and exurban development are a primary threat to ponderosa pine habitat, especially along the Front Range, but also in other parts of the state. Increasing development has led to an extensive wildland-urban interface in ponderosa habitat (Theobald 2005).

### 4 Transportation Corridors

Fragmentation of stands in exurban areas due to housing, roads, and utility corridors is likely to continue.

### 5 Biological Resource Use

Wood harvest activities are a minor source of disturbance in this habitat type, but extensive salvage logging and thinning may have local impacts.

### 7 Natural System Modifications

Ponderosa forest and woodland historically experienced relatively frequent low intensity fires that controlled the density, age, and structure of stands. With fire suppression, ponderosa has increased into foothills grassland, stands have greatly increased in density, and open ponderosa savanna habitat has decreased. Increased tree density and fuel accumulation has resulted in more severe fires in this habitat, as well as increased occurrence of mountain pine beetle and dwarf mistletoe infestation. The alteration of natural fire regimes through fire suppression is an ongoing threat for ponderosa pine habitat near developed areas.

### 8 Invasives, Problematic Native Species, & Pathogens

Mountain pine beetle has caused extensive mortality in ponderosa pine habitats throughout Colorado, although the current outbreak appears to be subsiding. Impacts of native grazers or domestic livestock and the spread of invasive grasses could also alter understory structure and composition, with the potential to negatively impact soil stability (Allen et al. 2002).

### 11 Climate Change & Severe Weather

Climate change may alter fire regimes slightly by affecting the community structure, but fire is not a primary threat for the persistence of this habitat, and may actually be beneficial in some areas if it restores some pre-settlement conditions (Covington and Moore 1994). A projected increase in the frequency of drought conditions is likely to exacerbate both fire and insect outbreaks, and change the structure and composition of ponderosa pine habitats.

Our climate change vulnerability analysis (Appendix F) indicated that ponderosa pine forests and woodlands in Colorado are moderately vulnerable to the effects of climate change by mid-century. The exposure of this habitat to warmer temperatures that interact with stressors (mountain pine beetle, drought, and fire) is the primary factor contributing to this assessment result.

### *Information Needs*

Promote landscape scale analysis of ponderosa pine condition class to ascertain appropriate level of heterogeneity and resiliency.

### *Conservation Actions*

Limit the footprint of permanent development in ponderosa pine forests through education and conservation easement. Additionally, provide education on the threat of wildfire to communities and landowners, along with realistic, outcome-based approaches to reduce wildfire risk. Promoting management to mimic natural range of variation of forest disturbances to increase stand heterogeneity may reduce potential negative impacts from management intervention. Increasing landscape level heterogeneity may reduce size and intensity of wildfires. Promoting the use of low and mixed severity prescribed fire will increase the pace and efficiency of forest restoration. Increasing the level of funding for management activities on both private and public land will increase the scale of forest restoration in this forest type.

## Spruce-Fir

### *Threats*

#### 5 Biological Resource Use

Timber harvest in spruce-fir forests has declined significantly since the late 19th century, but is an ongoing disturbance. Wood harvest activities are a minor source of disturbance in this habitat type, but extensive salvage logging and thinning may have local impacts.

#### 7 Natural System Modifications

Historic natural fire-return intervals in these forests have been on the order of several hundred years, and the tree species are not adapted to more frequent fires. Because natural fire return intervals in these habitats are long, fire suppression has not had widespread effects on the condition of spruce-fir habitat. At a landscape scale, however, age structures of spruce-fir forest are probably somewhat altered from pre-settlement conditions, so that some historically typical patch types may now be under-represented, with unknown consequences for future ecosystem trajectories.

### 8 Invasives, Problematic Native Species, & Pathogens

These forests are generally not susceptible to increased prevalence of invasive species, but are highly vulnerable to outbreaks of the native pest species, spruce bud worm and spruce beetle, which have caused extensive tree mortality in southwestern Colorado. Insect and disease outbreaks are typically associated with droughts.

### 11 Climate Change & Severe Weather

Climate change projections indicate an increase in droughts and faster snowmelt, which could increase forest fire frequency and extent within this habitat. It is not known if spruce-fir forests will be able to regenerate under such conditions, especially in lower elevation stands, and there is a potential for a reduction or conversion to other forest types, depending on local site conditions. The lag time of the current treeline position behind climate change is estimated to be 50-100+ years, due to the rarity of recruitment events, the slow growth and frequent setbacks for trees in the ecotone, and competition with already established alpine vegetation (Körner 2012). However, on the basis of historic evidence, treeline can be expected to migrate to higher elevations as temperatures warm, as permitted by local microsite conditions (Smith et al. 2003; Richardson and Friedland 2009; Grafius et al. 2012). The gradual advance of treeline is also likely to depend on precipitation patterns, particularly the balance of snow accumulation and snowmelt (Rochefort et al. 1994).

Our climate change vulnerability analysis (Appendix F) indicated that spruce-fir forests in Colorado are moderately vulnerable to the effects of climate change by mid-century. The restriction of this habitat to higher elevations and its relatively narrow biophysical envelope, slow-growth, and position near the southern end of its distribution in Colorado are primary factors contributing to this assessment result.

## *Information Needs*

Promote landscape scale analysis of spruce-fir condition class to ascertain appropriate level of heterogeneity and resiliency. Better understanding historic range of variability and the ecological drivers may aid in the conservation of this habitat type.

## *Conservation Actions*

Limit the footprint of permanent development in spruce-fir forests through education and conservation easement. Additionally, provide education on the threat of wildfire to communities and landowners, along with realistic, outcome-based approaches to reduce wildfire risk. Promoting management that mimics the natural range of forest disturbances to increase stand heterogeneity may reduce potential negative impacts from management intervention. Increasing landscape level heterogeneity may reduce size and intensity of wildfires and disease outbreaks.

# Subalpine Limber and Bristlecone Pine

## *Threats*

The scope and severity of most potential threats to subalpine limber and bristlecone pine forests are not well known. Minor impacts are likely from recreational area development, roads, mining, and livestock grazing, which are sources of disturbance, fragmentation, and have the potential to alter structure and condition of some stands.

### 7 Natural System Modifications

Limber and bristlecone pines are long-lived and slow growing, and are able to grow on cold, nutrient-poor acidic sites (Johnson 2001; Fryer 2004). The poor soils of this habitat generally mean that fuel loads are much less than for some other forest types. Subalpine limber and bristlecone habitat have historically experienced a range of fire regimes, from stand-replacing fires occurring at intervals of 300+ years to more frequent low-intensity surface fires at lower elevations. Both species regenerate on areas that have burned within the past few decades (Baker 1992). Many stands may still be within the historic range of variation for fire regime, although fire suppression may affect regeneration rates in some places.

### 8 Invasives, Problematic Native Species, & Pathogens

Five-needle pines, including limber and bristlecone, are threatened by white pine blister rust (WPBR) infection caused by the introduced fungus *Cronartium ribicola.* Initially detected in Colorado in northern Larimer County, the disease appears to have slowly spread southward in the state, primarily affecting limber pine, but also occurring on bristlecone pine. Because infections of WPBR seriously threaten these slow-growing and long-lived tree species, the disease has the potential to permanently alter the composition of forest ecosystems in the area (Schoettle 2004). The five-needle pine trees are also vulnerable to outbreaks of the mountain pine beetle (*Dendroctonus ponderosae*), although mortality has been limited in comparison with other conifer types (Gibson et al. 2008).

### 11 Climate Change & Severe Weather

Limber and bristlecone pine habitats are limited in distribution in Colorado, and although these long-lived species have survived past climate change, their slow recruitment and growth may increase their vulnerability to rapid climatic change, especially if future conditions enhance the spread of WPBR.

## *Information Needs*

Promote landscape scale analysis of five needle pines condition class to ascertain appropriate level of heterogeneity and resiliency. Better understanding historic range of variability and the ecological drivers may aid in the conservation of this habitat type.

### *Conservation Actions*

Promote research on five needle pine systems to understand the basic ecological drivers such as disease and fire. Monitor disease outbreaks as they occur to gain a better understanding of scale and mortality level. Education on the basic ecology of this system and wildlife species potentially impacted by natural disease outbreaks is needed.

# SHRUBLANDS

## Desert Shrub

### *Threats*

The majority of desert shrub habitats in Colorado occur in the low elevation, west-central valleys along the Colorado, Gunnison, Uncompahgre, Rio Grande and Dolores Rivers. In general, these plant communities are some of the most vulnerable in Colorado. Mancos shale formations dominate these valley floors and produce fine textured/highly alkaline soils that are inhospitable to most plants. The native species that do occur in these areas must be highly adapted to survive high summer temperatures, high pH, and low precipitation. Natural disturbance (primarily fire) in these communities is believed to have been rare, with no predictable fire regime due to discontinuous fuels (LANDFIRE 2007). Because of its historic stability, this plant community responds poorly to any soil disturbing activity, and past efforts to reclaim or restore habitat in the desert shrub community have often failed (Blaisdell and Holmgren 1984). General lack of native competition and slow community response to disturbance has made desert shrublands highly vulnerable to the weed infestations that often follow disturbance.

#### 1 Residential & Commercial Development

Threats to desert shrublands from exurban or recreational area development continue at a moderate level.

#### 2 Incompatible Agriculture

Although conversion to cropland is a limited ongoing threat, livestock grazing is an ongoing source of disturbance that alters the species composition of this habitat statewide.

#### 3 Energy Production & Mining

Oil and gas exploration and production pose a limited threat to the desert shrub community, particularly those in the NW and West-Central Valley's. In the San Luis Valley, concentrated solar energy development is a local source of habitat disturbance. Many of the habitats experiencing energy related impacts now are already highly degraded, and the biggest threat may be the further spread of noxious weeds.

#### 4 Transportation & Service Corridors

Roads and utility corridors, including those associated with solar energy development in the San Luis Valley, are an ongoing source of disturbance, and can facilitate the spread of invasive plant species, which have become established in some areas.

#### 8 Invasives, Problematic Native Species, & Pathogens

Perhaps the single greatest threat to desert shrub habitats in Colorado are invasive weeds. Historic overgrazing opened these habitats to a number of non-native annuals such as cheatgrass, annual wheatgrass, halogeton, and Russian thistle. Over time these plants have come to dominate large areas and are difficult, if not impossible to eradicate. In many cases, livestock grazing and destructive recreational practices (e.g., ATVs) are spreading these weeds and suppressing recovery of the native species.

#### 11 Climate Change & Severe Weather

Climate change could prove devastating to this habitat type. If a predicted warmer/drier climate shift does occur, it is believed that most vegetation communities in Colorado will transition to higher elevations and/or latitudes to compensate. However, many plants living in the salt desert shrub community have evolved over eons to thrive in soils found only in low elevation river valleys. It is questionable whether many of these species could make an abrupt transition to the more sandy/neutral ph soils that dominate much of the next elevation gradient. Higher temperatures and prolonged drought could simply turn these communities into exotic grasslands.

### *Information Needs*

An improved understanding of the potential impacts from climate change is needed.

### *Conservation Actions*

CPW is presently experimenting with potential restoration techniques on the Escalante State Wildlife Area west of Delta. A combination of aerial herbicide application and reseeding will be tested as a way to remove weed competition and restore native salt desert shrub communities. If these techniques prove successful, a collaboration will be formed with the BLM and local landowners that will implement landscape level restoration across broad geographic areas.

## Greasewood

### *Threats*

#### 1 Residential & Commercial Development

Threats to the persistence of large, intact greasewood shrublands from exurban or recreational area development continues at a moderate level, primarily in the San Luis Valley.

#### 2 Incompatible Agriculture

Although conversion to cropland is a limited ongoing threat, agricultural activity has an indirect effect on greasewood habitat in the San Luis Valley, since groundwater pumping for crops is a serious threat to the high water table that maintains these saline shrublands. Runoff of fertilizer and pesticide from adjacent agricultural areas is also a potential threat. Although greasewood is both unpalatable and poisonous to most ungulates and highly tolerand of heavy livestock use, livestock grazing is an ongoing source of disturbance that alters the understory species composition of this habitat statewide.

#### 8 Invasives, Problematic Native Species, & Pathogens

Overall, greasewood is one of the most resilient shrubs found in Colorado. This species sprouts readily from the root and has a remarkable tolerance to high water tables and saline soils. Unfortunately, the grass/forb community generally associated with greasewood has proven less resilient to human impacts. At this point in time, the understory in many greasewood communities consists of either non-native grasses that can tolerate heavy grazing, or annual weeds such as cheatgrass and Russian thistle.

### *Information Needs*

Improved understanding of the groundwater depth needed to maintain greasewood is a primary research need.

### *Conservation Actions*

CPW is not planning any conservation actions specific to increasing the distribution of greasewood. However, plant communities associated with greasewood shrublands will be part of a more general salt desert shrub restoration effort as described above. The development of weed management plans may be useful in some areas.

## Oak and Mixed Mountain Shrub

### *Threats*

#### 1 Residential & Commercial Development

Ongoing but limited threats from urban, exurban, commercial, and energy development are primarily in the southern and western portions of Colorado, where towns and well fields are often in close proximity to oak shrublands. Mixed mountain shrublands are somewhat less impacted by developments, primarily those associated with recreation areas or exurban housing.

#### 2 Incompatible Agriculture

Livestock grazing has degraded the understory grass community of some oak stands, and invasive cheatgrass and knapweed have become established in some areas. Mixed mountain shrublands are less impacted by invasives.

#### 4 Transportation Corridors

Ongoing but limited threats from to oak shrublands from roads and utility corridors associated with urban, exurban, commercial, and energy development are primarily in the southern and western portions of Colorado. Mixed mountain shrublands are somewhat less impacted by roads, primarily those associated with recreation areas or exurban housing.

#### 7 Natural System Modifications

Fire is a source of disturbance in these shrublands, and they are highly fire tolerant. As with other habitats in the wildland-urban interface, areas near developed areas are most likely to be threatened by the effects of fire suppression, while more remote areas are generally in good condition. Gambel oak reproduces primarily by sprouting of new stems, especially after disturbances such as logging, fire, and grazing, although recruitment from seedlings does occur (Brown 1958; Harper et al. 1985).

#### 11 Climate Change & Severe Weather

Oak and mixed mountain shrublands are widespread in western Colorado, and have a relatively wide ecological amplitude. Projected warming temperatures are likely to favor oak growth and persistence, although droughts and late frosts may affect the frequency of establishment through seedling recruitment by reducing the acorn crop in some years. In general, stands of these deciduous shrublands are thought to not be vulnerable to climate change.

### *Information Needs*

An improved understanding of some component shrub species' (e.g., *Purshia tridentata*, *Quercus gambelii*) response to drought is needed.

### *Conservation Actions*

Maintenance of appropriate patch size and mosaic is the primary conservation action needed.

## Sagebrush

### *Threats*

#### 1 Residential & Commercial Development

Threats to sagebrush shrublands from exurban or recreational area development continues at a moderate level. Hunting and recreational are minor sources of disturbance in this habitat.

### 2 Incompatible Agriculture

Chemical and other mechanical shrub removal for forage grass production, and to a lesser extent conversion to tilled crops, is a substantial threat in western Colorado. Conversion of native sagebrush habitats to introduced forage plant species continues to occur at low levels. Grazing by large ungulates (both wildlife and domestic livestock) can change the structure and nutrient cycling of sagebrush shrublands (Manier and Hobbs 2007), but the interaction of grazing with other disturbances such as fire and invasive species under changing climatic conditions appears to be complex (e.g., Davies et al. 2009) and has not been well studied in Colorado.

### 3 Energy Production & Mining

Large coal mining operations that completely remove this habitat prior to reclamation activity are an ongoing threat to the connectivity and quality of these shrublands. Oil and gas development, with associated roads, pipeline corridors, and infrastructure is another ongoing source of anthropogenic disturbance, fragmentation, and loss in this habitat in northwestern Colorado.

### 4 Transportation Corridors

Roads and utility corridors associated with energy and exurban development are a source of habitat fragmentation for these shrublands.

### 7 Natural System Modifications

Fire suppression and long-term heavy grazing by domestic livestock may have contributed to the loss of native forbs and grasses, and increased growth of woody species such as juniper in some sagebrush habitats.

### 8 Invasives, Problematic Native Species, & Pathogens

Other stressors for sagebrush shrublands are invasion by cheatgrass and expansion of pinyon-juniper woodlands. Warmer, drier sites (typically found at lower elevations) are more easily invaded by cheatgrass (Chambers et al. 2007). There is a moderate potential for invasion by halogeton, knapweed species, oxeye daisy, leafy spurge, and yellow toadflax under changing climatic conditions, and a potential for changing fire dynamics to affect the ecosystem. Although sagebrush tolerates dry conditions and fairly cool temperatures, it is not fire adapted, and is likely to be severely impacted by intense fires that increase wind erosion and eliminate the seed bank (Schlaepfer et al. 2014). Increased fire frequency and severity in these shrublands could occur under future climate conditions, potentially increasing the area dominated by exotic grasses, especially cheatgrass (D'Antonio and Vitousek 1992; Shinneman and Baker 2009).

### 11 Climate Change & Severe Weather

Because these are shrublands of lower elevations, they are not expected to be limited by a requirement for cooler, high elevation habitat. Bradley (2010) points out that sagebrush

shrublands in the western U.S. are currently found across a wide latitudinal gradient (from about 35 to 48 degrees north latitude), which suggests adaptation to a correspondingly wide range of temperature conditions. However, because these shrublands are apparently able to dominate a zone of precipitation between drier saltbush shrublands and higher, somewhat more mesic pinyon-juniper woodland, the distribution of sagebrush shrublands is likely to be affected by changes in precipitation patterns (Bradley 2010). Although sagebrush is generally a poor seeder, with small dispersal distances, there are no apparent barriers to dispersal for these shrublands. These stands may also be somewhat vulnerable to changes in phenology.

### *Information Needs*

Information needed includes improved understanding of: natural sagebrush community succession and climax states, long-term effects of past management actions, and reliable management techniques to combat non-native plant species invasion. Completion of NRCS Ecological Site Descriptions with accompanying state and transition models would be beneficial to sagebrush management in Colorado.

### *Conservation Actions*

CPW has historically placed great emphasis on, and devoted considerable resources toward, protecting and enhancing sagebrush communities. CPW is presently implementing approximately 5,000 acres of sagebrush enhancement or restoration work annually. Similar or increased restoration effort will likely be required over the next 10 years to buffer projected sage brush habitat loss. CPW will also continue protection activities through our Wildlife Habitat Protection Program, which over the last few years has preserved tens of thousands of acres of sagebrush habitat through fee title acquisitions and conservation easements. Many sagebrush dependent species require large tracts of contiguous sagebrush habitat to sustain viable populations. On an annual basis, the quantity of high quality sagebrush habitat on private lands offered to CPW through the Wildlife Habitat Incentive Program far exceeds program funding availability. Targeted expansion of these protection efforts would protect large unbroken tracts of sagebrush habitat in perpetuity.

## Saltbush

### *Threats*

#### 1 Residential & Commercial Development

Saltbush shrublands have limited but ongoing threat of conversion to urban and commercial development that can increase habitat fragmentation.

#### 2 Incompatible Agriculture

Saltbush shrublands have limited but ongoing threat of conversion to croplands. Many of the dominant shrubs are palatable to domestic livestock, so grazing can alter species composition.

#### 3 Energy Production & Mining

Oil and gas development, with associated roads, pipeline corridors, and infrastructure is the primary ongoing source of anthropogenic disturbance, fragmentation, and loss in this habitat.

#### 7 Natural System Modifications

Where substrates are shallow fine-textured soils developed from shale or alluvium, the naturally sparse plant cover makes these shrublands especially vulnerable to water and wind erosion, especially if vegetation has been depleted by grazing, anthropogenic disturbances, or fire. Historically, saltbush shrublands had low fire frequency (Simonin 2001), and are characterized by low fuel mass and low soil moisture, which tends to mitigate fire impacts (Allen et al. 2011). Many of the dominant shrubs are palatable to domestic livestock, so grazing can alter species composition as well as increasing erosion potential.

### *Information Needs*

No high priority research needs have been identified for this habitat.

### *Conservation Actions*

The highest priorities for saltbush habitats are improved grazing management, control of invasive weeds, and implementation of Best Management Practices for energy development.

## Sandsage

### *Threats*

#### 1 Residential & Commercial Development

Sandsage shrublands have limited but ongoing threat of conversion to urban/exurban and commercial development.

#### 2 Incompatible Agriculture

The greatest threat in sandsage systems is mis-managed grazing that has altered the grass and forb community structure under the sandsage. This habitat type is highly degraded in much of the state, resulting largely from uniform and intense livestock grazing over much of eastern Colorado. In northeast Colorado, there is evidence of declining and degraded component of the important grasses and forbs associated with sandsage due, in many cases, to historic mis-managed grazing followed by a long period of no grazing exacerbating the habitat issues. Under a "no-use" situation, most commonly observed on public lands and smaller parcels of property

owned for recreation properties (i.e., duck clubs) rather than as agricultural working lands, this habitat type tends to degrade to an excessive litter, low productivity state with few native perennial grasses. The system will then tend to be dominated by annuals, often invasive annuals such as cheatgrass. Mis-managed domestic livestock grazing tends to favor the increase of sandsage over associated native grasses. Long-term continuous grazing of domestic livestock has made a significant contribution to the alteration of these shrubland habitats from their pre-settlement condition, and this trend is likely to continue. Fire suppression may also contribute to an increase in shrub density in this habitat, although sandsage quickly resprouts after burning. Sandsage shrublands have limited but ongoing threat of conversion to row crop agriculture.

### 3 Energy Production & Mining

Oil and gas development and wind farms, along with associated roads, utility corridors, and infrastructure, are primary ongoing sources of anthropogenic disturbance, fragmentation, and loss in this habitat.

### 7 Natural System Modifications

Fire suppression and long-term heavy grazing by domestic livestock may have contributed to a loss of native forbs and grasses, and increased growth of woody species in some sandsage habitats. Cheatgrass encroachment is also an ongoing and increasing threat in this habitat type, especially in northeastern Colorado.

### 11 Climate Change & Severe Weather

Sandsage itself is resilient to drought, but extreme drought in combination with management actions that remove vegetation and litter could mobilize sandy substrates of this habitat, converting them to dunes.

## *Information Needs*

There is a significant need to understand how to control or eliminate cheatgrass and recover the native mid and tall grass species that were historically present but are currently lacking.

## *Conservation Actions*

Improving and implementing grazing systems that will return these systems to historic climax plant communities (HCPC) are needed. For these systems to provide wildlife habitat, they need to contain a diversity of vegetation height and condition, with a diverse suite of grasses, forbs, and legumes interspersed with the sandsage. Land protection strategies (e.g., conservation easements) can help avert conversion of sansage from urban development, agriculture, and energy development.

# Upland Shrub

## *Threats*

### 1 Residential & Commercial Development

Ongoing threats from suburban or exurban development, roads, or recreational infrastructure are primarily concentrated in stands in the Front Range, and are a source of fragmentation, disturbance, and habitat loss.

### 2 Incompatible Agriculture

Grazing disturbance from over-use by domestic livestock can compact soils and alter species composition, nutrient levels, and vegetation structure in this habitat. Heavy concentrations of domestic livestock may have significant impacts on shrub growth and reproduction. Increasing small-acreage exurban development with livestock ("ranchettes") appears to be increasing the incidence of weedy exotic species such as cheatgrass (*Bromus tectorum*) and leafy spurge (*Euphorbia esula*) in these habitats.

### 6 Human Intrusions & Disturbance

Hunting and associated vehicle noise or off-road use is a source of disturbance in these habitats.

### 7 Natural System Modifications

Fire is a naturally occurring, highly variable natural disturbance in this habitat, and response to fire is variable between shrub species. Many of the characteristic shrub species are quick to resprout after a fire. Fire suppression has allowed tree invasion in some areas, or the development of dense stands outside the range of natural historic variation. These dense communities dominated by old, decadent shrubs with substantial amounts of standing dead organic matter are susceptible to more intense fire and slower recovery. Ecotonal areas between grassland and ponderosa pine or juniper savanna may be especially vulnerable to successional changes.

### 8 Invasives, Problematic Native Species, & Pathogens

Over-use by native herbivores has the potential to alter environmental factors such as species composition, soil compaction, nutrient levels, and vegetation structure. These effects may be compounded by winter use by large populations of native ungulates. Over-utilization by locally overabundant native cervids can lead to a decline in vigor, over-browsing, and a reduction of the most palatable species in this habitat type.

#### 11 Climate Change & Severe Weather

Projected warming temperatures by mid-century may alter the relative species composition of these shrublands, but little is known about the potential response of component species to changing climate.

### *Information Needs*

Improved understanding of fire recovery, effects of weeds on fire regime, regeneration requirements for mountain mahogany (*Cercocarpus montanus*), and relationship(s) among different grazing regimes in different soil types and weed invasion is needed. Little is known about the potential effects of projected warming conditions on the species that dominate these shrublands.

### *Conservation Actions*

Primary conservation needs are maintenance of appropriate patch size and mosaic, control of weeds, and improved grazing management.

# GRASSLANDS

## Foothill and Mountain Grasslands

### *Threats*

#### 1 Residential & Commercial Development

Native grassland habitat can be lost or fragmented by suburban and exurban development. Higher elevation grasslands on relatively flat sites are often in private ownership, and are often greatly sought after for residential development. The extensive grasslands of South Park, in particular, are threatened by the subdivision of large properties. Recreational use (public open space use in lower elevations; off-road vehicle and ATV use, hunters, packers, and snow mobilers in higher elevations) associated with increased human presence is an ongoing source of disturbance in this habitat.

#### 2 Agriculture

Historically, soil disturbance in this habitat was largely the result of occasional concentrations of large native herbivores, or the digging action of fossorial mammals. Domestic livestock ranching has changed the timing and intensity of grazing disturbance from that of native herbivores, and generally has altered species composition, soil compaction, nutrient levels, and vegetation structure. In combination with grazing of domestic livestock, various "range improvement" activities (e.g., seeding, rodent control, herbicide application) have the potential to alter natural ecosystem processes and species composition. Increasing small-acreage exurban development

with livestock ("ranchettes") appears to be increasing the incidence of weedy exotic species in these habitats. Exotics include *Linaria dalmatica, Centaurea spp., Bromus inermis, B. tectorum*, *Melilotus officinalis*, and others. The current rate of conversion of lower elevation native grassland to cropland is low, but remains a threat for some limited areas.

### 4 Transportation Corridors

Native grassland habitat can also be lost or fragmented by suburban and exurban development, and transportation or utility infrastructure development. The extensive grasslands of South Park, in particular, are threatened by the development of transportation corridors.

### 7 Natural System Modifications

Historically, fire was a regular disturbance in these grassland habitats. Fire-return intervals have been considerably lengthened since settlement by European-Americans, and suppression has allowed the invasion of woody species, especially in combination with heavy grazing (Mast et al. 1997, 1998). Although woodlands and savannas are expected to occur naturally on the landscape, alteration of fire intensity and frequency, grazing, and changes in climate has resulted in various densities of younger trees occurring on sites that were once shrublands or grasslands (West 1999). Ecotonal areas between grassland and ponderosa pine or juniper savanna may be especially vulnerable to successional changes.

### 8 Invasives, Problematic Native Species, & Pathogens

Seeding with non-native pasture grasses and invasion by exotic forbs has altered species composition in these grassland habitats, and will continue to do so.

### 11 Climate Change & Severe Weather

Climate projections for mid-century indicate that foothill and mountain grasslands of Colorado will experience significant temperature increases. Vulnerability of these habitats to climate change is greater at elevations below 7,500 feet. The highly disturbed condition of most occurrences, especially at lower elevations, and the vulnerability of these areas to invasive species, are likely to interact with the rising temperature across much of the distribution of the habitat in Colorado to reduce resilience of these habitats.

## *Information Needs*

An improved understanding of the potential impacts of climate change is needed.

## *Conservation Actions*

Actions will depend upon which specific threats are impacting a site and must be planned on a site specific basis. Excessive off-road use will require significantly different conservation and management actions than will implementing a grazing plan to improve grassland habitat by altering timing, duration, and intensity of livestock production on private grasslands to address changes in plant height, density and composition.

# Mixed and Tallgrass Prairie

## *Threats*

### 1 Residential & Commercial Development

These grassland habitats can be fragmented by urban, suburban and exurban development, and associated infrastructure development.

### 2 Incompatible Agriculture

Grazing by domestic livestock, which differs in timing and intensity from grazing by native herbivores, is an ongoing threat that alters species composition, soil compaction, nutrient levels, and vegetation structure. Some areas may be vulnerable to runoff or drift of agricultural fertilizer and pesticides. Invasive species are most prevalent near areas disturbed by cultivation. The current rate of conversion of mixed-grass habitat to cropland has been comparatively low, but remains a threat for some limited areas in northeastern Colorado. Recent legislative reductions of Conservation Reserve Program acreage, together with improved prices for cultivated crops, have increased the likelihood that areas of this habitat will be converted to agricultural use. Remaining tallgrass areas are generally protected and not threatened by large scale habitat conversion, but past conversion to cropland has eliminated the majority of this habitat type in Colorado.

### 3 Energy Production & Mining

Energy development (oil and gas exploration and production, wind turbine farms) are a source of habitat fragmentation in mixed-grass habitats.

### 4 Transportation Corridors

Roads and utility corridors associated with urban, suburban, exurban, and energy development are a source of habitat fragmentation for these grasslands.

### 7 Natural System Modifications

Fire suppression has contributed to the increased growth of woody species in native grasslands (Bock and Bock 1998).

### 8 Invasives, Problematic Native Species, & Pathogens

Within the range of mixed-grass and tallgrass prairie in northeastern Colorado, major problem species include cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola kali*), Canada thistle (*Cirsium canadensis*), musk thistle (*Carduus nutans*), and knapweed (*Centaurea* spp.). Tallgrass habitat in Colorado is susceptible to invasion by non-native grasses such as smooth brome and Kentucky bluegrass.

#### 11 Climate Change & Severe Weather

Under two widely-used climate change models (National Assessment Synthesis Team 2000), as levels of atmospheric $CO_2$ increase, the predicted scenario for much of the range of mixed-grass prairie in the Central Shortgrass Prairie Ecoregion is a shift away from grassland to either shrubland/woodland (under increased precipitation conditions) or arid land (under decreased precipitation).

### *Information Needs*

An improved understanding of the potential impacts of climate change is needed.

### *Conservation Actions*

This habitat type is very important to many grassland nesting birds in Colorado and most of the historic habitat has been converted to urban and agricultural uses. The use of conservation easements is the most effective tool to address development and conversion pressures where intact examples remain. Re-establishing this habitat type through programs such as the Conservation Reserve Program is a high priority for many species. Great care needs to be taken in the development of seed mixes, as experience has shown substantial issues in maintaining diverse mixed and tall grass habitat when certain aggressive native species (western wheatgrass and sideoats grama) or aggressive non-natives (smooth brome and crested wheatgrass) are included in mixes.

Mixed and tallgrass prairies still exists within functional landscapes associated with riparian creek bottoms and well managed sandhills in northeastern and east-central Colorado. In these situations, continuing or improving grazing management of domestic livestock is necessary to maintain or improve habitat condition. This habitat type is the most threatened and limited of the grassland habitat types in eastern Colorado, and wildlife use is extremely high where this habitat type has been restored.

## Shortgrass Prairie

### *Threats*

#### 1 Residential & Commercial Development

Habitat loss is a continuing threat to shortgrass prairie. Residential and commercial development is a significant source of habitat loss and fragmentation on the western margins of Colorado's shortgrass prairie distribution; it is less so in other areas, but rarely entirely absent.

### 2 Incompatible Agriculture

In the northeastern portion of Colorado, patterns of land cultivation, including windbreaks, have largely fragmented the matrix of the shortgrass prairie, reducing or eliminating connectivity for species that depend on prairie habitats, and this trend is likely to continue. There has been significant conversion pressure in eastern Colorado the past several years as the commodity prices and federal crop insurance policies have combined to exert significant conversion pressure of all grassland types, including shortgrass prairie, to cropland.

Grazing by domestic livestock is the primary use of remaining shortgrass prairie. Management for increased livestock production tends to produce a more homogeneous grassland dominated by key forage species (Fuhlendorf and Engle 2001), and requires additional management effort to restore a mosaic of habitat structure suitable for characteristic wildlife species. Thus, there is an ongoing threat of habitat degradation or loss of function for shortgrass prairie.

### 3 Energy Production & Mining

Development of oil and gas resources is ongoing in shortgrass prairie habitat, especially in the Niobrara shale of the Denver-Julesburg Basin that lies under most of the northern portion of shortgrass prairie extent in Colorado. The density of associated roads, pipeline corridors, and infrastructure is a primary source of anthropogenic disturbance, fragmentation, and loss in this habitat. Disturbance from wind energy development remains small from a statewide perspective, but can have significant localized effects. Utility-scale solar installations have thus far been confined to areas near urban development, but there is a potential for future disturbance from this type of facility, which would require associated utility corridor development.

### 7 Natural System Modifications

Domestic livestock grazing and fire suppression have altered the natural fire regime of this habitat, contributing to changes in structure and species composition, including increased growth of woody species (Bock and Bock 1998).

### 8 Invasives, Problematic Native Species, & Pathogens

Within the range of shortgrass prairie in northeastern Colorado, major problem species include Russian thistle (*Salsola kali*), cheatgrass (*Bromus tectorum*), Canada thistle (*Cirsium canadensis*), musk thistle (*Carduus nutans*), and knapweed (*Centaurea* spp.).

### 11 Climate Change & Severe Weather

Climate projections for mid-century indicate that the eastern plains of Colorado will experience significant temperature increases, and an increase in drought days. Although the dominant species of this habitat are well adapted to warm and dry conditions, blue grama in particular can be slow to recover from drought. Warmer and drier conditions could lead to a shift in the relative abundance of shortgrass prairie species, with the resulting development of novel plant

communities. In particular, warmer night-time temperatures are likely to favor cool-season species, both native and exotic. However, due to uncertainties in future precipitation patterns, the effect of increasing temperatures on this habitat is difficult to predict.

### *Information Needs*

An improved understanding of impacts of climate change is a significant need, as is better information on the relationship(s) among climate and ecological process (e.g., fire) factors and shrub invasion. Data on impacts of energy development are lacking.

### *Conservation Actions*

This grassland habitat type is the most abundant in Colorado and, while degraded, is generally in better functioning ecological condition than the other grassland habitat types in eastern Colorado. The use of conservation easements is the most effective tool to address development and conversion pressures in this habitat type. Effective outreach to improve grazing management that restores vegetation condition, function, and structure will address other threats in this habitat type. Several important forbs, shrubs, and half shrubs (i.e., winterfat, native prairie clovers, leadplant) associated with this habitat type are absent or heavily reduced, negatively impacting wildlife habitat potential; this can be addressed by effectively implementing improved grazing management on public and private shortgrass prairies.

# RIPARIAN AND WETLAND HABITATS

## Playas

### *Threats*

#### 1 Residential & Commercial Development

Conversion of playa-containing watersheds to urban/exurban development, and associated roads or utility corridors is an ongoing threat to this habitat.

#### 2 Incompatible Agriculture

Agriculture and associated infrastructure is a source of stressors such as culturally-accelerated sedimentation, pollution, runoff of fertilizer or pesticides, and invasion by exotic species. Specific agricultural stressors include tilling, and continuous, intensive grazing. Plowing can alter native plant communities, removing perennial plants and decreasing species richness (O'Connell et al. 2013). Potential effects of these changes on the quality of food and cover for SCGN in Colorado are generally unknown.

### 3 Energy Production & Mining

Energy development (especially oil and gas drilling) is another source of disturbance in these habitats, especially in the northern part of the eastern plains. Like urban development, primary issues revolve around direct habitat loss, as well as the fragmentation that occurs from roads, utility corridors, and associated infrastructure.

### 7 Natural System Modifications

Although most playas are already altered to some extent, the threat of additional direct hydrologic modification, or modifications within the immediate watershed, is ongoing for playa habitat in Colorado. Specific stressors include culturally-accelerated sedimentation, pit excavation to increase water storage, and runoff diversion.

### 8 Invasives, Problematic Native Species, & Pathogens

Altered playas may be more vulnerable to colonization by exotic species, although highly invasive species with the potential to dramatically alter habitat are generally not an issue. The potential consequences of the loss of native plant diversity in these habitats is not known.

### 9 Pollution

Both urban areas and rural croplands are sources of pesticide (Kimbrough and Litke 1996) or fertilizer runoff (Carpenter et al. 1998; White et al. 2003). Non-point source pollution is high in agricultural and urban landscapes of Colorado's eastern plains.

### 11 Climate Change & Severe Weather

Our climate change vulnerability analysis (Appendix F) indicated that playas in eastern Colorado are highly vulnerable to the effects of climate change by mid-century. The exposure of this habitat to projected increases in temperature and drought frequency, as well as the high level of previous anthropogenic impacts, are primary factors contributing to this assessment result. Although there are not very many direct effects of climate change on playas as geologic features, playas as functioning wetland habitat are likely to decrease under climate change.

## *Information Needs*

Analyzing playa hydroperiods over time to determine if there are long-term declining trends due to climate change and/or hydrologic alterations is needed. It is unknown to what extent culturally-accelerated sedimentation is impacting playas in northeast Colorado. At some level, sedimentation is necessary for the formation of playas. Additional work needs to be done in Colorado to determine if increased or more rapid sedimentation is actually occurring, and if Colorado playas warrant management. It is generally assumed that they do, but applying general management treatments such as sediment removal has the potential to degrade or eliminate the playa if done incorrectly and without knowledge of whether the sediment load in the playa is actually excessive and in need of management.

### *Conservation Actions*

Protection and restoration needs include 1) using newly-developed prioritization tools developed by the Playa Lakes Joint Venture to target playas and playa complexes for protection and restoration; 2) where warranted, restoring playa hydrology by filling pits, removing excess accumulated sediments where appropriate, and planting grass buffers, and 3) compatible site-specific management of grazing through fencing, providing alternate water sources, and grazing plans.

Site-specific assessment is the first and most important conservation action to apply to playas before initiating any management action. Depending on the outcome of the assessment, sediment removal and/or buffering may or may not be warranted. In many cases, standard playa recommendations are both unnecessary and can be detrimental. Playas require localized run-off to fill, and some level of small particulate clay sedimentation is necessary to maintain water levels and function. On occasion, buffers that are too large are so effective at slowing or preventing run-off that the playa basin does not fill, and playas are most important to wildlife when they have water in their basins. In all cases where possible, filling a pit or ditch dug out within the playa basin is warranted and necessary to restore proper hydrologic function. Pits should be filled with nearby spoils piles which are almost always directly adjacent to the pit, which will contain the clay sediments necessary to maintain the underlying clay pan. Ditches should simply be smoothed over. Where pits are used to provide water for livestock developing alternative upland water sources is preferable to having a pit.

## Riparian Woodlands and Shrublands

This category combines many specific habitats across the range of elevational gradients in Colorado. The setting, function, and land uses within the habitats vary, depending on whether one is considering waterways in the eastern prairies and foothills, the high country, or the deserts and canyonlands of the western slope. Summaries of threats for these habitats are discussed by geographic region as needed.

### *Threats*

#### 1 Residential & Commercial Development

Colorado's riparian habitats continue to be threatened by urban, exurban, and recreational development in adjacent uplands. Effects of these activities can contribute to a gradual loss of habitat area and quality. Land use within the riparian area, as well as in adjacent upland areas, can fragment the landscape and reduce connectivity between riparian patches, and between riparian and upland areas. This adversely affects the quantity, quality, and movement of surface water and groundwater, cycling of nutrients, and dispersal of plants and animals in riparian

habitats. Roads, bridges, and other infrastructure associated with development can also fragment and degrade riparian habitats. In particular, the increase of impervious surface area associated with development can increase runoff, including non-point source pollution.

### *Eastern Plains*

Urbanization is widespread along the western edge of the plains and in the foothills ecotones. In these areas the threat of habitat fragmentation and loss from residential development is ongoing.

### *Mountains*

Threats to riparian woodlands and shrublands in mountain areas of Colorado vary with elevation. Residential and commercial development occurs in comparatively limited distribution, and tends to be more concentrated along major transportation corridors and near large recreational developments.

### *Western Slope*

As in the eastern plains and mountainous regions of Colorado, altered hydrologic regime (e.g., dams, diversion, roads) is an important primary threat to riparian habitats on the West Slope. Threats to riparian habitats from ongoing urban and exurban development are generally less severe than on the Front Range, but not absent. Agricultural activities are ubiquitous in lower elevations, including irrigated tilled and untilled crops, and domestic livestock grazing. The greatest level of impact is in the vicinity of Grand Junction/Palisade, and in the four corners area of southwestern Colorado.

## 2 Incompatible Agriculture

Colorado's riparian habitats continue to be threatened by agricultural activities (e.g., crop production, livestock grazing, and concentrated animal feeding operations) in adjacent uplands. Across most of the eastern prairie, agricultural production, both ranching and cropland, is the dominant land use. Grazing is an ongoing land use in mountain and West Slope riparian areas. Many West Slope and lower elevation mountain riparian areas are irrigated and mowed for forage production. Effects of these activities can contribute to a gradual loss of habitat area and quality. Land use within the riparian area, as well as in adjacent upland areas, can fragment the landscape and reduce connectivity between riparian patches, and between riparian and upland areas. This adversely affects the quantity, quality, and movement of surface water and groundwater, cycling of nutrients, and dispersal of plants and animals in riparian habitats.

In riparian areas where livestock use is heavy, plant community composition and structure has been altered, as have channel morphology, water quality, soil structure, streamflow patterns, erosion and sedimentation rates (Schulz & Leininger 1990; Armour et al. 1994; Trimble and Mendel 1995; Belsky et al. 1999; Bestcha et al. 2013). This is especially true where cattle concentrate in riparian areas that are not protected by fencing. However, appropriate timing and intensity of grazing can be used as a management tool to improve the seasonal quality of habitat

used by some SGCN (e.g., Manier et al. 2013), if tradeoffs for various species requirements are considered (Van Horn et al. 2012).

### 3 Energy Production & Mining

Gravel mining is common along the larger rivers in Colorado. Impacts from this activity, as well as past and current impacts from other types of extractive mining, are widespread in the South Platte and Arkansas River basins, and throughout the high mountains and southwestern Colorado. Oil and gas production is a potentially significant source of impact, particularly in the South Platte basin and northwest Colorado.

### 4 Transportation & Service Corridors

Many of Colorado's larger rivers and streams have roads and/or railroads that run alongside or nearby. For many rural and less traveled roads, impacts are likely localized. In areas where road density is very high and road crossings are common, impacts to riparian habitats can be severe. Issues include altered flows, pollution, fragmentation, erosion and downcutting (incision) that leads to loss or degradation of wet meadows. The largest, most concentrated road density in the state is in the Front Range urban area. Other areas of significant impact include the intensively cultivated eastern plains (TNC in prep).

### 7 Natural System Modifications

Alteration of natural hydrological processes and resource consumption through groundwater pumping have considerably altered the pre-settlement condition of riparian, and wetland habitats, and are an ongoing threat. Dams, reservoirs, diversions, channelization, ditches and other human land uses alter the natural flow regime of streams, and can disrupt the ecological integrity of the riparian habitats. Habitat modifications for flood control can greatly reduce the spatial complexity of riparian and wetland habitat. Physical changes resulting from altered flow regimes include erosion and channelization, reduced complexity in channel morphology, reduced base and/or peak flows, lower water tables in floodplains, tree and shrub establishment on sandbars due to reduced scouring flows, and altered sediment transport and deposition in the floodplain (Poff et al. 1997).

#### *Eastern Plains*

Most hydrological alteration is due to agricultural needs, except in highly developed areas along the Front Range, where urban uses are overtaking agricultural use. Continued groundwater pumping from the Ogallala-High Plains aquifer has lowered the water table such that many formerly flowing streams are now dry for much of the year (Dodds 1997). The main stems of the South Platte and the Arkansas Rivers, as well as the Purgatoire and portions of the Republican Rivers, are highly impacted by reservoirs and dams (TNC in prep).

### *Mountains*

Except at the highest elevations, few mountain aquatic and riparian habitats are without hydrological modification, and the ongoing stresses from reservoirs, dams, diversions, and similar alterations include downstream erosion and channelization, reduced channel morphology dynamics, reduced base and/or peak flows, lower water tables in floodplains, and reduced sediment deposition in the floodplain (Poff et al. 1997). The upper Colorado River, in particular, is highly impacted by reservoir storage (TNC in prep).

### *Western Slope*

The construction of dams in the Colorado River Basin has fragmented and inundated riverine habitat. The altered timing, rate, quantity, and temperature of flows changes recruitment and survival patterns for riparian vegetation.

#### 8 Invasives, Problematic Native Species, & Pathogens

Seeding with non-native pasture grasses and invasion by tamarisk and exotic forbs has already altered species composition in riparian habitats, and will continue to do so. Invasive species with the potential to alter ecosystem function (e.g., tamarisk) are an ongoing management challenge, especially along the Arkansas and Purgatoire Rivers in eastern Colorado, and the upper Colorado, Dolores, San Juan and White Rivers on the western slope (TNC in prep). These disturbances are likely to continue to reduce habitat area and quality in riparian habitats.

#### 9 Pollution

Both urban areas and rural croplands are sources of pesticide (Kimbrough and Litke 1996) or fertilizer runoff (Carpenter et al. 1998; White et al. 2003). These stressors can affect the riparian community composition and structure. Non-point source pollution in Colorado riparian areas is highest in agricultural and urban landscapes in the eastern plains, and along developed stream corridors elsewhere.

#### 11 Climate Change & Severe Weather

Riparian woodlands and shrublands throughout the state should probably be regarded as having some degree of vulnerability to climate change, especially the potential for increasing frequency and/or magnitude of multi-year droughts.

## *Information Needs*

A critical need is an evaluation of the results of implemented restoration projects. Other information needs include developing assessment techniques, and conducting field-based assessments to determine the quantity and quality of riparian woodland and shrubland habitat currently available for Tier 1 wildlife species. Development of decision support tools is needed for prioritizing riparian woodland and shrubland habitats for conservation, based on anticipated benefits to Tier 1 wildlife species. Tools for determining flows needed to maintain healthy

riparian habitats, including spring peak flows, gradual recedence after the peak, and maintenance flows in summer, fall and winter need to be developed for many major rivers and minor streams.

### *Conservation Actions*

Control of invasive vegetation and replanting with native species where appropriate is needed. Other needs include reducing erosion by restoring streambed and bank morphology and revegetating as appropriate; managing grazing to be compatible with habitat requirements; and clearing trees and shrubs from sandbars, and reshaping as appropriate to encourage overtopping and sand movement. Private Sector Standards and Codes should prohibit development in riparian zones within at least the 100-year floodplain.

Conservation actions needed for riparian areas on small streams include: restoration of degraded stream reaches; protecting seeps and springs from development; control of invasive species; compatible management of grazing (including native and non-native ungulates); proper placement of roads, road crossings, and culverts; and protection (e.g., via conservation easements) within watersheds that are important for wildlife. Conservation actions needed for riparian areas on large rivers include: restoration of hydrologic regime; restoration of degraded riparian areas and river beds; improved design of road crossings to eliminate erosion, down cutting, and head cutting; hay meadow restoration; avoidance of additional dam/diversions construction, and possible removal of obsolete or abandoned dams and diversions; and use of conservation easements to protect private lands that control or directly influence large stretches of river.

## Wetlands

This category combines many distinctive habitats across the range of elevational gradients in Colorado. The setting, function, and land uses within the habitats vary, depending on whether one is considering wetlands in the eastern prairies and foothills, the high country, or the deserts and canyonlands of the western slope. Summaries of threats for these habitats are discussed by geographic region as needed.

### *Threats*

#### 1 Residential & Commercial Development

Wetlands of Colorado's eastern plains continue to be threatened by urban and exurban development, which contribute to a gradual loss of habitat area and quality. With the exception of lower elevations in the Front Range foothills, wetlands of other areas in Colorado are generally not threatened by additional residential or commercial development.

### 2 Incompatible Agriculture

#### *Eastern Plains*

Agricultural activities (e.g., crop production, livestock grazing, and concentrated animal feeding operations) in adjacent uplands, generally contribute to a gradual loss of wetland habitat area and quality. Many wetlands in eastern Colorado occur as a result of water developments for primarily agricultural purposes. While these wetlands have developed relatively recently, they provide important wetland habitat for many species. In these situations, water development has been a positive for wildlife and wetland habitat in Colorado. However, reallocation of this water from agricultural use to municipal use is a significant an increasing threat to many wetlands in eastern Colorado. Moreover, the creation of wetlands through water management activities is not always an adequate substitute for preservation of natural wetlands (Sueltenfuss et al. 2013). Timing and intensity of grazing can affect the seasonal quality of habitat used by some SGCN and may be suitable for use as a habitat management tool in these instances, if tradeoffs for various species requirements are considered (West and Messmer 2006).

#### *Mountains*

With the exception of the extensive wetlands of the San Luis Valley, where groundwater pumping and diversions are widespread, wetland habitats in mountain areas of Colorado are generally less threatened by agriculture than those in lower elevations of the state.

#### *Western Slope*

Hanging gardens are an especially fragile wetland type of the western slope. Where they are accessible to livestock, erosion, trampling, and introduction of exotic species are an ongoing threat.

### 4 Transportation & Service Corridors

In areas where road density is very high and road crossings are common, impacts to wetland habitats can be severe. Issues include altered hydrographs, pollution, and fragmentation that lead to loss or degradation of wetland habitat. The largest, most concentrated road density in the state is in the Front Range urban area. Other areas of significant impact include the intensively cultivated eastern plains (TNC in prep).

### 7 Natural System Modifications

Wetland habitats have been heavily impacted by anthropogenic water management (Gage and Cooper 2007). Altered hydrology due to dams, diversions, and groundwater pumping may interact with warming temperatures and changes in precipitation pattern to alter groundwater recharge rates, leading to drying or contraction of wetlands, including small seeps and springs that support hanging gardens. Lack of scouring flows in adjacent lotic habitat has resulted in sedimentation and dominance of late successional wetland plants in many floodplain wetlands (e.g., warm water sloughs). Prairie wetlands have evolved under a disturbance regime where

both annual variation in the hydrological cycle and the incidence or intensity of weather extremes such as drought and flooding from year to year interact with other natural processes to produce a diverse patchwork of community types and successional states that provide habitat for many wildlife species. In general, intensive water management has greatly altered the flooding regime of many marshes, with consequent changes in species composition and community structure.

### 8 Invasives, Problematic Native Species, & Pathogens

Altered wetlands may be more vulnerable to invasion by exotic species, or loss of diversity. Some wetlands, especially in urban and agricultural areas, have seen increased hydroperiods during the growing season and resulting monocultures of cattails.

### 9 Pollution

Both urban areas and rural croplands are sources of pesticide (Kimbrough and Litke 1996) or fertilizer runoff (Carpenter et al. 1998; White et al. 2003). These stressors can affect the wetland community composition and structure. Non-point source pollution in Colorado wetlands is highest in agricultural and urban landscapes in the eastern plains, and along developed valley corridors elsewhere.

### 11 Climate Change & Severe Weather

Wetlands throughout the state should probably be regarded as having some degree of vulnerability to climate change. Increased frequency and magnitude of drought is likely to have significant impact on these habitats.

## *Information Needs*

Develop decision support tools for prioritizing wetland habitats for conservation, based on anticipated benefits to Tier 1 wildlife species. Also, develop assessment techniques and conduct field-based assessments to determine the quantity and quality of wetland habitat currently available for Tier 1 wildlife species, and to evaluate the results of restoration.

## *Conservation Actions*

Restore wetlands and create new wetlands where possible by managing water and hydrology. Where appropriate, excavate sediments and protect wetlands from further sedimentation and erosion. Manage grazing and cattail monocultures to promote plant diversity. Reshape gravel ponds to increase shallow margins and promote establishment of wetland vegetation. Restore historic function of warm-water slough and wet meadow habitats. Employ land and water protection tools where possible to alleviate pressures from habitat conversion and hydrological modifications.

# AQUATIC HABITATS

Aquatic and riparian habitats are inextricably linked in terms of ecological processes, and therefore, threats operating on one will often also impact the other. The setting, function, land uses, and threats within these habitats vary, depending in part on elevation, but also on whether one is considering waterways in the eastern prairies & foothills, the high country, or the deserts and canyonlands of the western slope. Regional differences are summarized as needed. Although we have summarized aquatic and riparian habitats separately, there is inevitably some overlap in threats and actions.

## Rivers

### *Threats*

#### 1 Residential & Commercial Development

Colorado's river habitats continue to be threatened by changes in water withdrawal patterns driven by commercial, urban, exurban, and recreational development. Land use within the catchment area can adversely affects the quantity, quality, and movement of surface water and groundwater, cycling of nutrients, and dispersal of plants and animals in aquatic habitats. Roads, culverts, bridges, and other infrastructure associated with development can also fragment and degrade aquatic habitats.

##### *Eastern Plains*

Urbanization is widespread along the western edge of the plains and in the foothills ecotones. According to an analysis by The Nature Conservancy, the eastern plains rivers and streams, including the Arkansas and the South Platte Rivers, are the most heavily impacted by urban consumptive use in Colorado. Rivers and streams are especially impacted in the urban area from Denver to the Wyoming border (TNC in prep).

##### *Rio Grande Valley*

Commercial development occurs in comparatively limited distribution in the vicinity of Alamosa, and residential development tends to be concentrated along major transportation corridors and near recreational areas.

##### *Western Slope*

Threats to aquatic habitats from ongoing urban and exurban development are generally less in most areas of Colorado's west slope in comparison with the Front Range, but not absent. Areas of greatest commercial or recreational development impact are in the valleys of the Colorado, Gunnison, and Uncompahgre rivers, while exurban development is widespread throughout southwestern Colorado.

### 2 Incompatible Agriculture

The primary impact of agricultural activities (e.g., crop production, livestock grazing, and concentrated animal feeding operations in adjacent uplands) on rivers is the withdrawal of surface and groundwater. Irrigation is the leading water use in Colorado, where on an annual basis, about two-thirds of all allocated surface water goes to this use (CDWR 2012). However, degradation of riparian vegetation, both through direct alteration by cultivation or mowing, and indirectly through modified water levels, also alters the habitat quality and food web that supports aquatic species. Some fish rely on habitat structure associated with downed woody riparian vegetation and temperature moderation provided by shade from overhanging vegetation. Riparian vegetation also contributes directly to the aquatic food web, as berries, leaf litter, and associated terrestrial invertebrates falling into the water support aquatic invertebrates and fish. Finally, riparian vegetation can buffer the effects of agricultural runoff into freshwater ecosystems.

#### *Eastern Plains*

According to an analysis by The Nature Conservancy, the eastern plains rivers and streams are heavily impacted by consumptive use for irrigation in the agricultural landscapes of the South Platte, Arkansas, and Republican River basins (TNC in prep).

#### *Rio Grande Valley*

Agriculture is a primary land use in the San Luis Valley, a source of impact related to consumptive use and an ongoing source of degradation of aquatic habitats at lower elevations, though not to the degree experienced on the eastern plains (TNC in prep).

#### *Western Slope*

Threats to aquatic habitats from agricultural activities are ubiquitous in lower elevations, including irrigated tilled and untilled crops, and domestic livestock grazing. The greatest level of impact is in the vicinity of Grand Junction/Palisade, the valley of the Gunnison and Uncompahgre south of Grand Mesa, and in the four corners area of southwestern Colorado. Irrigation contributes to high selenium concentrations in upper Colorado River, the Gunnison River, and the San Juan River (Anderson et al. 1961). Irrigation and groundwater pumping can result in high levels of selenium that may affect the survival and reproductive success some aquatic SGCN.

### 7 Natural System Modifications

Patterns of water flow and their interaction with local landforms and substrates at a variety of scales are the primary determinant of physical habitat for river organisms. Aquatic organisms evolved with and are adapted to the characteristic natural flow regime of their habitat; changes in flow regime can cause serious disruption to the reproduction and survival of many aquatic species, leading to an eventual loss of biodiversity (Poff et al. 1997; Bunn and Arthington 2002). Reduced connectivity in aquatic habitats, both in-stream, and between the river channel and

associated floodplain habitats, reduces habitat availability and diversity, with consequent negative effects on the population viability of aquatic species. Altered flow regimes, and trans-basin diversions can facilitate the invasion and establishment of exotic species (Bunn and Arthington 2002). Finally, riverine systems act to integrate and collect the effects of disturbances within the catchment, including those due to flow modification (Naiman et al. 2002).

### *Eastern Plains*

Ongoing and extensive water diversions and impoundments in the Great Plains began in the 1860s, and, along with groundwater mining and transbasin diversions, have greatly altered the hydrologic regime of rivers on Colorado's eastern plains. Prior to settlement, the large rivers heading in the mountains (the South Platte and the Arkansas) would have experienced high flows in spring during snowmelt, and have been nearly dry during other times of year (Escher et al. 1983). Reservoir and diversion construction have decreased peak flows, and converted the hydrograph to a flatter, more consistent perennial flow, generally facilitating the development of riparian forest and narrower channels (Wohl et al. 2009). Alterations are particularly pronounced on the South Platte and Arkansas Rivers, and have had significant impacts on species that rely on these habitats, particularly many species of native fish that evolved with more variable flows. Colorado's obligations under the South Platte River Compact, Republican River Compact, and Arkansas River Compact also play a significant role in the regulation of flows in this region.

### *Rio Grande Valley*

The northern part of the San Luis Valley is a hydrologically closed basin; in the southern part of the valley the Rio Grande River is the primary riverine habitat in the region. The upper Rio Grande is snowmelt fed, with peak flows during late spring to early summer. High year to year variability of streamflow level is characteristic of this river system and unregulated annual streamflow volume can differ by an order of magnitude (Llewellyn and Vaddey 2013). Agricultural diversions began in the mid-19$^{th}$ century; at one point substantial flow was diverted from the Rio Grande to storage in the closed basin aquifer. Eventually, these diversions were reduced, and largely replaced by groundwater pumping. The hydrograph of the upper Rio Grande is less impacted by modifications than in lower reaches outside Colorado; however, in the San Luis Valley the requirements of the Rio Grande Compact with New Mexico and Texas affect the allocation of water.

### *Western Slope*

Streamflow in western slope rivers comes mainly from winter storms that build snowpacks in the high mountains of western Colorado; snowmelt produces peak annual flows between April and July. Atmospheric circulation patterns and sea-surface temperatures produce high year to year variation in annual flow levels. Impoundments and diversions are common on most of Colorado's West Slope rivers, and have altered the annual hydrograph. The construction of dams in the Colorado River Basin has fragmented and inundated riverine habitat; altered timing,

rate, quantity, and temperature of flows; affected seasonal availability of aquatic habitats; decreased turbidity (i.e., loss of cover from predators, loss of sandy backwater habitat); and blocked fish passage. In particular, large dams such as Flaming Gorge, Navajo, and the Aspinall Unit, and associated alterations have directly influenced thermal and hydrological regimes in both the Lower and Upper Colorado River basins, with resultant adverse impacts to native fish species. The Colorado River and Upper Colorado River Compacts affect allocation and flow patterns for the entire western slope.

### 8 Invasives, Problematic Native Species, & Pathogens

The quality of river habitats for fish species of concern is degraded by the presence of non-native fish that compete with and/or hybridize with native species. Impoundments are widespread potential sources of non-native fish species, which in some cases escape into SGCN habitat to the detriment of the native fishes. The growth of non-native riparian plant species, especially tamarisk and Russian olive, alters flow patterns by stabilizing channels and reducing riverine habitat diversity. These species may also increase shading of aquatic habitats, and alter nutrient inputs, thereby changing food availability for native species.

### 9 Pollution

#### *Eastern Plains*

Mining and energy production impacts water quality, especially in the Arkansas (mining) and Purgatoire (coalbed methane) rivers. Issues include increased concentrations of pollutants (heavy metals, saline) and wastewater (alteration of stream flows as well as pollution). Stochastic events such as extreme rainstorms and mudslides can exacerbate these impacts, potentially leading to significant impacts on SGNC (e.g., extensive fish kills).

#### *Mountains*

Mining in Colorado has altered stream channel geometry, contributed to higher sediment loads, and released toxic substances such as heavy metals. Copper and cyanide from the Summitville Mine were released into the headwaters of the Alamosa River beginning in 1986 (Csiki and Martin 2008). The spill and chronic contamination from Summitville Mine downstream on Wightman Fork to Alamosa River and through Terrace Reservoir left the river and reservoir fishless[16]. In 1997, heavy metals from historic mines were flushed by a summer rainstorm into Kerber Creek. All fish in Kerber Creek died, along with 43% of the fish in a 4km stretch of San Luis Creek (Alves 1997a; Bestgen, Compton, Zelasko, and Alves 2003).

[16] A new treatment facility at Summitville Mine has significantly improved water quality below Wightman Fork confluence on the Alamosa River to Terrace Reservoir.

### *Information Needs*

Analysis of hydroperiods over time to determine flows needed to maintain riverine habitat diversity is needed. Decision support tools are needed for prioritizing rivers for conservation and restoration, based on anticipated benefits to Tier 1 wildlife species.

### *Conservation Actions*

Conservation actions needed for large rivers include: restoration of key components of the hydrologic regime; restoration of degraded river beds; improved design of road crossings to eliminate erosion, down cutting, and head cutting; floodplain restoration; avoidance of additional dam/diversions construction, and possible removal of obsolete or abandoned dams and diversions; and use of conservation easements to protect private lands that control or directly influence large stretches of river.

## Streams

### *Threats*

#### 1 Residential & Commercial Development

Stream habitats in Colorado continue to be threatened by changes in water withdrawal patterns driven by urban, exurban, and recreational development. Land use within the catchment area can adversely affects the quantity, quality, and movement of surface water and groundwater, cycling of nutrients, and dispersal of plants and animals in aquatic habitats. Roads, culverts, bridges, and other infrastructure associated with development can also fragment and degrade aquatic habitats. In most areas of Colorado, commercial development along streams occurs in comparatively limited distribution and residential development tends to be concentrated along major transportation corridors and near recreational areas. Urbanization is most prevalent along the western edge of the plains and in the foothills ecotones. Development and transportation corridors in mountain areas of Colorado are generally concentrated in valley bottoms along streams; in mountainous areas development associated with tourism and recreation is ongoing. Exurban development is widespread throughout western Colorado.

#### 2 Incompatible Agriculture

The primary impact of agricultural activities (e.g., crop production, livestock grazing, and concentrated animal feeding operations in adjacent uplands) on streams is the withdrawal of surface and groundwater. Irrigation is the leading water use in Colorado, where on an annual basis, about two-thirds of all allocated surface water goes to this use (CDWR 2012).

##### *Eastern Plains*

Most streams of the eastern plains are characterized by intermittent surface flow, with dry stretches interrupted by pools that provide refuge habitat for plains fish. Flow patterns for these

streams are affected by changes in the water table level due to groundwater pumping and irrigation. These changes are most prevalent in areas overlying the Ogallala aquifer, which have been extensively developed for crop growing.

### *Rio Grande Valley*

Appropriation of surface water streams for agricultural use in the valley began in the 1850s. By 1900, the natural flow on all surface streams in the valley was over-appropriated. Because the construction of reservoirs for surface water storage was hindered by a series of embargos on the use of federal lands for reservoir construction, crop growers began using the unconfined aquifer of the closed basin as a storage reservoir through the practice of subirrigation, substantially elevating the water table in the closed basin (District Court, Water Division No. 3, Colorado. Confined Aquifer New Use Rules for Division 3, Case No. 2004CW24, Findings of Fact, Conclusions of Law, Judgment and Decree, November 9, 2006). Eventually, the combination of reduced diversions from the Rio Grande River to the closed basin and increased groundwater pumping lowered the groundwater table, eliminating the possibility for subirrigation of agriculture or wetlands. In the San Luis Valley the requirements of the Rio Grande Compact with New Mexico and Texas also affect the allocation of water.

### *Western Slope*

Valley bottoms throughout western Colorado are used for irrigated forage production (e.g., hay, alfalfa) and/or directly grazed. Diversions and storage dams are common.

## 7 Natural System Modifications

Patterns of water flow and their interaction with local landforms and substrates at a variety of scales are the primary determinant of physical habitat for stream organisms. Aquatic organisms evolved with and are adapted to the characteristic natural flow regime of their habitat; changes in flow regime can cause serious disruption to the reproduction and survival of many aquatic species, leading to an eventual loss of biodiversity (Poff et al. 1991; Bunn and Arthington 2002). Reduced connectivity in aquatic habitats, both in-stream, and between the stream channel and associated floodplain habitats, reduces habitat availability and diversity, with consequent negative effects on the population viability of aquatic species. Altered flow regimes, and trans-basin diversions can facilitate the invasion and establishment of exotic species (Bunn and Arthington 2002). Finally, stream systems act to integrate and collect the effects of disturbances within the catchment, including those due to flow modification (Naiman et al. 2002).

### *Eastern Plains*

Changes in streamflow patterns create barriers to aquatic species movement (stream de-watering, fragmenting formerly-continuous stretches of free-flowing streams) and reduced habitat quality (e.g., altered turbidity levels and sediment concentrations). Even small structures such as irrigation intakes, v-notch gauges, and culverts act as barriers to native plains fishes, fragmenting habitat and reducing population viability (Wohl et al. 2009).

### *Transition Zone Streams*

Hydrological modification to transition zone streams of the Colorado Front Range began with early mining practices, and was followed by extensive diversions and impoundments for agricultural and urban development (Wohl 2005). These modifications altered natural streamflow patterns, with consequent changes to sediment transport, water temperature, and in-stream habitat diversity.

### *Mountains*

Unmodified streams display a mosaic of habitats created by flow and sedimentation patterns. Extensive removal of beaver throughout Colorado in the first half of the 19th century probably had a considerable effect on channel structure, diversity, and stability, as well as sediment levels in mountain streams (Wohl 2006). Placer mining was an even stronger agent of hydrologic modification in many areas. Diversion dams tend to shift habitat toward slower flow and increased fine sedimentation (Baker et al. 2011). The legacy of these historic anthropogenic disturbances is reduced habitat suitability for native species.

### *Western Slope*

Water storage impoundments and diversions are common on most of Colorado's West Slope streams, and have altered the hydrograph of annual flow patterns. The construction of dams in the Colorado River Basin has fragmented and inundated stream habitat; altered timing, rate, quantity, and temperature of flows; affected seasonal availability of aquatic habitats; decreased turbidity (i.e., loss of cover from predators, loss of sandy backwater habitat); and blocked fish passage.

## 8 Invasives, Problematic Native Species, & Pathogens

The quality of river habitats for fish species of concern is degraded by the presence of non-native fish that compete with and/or hybridize with native species. In mountain streams, introduced salmonids are a threat to populations of native cutthroat trout. Impoundments are widespread potential sources of non-native fish species, which in some cases escape into SGCN habitat to the detriment of the native fishes. At lower elevations, the growth of non-native riparian plant species, especially tamarisk and Russian olive, alters flow patterns by stabilizing channels and reducing riverine habitat diversity. These species may also increase shading of aquatic habitats, and alter nutrient inputs, thereby changing food availability for native species. Finally, the freshwater diatom *Didymosphenia geminata* (commonly called didymo or rocksnot), although native to low-nutrient cold-water streams of the area, has the potential to become a problem in warmer, nutrient-rich systems because it is expanding its geographic range into such areas (Spaulding and Elwell 2007).

## 9 Pollution

Both urban areas and rural croplands are sources of pesticide (Kimbrough and Litke 1996) or fertilizer runoff (Carpenter et al. 1998; White et al. 2003). These stressors can affect the aquatic

community composition and resilience by increasing growth of algae, depleting oxygen levels, and direct mortality of aquatic species. Non-point source pollution in Colorado streams is highest in agricultural and urban landscapes in the eastern plains, and along developed stream corridors elsewhere.

### 11 Climate Change & Severe Weather

#### *Transition Zone Streams*

Under projected warming water temperatures at mid-century, the proportion of warm water reach length is likely to increase. Transitional areas would generally move up in elevation, and become concentrated in the mountain region. Without accounting for water temperatures maintained by storage release, cold water reaches may essentially disappear from the foothill streams of Colorado, and some species may not be able to migrate to suitable upstream reaches (Fink and Decker 2015).

## *Information Needs*

Analysis of hydroperiods over time to determine flows needed to maintain stream habitat diversity is needed. Decision support tools are needed for prioritizing streams for conservation and restoration, based on anticipated benefits to Tier 1 wildlife species. Evaluation of impacts from roads on the smaller streams is needed. Roads that are near or cross a small stream often downcut or channel the water in such a way that the wetted area shrinks in size when the water is flushed through the area at a more rapid pace, and thus is not able to spread out across the floodplain.

## *Conservation Actions*

Conservation actions needed for streams include: management of streamflows to maintain diversity of in-stream habitats; restoration of degraded stream reaches; protecting seeps and springs from development; control of invasive species; compatible management of grazing (including native and non-native ungulates); proper placement of roads, road crossings, and culverts; and protection (e.g., via conservation easements) within important wildlife watersheds.

# Lakes and Reservoirs

## *Threats*

### 1 Residential & Commercial Development

Most natural lakes in Colorado are not heavily impacted by development because they are small and located at high elevations. Residential and recreational development are a primary source of disturbance for reservoirs and shorelines, especially if connected with larger water bodies in locations favorable for recreational activity (e.g., scenic areas or easily accessible from urban areas). Smaller reservoirs associated with flood control or water storage on smaller streams are not generally impacted.

### 6 Human Intrusions & Disturbance

Both lakes and reservoirs provide habitat for SGCN, and recreational use of these areas can be a disturbance during seasonally important life cycle events (e.g., breeding, nesting) for some species.

### 9 Pollution

Atmospheric deposition (air pollutants deposited to ecosystems) occurs in both wet deposition through rain, snow, cloud or fog, and as dry deposition via dust and gases. Atmospheric nitrogen and sulfur deposition can change water chemistry and thereby impact aquatic vegetation, invertebrate communities, amphibians, and fish. High elevation lakes are particularly sensitive to nitrogen and sulfur deposition, and receive more deposition than lower elevations due to greater amounts of snow and rain. High elevation lakes are especially sensitive to acidification from sulfur and nitrogen deposition and excess nitrogen enrichment, although buffering capacity varies with local geology. Non-point sources of nitrogen and phosphorus (runoff from urban and agricultural areas) produce eutrophication resulting in algal blooms and fish kills in some reservoirs and lakes.

## *Information Needs*

Identify areas where recreational activity may be impacting habitat use by Tier 1 wildlife species. Develop decision support tools for prioritizing lake or reservoir habitats for conservation, based on anticipated benefits to Tier 1 wildlife species. Also, develop assessment techniques and conduct field-based assessments to determine the quantity and quality of lake or reservoir habitat currently available for Tier 1 wildlife species, and to evaluate the results of restoration.

### *Conservation Actions*

Manage water levels where possible to protect littoral habitat identified as important for Tier 1 wildlife species. Develop recreation management plans to mitigate and reduce human disturbance of Tier 1 wildlife species during key seasonal use.

# OTHER HABITATS

## Cliffs and Canyons

### *Threats*

#### 3 Energy Production & Mining

Throughout the state, sandstone, limestone, granite, and shale outcrops are quarried for a variety of uses, which essentially destroys the habitat. In eastern Colorado, wind energy development is frequently concentrated on outcrops and canyon rims, causing fragmentation, disturbance, and loss of habitat.

#### 4 Transportation Corridors

Surface impacts by transportation corridor disturbance are largely due to road construction and maintenance, including rockfall mitigation.

#### 6 Human Intrusions & Disturbance

A primary threat to this habitat is anthropogenic surface disturbance that leads to change in soil or substrate structure or change in vegetation structure. Canyons and outcrops of the eastern plains are subject to disturbance from military training activities in some areas. Many occurrences of this habitat are found on public lands where recreational use (especially climbing) can be a major source of disturbance.

#### 7 Natural System Modifications

Cliffs and canyons are often part of water storage construction projects, and may be inundated or disturbed by dam construction. Hydrological modification due to water storage can change groundwater flow patterns for cliff habitats, with the potential to impact vegetation composition or persistence.

#### 11 Climate Change & Severe Weather

The primary threat of changing climate in this habitat would be the potential for increased frequency of extreme storm events that result in floods and erosion.

### *Information Needs*

No priority information needs have been identified.

### *Conservation Actions*

The primary conservation need is maintenance of appropriate patch size and landscape mosaic.

## Alpine

### *Threats*

#### 1 Residential & Commercial Development

Ongoing threats from development in alpine habitats are associated with recreation areas and activities, including associated roads and infrastructure; these are generally are limited in extent.

#### 2 Incompatible Agriculture

In southwestern Colorado, sheep grazing is a stessor with the potential to alter species composition in alpine habitats.

#### 6 Human Intrusions & Disturbance

Camping, hiking, and other recreational activities can have locally severe impacts on vegetation, with the proliferation of social trails, as well as disturbance to wildlife. Impacts are greatest in areas that have access to popular "fourteener" climbs.

#### 9 Pollution

Anthropogenic nitrogen deposition is an ongoing threat that can change patterns of plant growth and diversity in alpine habitats (Grantz et al. 2003).

#### 11 Climate Change & Severe Weather

Our climate change vulnerability analysis (Appendix F) indicated that alpine habitats in Colorado are moderately vulnerable to the effects of climate change by mid-century. However, the location of this habitat at the highest available elevations, narrow biophysical envelope, and edge-of-range character of many constituent species combine to limit the potential for this habitat to persist in the long term under projected conditions. Invasive species have not previously been a threat in these habitats, but there is a possibility that this will change under future climatic conditions. Likewise, fire could become a future source of disturbance in these areas if trees are able to establish at higher elevations.

### *Information Needs*

Investigations into the effects of climate change on alpine habitats and constituent species is needed.

### *Conservation Actions*

Due to their unique locations within the state, and the fact that they are generally federally owned and managed landscapes, the primary conservation action for alpine habitats is to manage for viable condition.

## Sand Dunes

### *Threats*

#### 2 Incompatible Agriculture

Smaller blowouts and sand dune habitats on the eastern plains of Colorado are often stabilized as part of grazing management, which can change species composition (Kelso et al. 2007). Stabilization practices and conversion to cropland may fragment or degrade these habitats.

#### 6 Human Intrusions & Disturbance

Large sand dune fields and other unstable sandy habitats in Colorado have limited but ongoing threat from recreational use. Sand dunes in a few areas (North Dune Field in North Park) are vulnerable to disturbance by excessive OHV recreational use.

#### 11 Climate Change & Severe Weather

Climate change has great potential to change the abundance and distribution of these habitats in Colorado, as has happened in the past (Muhs and Holliday 1995). The development, extent, and persistence of unstable sandy areas and dunes are tightly linked to local and regional hydrology, including both surface and groundwater. The dynamics of this habitat are affected by precipitation, sand supply, wind patterns, the adjacent topography, and surface flow in local drainages. The extent and movement of unstable sand is greater in periods of drought and higher temperatures; dune and sand sheet movement is projected to increase under future climate conditions (Muhs and Maat 1993).

### *Information Needs*

Investigations into the effects of climate change on sand dune habitats and constituent species is needed.

### *Conservation Actions*

Due to their unique locations within the state, and the fact that they are generally federally owned and managed, the primary conservation action for sand dune habitats is to manage for viable condition.

# Hot Springs

## *Threats*

### 1 Residential & Commercial Development

Most of Colorado's hot springs have been developed to some extent for recreational use. Effects of these often extensive alterations, and the associated recreational impacts, are unknown.

### 3 Energy Production & Mining

Although hot springs are a characteristic feature of geothermal energy, it is only in the Mt. Princeton area that hot spring habitat occurs in an area with sufficient potential for geothermal energy development to threaten the habitat.

## *Information Needs*

Information about current condition and potential impacts of development for hot spring habitats is lacking.

## *Conservation Actions*

The primary conservation action for hot springs habitats is to manage for viable condition of the species of concern.

# Agriculture

## *Threats*

Wildlife challenges in agriculture are mainly connected to the extent of cropped acreage in a landscape, and different methods and timing of agricultural practices. With the modernization of farming has come the reduction of diversity within agricultural fields. The progression to "clean" farming (removal of all weeds or non-cropland cover and utilization of every acre of a field) has removed much of the annual vegetation and other permanent wildlife cover that historically occurred adjacent to and within crop fields, and has reduced movement ability for wildlife throughout an agricultural landscape. Lack of diversity of cropping rotations, both within a field and across an entire area, has reduced potential wildlife cover by limiting the structural diversity and cover types that are present.

Mortality of wildlife within croplands during harvest is another common challenge, especially within hay fields. Modernization of swathing and harvest implements has increased equipment widths and increased harvest-associated mortality. Along with harvest techniques, the preparation of a field for the next crop can impact wildlife. Waste grain that remains on the ground after harvest can be a valuable food source for wildlife during the winter and spring

months. This is especially true for migrating species such as the greater sandhill cranes in the San Luis Valley, or waterfowl along the South Platte River. When a tillage operation is performed too early, the waste grain becomes inaccessible to wildlife.

In regions of the state where irrigated agriculture is predominant, dewatering cropland through water rights sale, lease, or other transfers can negatively impact wildlife habitat quantity and quality, with resulting decreases in wildlife populations in these areas. Cropland irrigation runoff can provide surface habitat through pooling and creation of wetland type features. This can be viewed as a benefit. Additionally the movement of agricultural water underground can augment water tables, increase vegetative growth in low areas and form artificial wetlands. Uncropped irrigation circles leave corners that may provide wildlife habitat benefits.

### *Conservation Actions*

Primary conservation actions include increasing the diversity of vegetation on the landscape by incorporating multispecies cover crops into crop rotations, planting marginally productive acres in plant species that provide permanent wildlife cover, and implementing integrated pest management. Delayed harvest, especially on hay fields, to avoid the peak brood-rearing seasons and employing wildlife friendly harvest techniques (e.g., flushing bars, lower equipment speeds) would minimize wildlife mortalities during harvest. Placing conservation easements or forming co-operative agreements between landowners would help conserve water rights in key areas that are of great importance to waterbirds and other wildlife.

## Conservation Reserve Program

### *Threats*

Conservation Reserve Program (CRP) lands vary widely in plant composition with their geographic location in the state, the age of the planting, and any previous management they may have received. Declining habitat quality is a primary issue facing Colorado's CRP lands. Older CRP plantings typically are monocultures or low plant diversity stands trending towards monoculture, and often exhibit static and uniform vegetative structure. Newer stands may show higher plant diversity, but standard agency seed mixes for the program are low diversity and could be enhanced to maximize wildlife benefits. As new CRP sign-ups occur, more diverse seed mixes designed to address habitat limiting factors should be used to target local priority wildlife species. These seed mixes should be high diversity with a significant and diverse forb component. Aggressive grasses such as sideoats grama and western wheatgrass should be avoided to prolong the diversity of structure and plant composition of the grass stand to maintain wildlife habitat values.

Another primary threat to CRP lands is the overall loss of acres of this habitat type in the state. Nationally the number of acres that can be enrolled in the program has decreased from a high of 39 million to 26 million. In Colorado, the number of enrolled acres had decreased from 2.2 million to 1.8 million acres currently. With the decline in eligible acres in the program nationally, it is expected that the quantity of CRP acres in Colorado will continue to decline. If lands currently in CRP are not re-enrolled into the program, fields that have expired out of the program are most often converted back to production crop agriculture and their habitat value is lost. This has already occurred in core Colorado lesser prairie-chicken range, and is having clear negative impacts to the state's population of this federally threatened species. The reduced national acreage enrollment cap increases the difficulty for currently cropped lands to enter into the program due to increased competition, resulting in missed conservation value and negative impacts to habitat for several SGCN.

## *Conservation Actions*

CRP lands can be managed to provide habitat benefits for many SGCN, although management must occur within the program policy framework of the Farm Service Agency. A major hindrance to maximizing CRP fields for wildlife benefits is the Emergency Use provision of CRP, which allows haying and/or grazing activities to occur during drought years, resulting in severe negative repercussions to habitat diversity and structure in Colorado, often eliminating wildlife habitat value for multiple years of the CRP contract, and often permanently altering the plant species composition in the field. Haying done incorrectly during drought situations can eliminate mid to tall warm season grasses and forbs that often provide necessary and generally lacking vegetative structure on the landscape, to the detriment of a large suite of grassland nesting birds and other wildlife. The Emergency Use activities allowed within the program are conducted with little regard to the impact on wildlife habitat during drought, and basic rules to leave a minimum amount of cover during these times is frequently not enforced.

Finally, CRP enrollment would benefit greatly from an educational effort to landowners on the part of state and federal agencies that promote the wildlife benefits of the program. CRP provides significant financial incentives for planting wildlife habitat that are not always understood by landowners. Increased outreach activities could lead to increased enrollment in targeted areas of the state, thereby benefitting target SGCN.

## Table 8. Key Habitats Threats and Conservation Actions.

Sorted by Habitat Type and Habitat Name.

### Forest

### Aspen

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain Population) | ☐ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Mammals | *Ochotona princeps* | American pika | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Euderma maculatum* | Spotted bat | ☐ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |
| Mammals | *Gulo gulo* | Wolverine | ☐ |
| Plants | *Ipomopsis ramosa* | Coral ipomopsis | ☐ |
| Plants | *Draba malpighiacea* | Whitlow-grass | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates sylvatica* | Wood frog | ☐ |
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ☐ |
| Birds | *Aegolius funereus* | Boreal owl | ☐ |
| Birds | *Peucaea cassinii* | Cassin's finch | ☑ |
| Birds | *Otus flammeolus* | Flammulated owl | ☑ |
| Birds | *Passerina amoena* | Lazuli bunting | ☐ |
| Birds | *Accipiter gentilis* | Northern goshawk | ☑ |
| Birds | *Contopus cooperi* | Olive-sided flycatcher | ☑ |
| Birds | *Progne subis* | Purple martin | ☑ |
| Birds | *Oreothlypis virginiae* | Virginia's warbler | ☐ |
| Insects | *Pyrgus xanthus* | Xanthus skipper | ☐ |
| Mammals | *Sorex nanus* | Dwarf shrew | ☑ |
| Mammals | *Canis lupus* | Gray wolf | ☑ |
| Mammals | *Ursus arctos* | Grizzly bear | ☑ |
| Mammals | *Lasiurus cinereus* | Hoary bat | ☑ |
| Plants | *Penstemon mensarum* | Grand Mesa penstemon | ☑ |
| Plants | *Botrychium lineare* | Narrowleaf grape fern | ☑ |
| Plants | *Draba smithii* | Smith whitlow-grass | ☐ |
| Plants | *Delphinium robustum* | Wahatoya Creek larkspur | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.1 Fire & Fire Suppression | Reduced acreage due to fire suppression | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | H |
| 11.2 Droughts | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts) | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 01.3 Tourism & Recreation Areas | Roads, trails, ski areas | 2.1 Site/Area Management | Coordinate on ecologically sensitive design of recreational facilities | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation | 2.1 Site/Area Management | Implement compatible forest management practices | M |
| 08.2 Problematic Native Species | Native herbivore browsing | 2.3 Habitat & Natural Process Restoration | Manage natural herbivory using context-appropriate methods (e.g., exclosures, fire, forest management) | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Avoid destruction of large tracts of native habitat | L |

**Table 8 - Continued.**

**Forest** **Lodgepole Pine**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain Population) | ☐ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Mammals | *Ochotona princeps* | American pika | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Lynx canadensis* | Lynx | ☑ |
| Mammals | *Gulo gulo* | Wolverine | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates sylvatica* | Wood frog | ☐ |
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ☐ |
| Birds | *Aegolius funereus* | Boreal owl | ☑ |
| Birds | *Peucaea cassinii* | Cassin's finch | ☑ |
| Birds | *Accipiter gentilis* | Northern goshawk | ☑ |
| Birds | *Contopus cooperi* | Olive-sided flycatcher | ☑ |
| Insects | *Coloradia luski* | Lusk's pinemoth | ☐ |
| Insects | *Agapema homogena* | Rocky Mountain agapema | ☐ |
| Mammals | *Martes americana* | American marten | ☑ |
| Mammals | *Sorex nanus* | Dwarf shrew | ☑ |
| Mammals | *Canis lupus* | Gray wolf | ☑ |
| Mammals | *Ursus arctos* | Grizzly bear | ☑ |
| Mammals | *Clethrionomys gapperi* | Red-backed vole | ☑ |
| Mammals | *Lepus americanus* | Snowshoe hare | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.2 Problematic Native Species | Insect outbreaks | 2.1 Site/Area Management | Implement compatible forest management practices | H |
| 01.1 Housing & Urban Areas | Exurban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 05.3 Logging & Wood Harvesting | Altered native vegetation (clearcutting and salvage) | 2.1 Site/Area Management | Implement compatible forest management practices | M |
| 07.1 Fire & Fire Suppression | Altered fire regime (fire suppression leading to high intensity fires) | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 01.1 Housing & Urban Areas | Exurban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |

**Table 8 - Continued.**

**Forest** **Mixed Conifer**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain Population) | ☐ |
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ☐ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Mammals | *Ochotona princeps* | American pika | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☑ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☑ |
| Mammals | *Lynx canadensis* | Lynx | ☑ |
| Mammals | *Euderma maculatum* | Spotted bat | ☐ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☑ |
| Mammals | *Gulo gulo* | Wolverine | ☐ |
| Plants | *Ipomopsis ramosa* | Coral ipomopsis | ☐ |
| Plants | *Hackelia gracilenta* | Mesa Verde stickseed | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates sylvatica* | Wood frog | ☐ |
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ☑ |
| Birds | *Peucaea cassinii* | Cassin's finch | ☑ |
| Birds | *Otus flammeolus* | Flammulated owl | ☐ |
| Birds | *Strix occidentalis lucida* | Mexican spotted owl | ☑ |
| Birds | *Accipiter gentilis* | Northern goshawk | ☑ |
| Birds | *Contopus cooperi* | Olive-sided flycatcher | ☑ |
| Birds | *Oreothlypis virginiae* | Virginia's warbler | ☑ |
| Insects | *Coloradia luski* | Lusk's pinemoth | ☐ |
| Insects | *Agapema homogena* | Rocky Mountain agapema | ☐ |
| Insects | *Pyrgus xanthus* | Xanthus skipper | ☐ |
| Mammals | *Idionycteris phyllotis* | Allen's big-eared bat | ☐ |
| Mammals | *Sorex nanus* | Dwarf shrew | ☑ |
| Mammals | *Canis lupus* | Gray wolf | ☑ |
| Mammals | *Ursus arctos* | Grizzly bear | ☑ |
| Mammals | *Lasiurus cinereus* | Hoary bat | ☑ |
| Mammals | *Clethrionomys gapperi* | Red-backed vole | ☑ |
| Plants | *Astragalus sparsiflorus* | Front Range milkvetch | ☑ |
| Plants | *Telesonix jamesii* | James telesonix | ☐ |
| Plants | *Botrychium lineare* | Narrowleaf grape fern | ☐ |
| Plants | *Ipomopsis aggregata ssp. weberi* | Rabbit Ears gilia | ☑ |
| Plants | *Draba smithii* | Smith whitlow-grass | ☐ |
| Plants | *Astragalus iodopetalus* | Violet milkvetch | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 08.2 Problematic Native Species | Western spruce budworm | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 11.1 Habitat Shifting & Alteration | Altered species composition | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | L |
| 05.3 Logging & Wood Harvesting | Altered native vegetation | 2.1 Site/Area Management | Implement compatible forest management practices | L |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |

**Table 8 - Continued.**

**Forest** **Pinyon - Juniper**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Aquila chrysaetos* | Golden eagle | ✔ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ✔ |
| Mammals | *Myotis lucifugus* | Little brown myotis | |
| Mammals | *Euderma maculatum* | Spotted bat | |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ✔ |
| Plants | *Lygodesmia doloresensis* | Dolores River skeletonplant | ✔ |
| Plants | *Boechera glareosa* | Dorn's rockcress | |
| Plants | *Pediocactus knowltonii* | Knowlton cactus | ✔ |
| Plants | *Astragalus humillimus* | Mancos milkvetch | |
| Plants | *Hackelia gracilenta* | Mesa Verde stickseed | ✔ |
| Plants | *Astragalus schmolliae* | Schmoll milkvetch | ✔ |
| Plants | *Penstemon scariosus var. albifluvis* | White River penstemon | |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Spea intermontana* | Great Basin spadefoot | ✔ |
| Birds | *Falco peregrinus anatum* | American peregrine falcon | |
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ✔ |
| Birds | *Aegolius funereus* | Boreal owl | |
| Birds | *Peucaea cassinii* | Cassin's finch | ✔ |
| Birds | *Buteo regalis* | Ferruginous hawk | |
| Birds | *Vireo vicinior* | Gray vireo | ✔ |
| Birds | *Baeolophus ridgwayi* | Juniper titmouse | ✔ |
| Birds | *Passerina amoena* | Lazuli bunting | ✔ |
| Birds | *Melanerpes lewis* | Lewis's woodpecker | ✔ |
| Birds | *Strix occidentalis lucida* | Mexican spotted owl | ✔ |
| Birds | *Accipiter gentilis* | Northern goshawk | ✔ |
| Birds | *Contopus cooperi* | Olive-sided flycatcher | ✔ |
| Birds | *Gymnorhinus cyanocephalus* | Pinyon jay | ✔ |
| Birds | *Falco mexicanus* | Prairie falcon | |
| Birds | *Oreothlypis virginiae* | Virginia's warbler | ✔ |
| Insects | *Callophrys comstocki* | Comstock's hairstreak | ✔ |
| Insects | *Incisalia fotis* | Early elfin | |
| Insects | *Callophrys mossii schryveri* | Moss's elfin | ✔ |
| Insects | *Euphilotes spaldingi* | Spalding's blue | ✔ |
| Insects | *Pyrgus xanthus* | Xanthus skipper | |
| Mammals | *Idionycteris phyllotis* | Allen's big-eared bat | ✔ |
| Mammals | *Nyctinomops macrotis* | Big free-tailed bat | ✔ |
| Mammals | *Thomomys bottae rubidus* | Botta's pocket gopher (rubidus ssp) | |
| Mammals | *Conepatus leuconotus* | Common hog-nosed skunk | ✔ |
| Mammals | *Sorex nanus* | Dwarf shrew | |
| Mammals | *Canis lupus* | Gray wolf | ✔ |
| Mammals | *Lasiurus cinereus* | Hoary bat | ✔ |
| Plants | *Lepidium crenatum* | Alkaline pepperwort | ✔ |
| Plants | *Nuttallia densa* | Arkansas Canyon stickleaf | ✔ |
| Plants | *Herrickia horrida* | Canadian River spiny aster | ✔ |
| Plants | *Astragalus debequaeus* | DeBeque milkvetch | ✔ |
| Plants | *Penstemon degeneri* | Degener beardtongue | ✔ |
| Plants | *Camissonia eastwoodiae* | Eastwood evening primrose | |
| Plants | *Astragalus piscator* | Fisher Towers milkvetch | ✔ |
| Plants | *Penstemon fremontii var. glabrescens* | Fremont's beardtongue | ✔ |
| Plants | *Nuttallia chrysantha* | Golden blazing star | |
| Plants | *Physaria vicina* | Good-neighbor bladderpod | ✔ |
| Plants | *Penstemon grahamii* | Graham beardtongue | |
| Plants | *Astragalus equisolensis* | Horseshoe milkvetch | ✔ |
| Plants | *Thelypodiopsis juniperorum* | Juniper tumble mustard | ✔ |
| Plants | *Aletes macdougalii ssp. breviradiatus* | Mesa Verde aletes | |
| Plants | *Astragalus naturitensis* | Naturita milkvetch | |
| Plants | *Oreocarya osterhoutii* | Osterhout cat's-eye | |

**Table 8 - Continued.**

| | | | |
|---|---|---|---|
| Plants | *Lupinus crassus* | Payson lupine | ☑ |
| Plants | *Penstemon scariosus var. cyanomontanus* | Plateau penstemon | ☑ |
| Plants | *Astragalus rafaelensis* | San Rafael milkvetch | ☑ |
| Reptiles | *Thamnophis cyrtopsis* | Blacknecked gartersnake | ☐ |
| Reptiles | *Hypsiglena chlorophaea* | Desert nightsnake | ☑ |
| Reptiles | *Gambelia wislizenii* | Long-nosed leopard lizard | ☑ |
| Reptiles | *Crotalus oreganus concolor* | Midget faded rattlesnake | ☑ |
| Reptiles | *Rena dissectus* | New Mexico threadsnake | ☑ |
| Reptiles | *Phrynosoma modestum* | Round-tailed horned lizard | ☑ |
| Reptiles | *Tantilla horbartsmithi* | Smith's black-headed snake | ☑ |
| Reptiles | *Lampropeltis triangulum taylori* | Utah milksnake | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.1 Oil & Gas Drilling | Fragmentation of native habitat due to oil/gas development & associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.) | 2.1 Site/Area Management | Implement compatible forest management practices | M |
| 08.2 Problematic Native Species | Ips outbreaks, black stain root disease | 2.1 Site/Area Management | Implement compatible forest management practices | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Prepare climate change adaptation strategy to identify and address barriers to species movement and habitat shifting | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.1 Legislation | Promote zoning that concentrates use and protects habitat | L |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | L |
| 06.1 Recreational Activities | Increasing disturbance from horseback riding, ATV use, bicycling | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | L |
| 06.2 War, Civil Unrest & Military Exercises | Military training disturbance at Fort Carson and Pinon Canyon Maneuver Site | 7.2 Alliance & Partnership Development | Coordinate with related agencies to align goals, policies, measures of success, etc. | L |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |

**Table 8 - Continued.**

**Forest** **Ponderosa Pine**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☑ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☑ |
| Mammals | *Euderma maculatum* | Spotted bat | ☐ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☑ |
| Plants | *Boechera glareosa* | Dorn's rockcress | ☐ |
| Plants | *Ipomopsis polyantha* | Pagosa skyrocket | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Falco peregrinus anatum* | American peregrine falcon | ☐ |
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ☑ |
| Birds | *Aegolius funereus* | Boreal owl | ☐ |
| Birds | *Peucaea cassinii* | Cassin's finch | ☑ |
| Birds | *Otus flammeolus* | Flammulated owl | ☑ |
| Birds | *Setophaga graciae* | Grace's warbler | ☑ |
| Birds | *Melanerpes lewis* | Lewis's woodpecker | ☑ |
| Birds | *Strix occidentalis lucida* | Mexican spotted owl | ☑ |
| Birds | *Accipiter gentilis* | Northern goshawk | ☑ |
| Birds | *Contopus cooperi* | Olive-sided flycatcher | ☑ |
| Birds | *Gymnorhinus cyanocephalus* | Pinyon jay | ☑ |
| Birds | *Oreothlypis virginiae* | Virginia's warbler | ☑ |
| Insects | *Incisalia fotis* | Early elfin | ☑ |
| Insects | *Coloradia luski* | Lusk's pinemoth | ☑ |
| Insects | *Callophrys mossii schryveri* | Moss's elfin | ☑ |
| Insects | *Hesperia leonardus montana* | Pawnee montane skipper | ☑ |
| Insects | *Agapema homogena* | Rocky Mountain agapema | ☐ |
| Insects | *Euphilotes spaldingi* | Spalding's blue | ☐ |
| Insects | *Pyrgus xanthus* | Xanthus skipper | ☐ |
| Mammals | *Sciurus aberti* | Abert's squirrel | ☑ |
| Mammals | *Idionycteris phyllotis* | Allen's big-eared bat | ☑ |
| Mammals | *Sorex nanus* | Dwarf shrew | ☑ |
| Mammals | *Canis lupus* | Gray wolf | ☑ |
| Mammals | *Ursus arctos* | Grizzly bear | ☑ |
| Mammals | *Lasiurus cinereus* | Hoary bat | ☑ |
| Plants | *Aletes humilis* | Larimer aletes | ☐ |
| Plants | *Astragalus missouriensis var. humistratus* | Missouri milkvetch | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 07.1 Fire & Fire Suppression | Altered native vegetation (increased tree density) | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | H |
| 11.1 Habitat Shifting & Alteration | Habitat shifting, climate interaction with natural processes e.g. fire. | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 04.1 Roads & Railroads | Roads or Railroads | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | L |
| 05.3 Logging & Wood Harvesting | Altered native vegetation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |
| 08.2 Problematic Native Species | Altered habitat due to mountain pine beetle | 2.1 Site/Area Management | Implement compatible forest management practices | L |

**Table 8 - Continued.**

**Forest** **Spruce - Fir**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain Population) | ☐ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Mammals | *Ochotona princeps* | American pika | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Lynx canadensis* | Lynx | ☑ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |
| Plants | *Ipomopsis ramosa* | Coral ipomopsis | ☑ |
| Plants | *Physaria scrotiformis* | West Silver bladderpod | ☐ |
| Plants | *Draba malpighiacea* | Whitlow-grass | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates sylvatica* | Wood frog | ☐ |
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ☐ |
| Birds | *Aegolius funereus* | Boreal owl | ☑ |
| Birds | *Peucaea cassinii* | Cassin's finch | ☑ |
| Birds | *Otus flammeolus* | Flammulated owl | ☐ |
| Birds | *Contopus cooperi* | Olive-sided flycatcher | ☑ |
| Mammals | *Martes americana* | American marten | ☑ |
| Mammals | *Sorex nanus* | Dwarf shrew | ☑ |
| Mammals | *Canis lupus* | Gray wolf | ☑ |
| Mammals | *Ursus arctos* | Grizzly bear | ☑ |
| Mammals | *Lasiurus cinereus* | Hoary bat | ☑ |
| Mammals | *Sorex hoyi montanus* | Pygmy shrew | ☑ |
| Mammals | *Lepus americanus* | Snowshoe hare | ☑ |
| Plants | *Townsendia rothrockii* | Rothrock townsend-daisy | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.2 Problematic Native Species | Insect outbreaks | 2.1 Site/Area Management | Implement compatible forest management practices | H |
| 05.3 Logging & Wood Harvesting | Logging and hazard tree salvage | 2.1 Site/Area Management | Implement compatible forest management practices | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |

**Forest** **Subalpine Limber - Bristlecone Pine**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Mammals | *Gulo gulo* | Wolverine | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ☐ |
| Birds | *Aegolius funereus* | Boreal owl | ☐ |
| Birds | *Peucaea cassinii* | Cassin's finch | ☑ |
| Birds | *Otus flammeolus* | Flammulated owl | ☐ |
| Birds | *Contopus cooperi* | Olive-sided flycatcher | ☑ |
| Birds | *Gymnorhinus cyanocephalus* | Pinyon jay | ☑ |
| Birds | *Oreothlypis virginiae* | Virginia's warbler | ☐ |
| Mammals | *Sorex nanus* | Dwarf shrew | ☐ |
| Mammals | *Canis lupus* | Gray wolf | ☐ |
| Mammals | *Ursus arctos* | Grizzly bear | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 08.1 Invasive Non-Native/Alien Species | White pine blister rust | 2.2 Invasive/Problematic Species Control | Manage recreation and other human disturbances to control the spread of pathogens | H |
| 11.2 Droughts | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.) | 5.2 Policies & Regulations | Prepare climate change adaptation strategy to identify and address barriers to species movement and habitat shifting | H |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |

**Table 8 - Continued.**

**Shrub** **Desert Shrub**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Leucosticte australis* | Brown-capped rosy-finch | ☐ |
| Birds | *Athene cunicularia* | Burrowing owl | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Birds | *Charadrius montanus* | Mountain plover | ☐ |
| Mammals | *Mustela nigripes* | Black-footed ferret | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Cynomys gunnisoni* | Gunnison's prairie dog | ☑ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Euderma maculatum* | Spotted bat | ☐ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |
| Mammals | *Cynomys leucurus* | White-tailed prairie dog | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Spea intermontana* | Great Basin spadefoot | ☑ |
| Birds | *Spizella breweri* | Brewer's sparrow | ☐ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☐ |
| Birds | *Calamospiza melanocorys* | Lark bunting | ☑ |
| Birds | *Lanius ludovicianus* | Loggerhead shrike | ☑ |
| Birds | *Circus cyaneus* | Northern harrier | ☐ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Insects | *Hemileuca neumoegeni* | A buckmoth | ☑ |
| Insects | *Callophrys comstocki* | Comstock's hairstreak | ☑ |
| Insects | *Euphilotes rita emmeli* | Desert buckwheat blue | ☑ |
| Insects | *Incisalia fotis* | Early elfin | ☐ |
| Insects | *Bombus morrisoni* | Morrison bumblebee | ☑ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Mammals | *Nyctinomops macrotis* | Big free-tailed bat | ☑ |
| Mammals | *Conepatus leuconotus* | Common hog-nosed skunk | ☐ |
| Mammals | *Vulpes macrotis* | Kit fox | ☑ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ☐ |
| Reptiles | *Thamnophis cyrtopsis* | Blacknecked gartersnake | ☐ |
| Reptiles | *Lampropeltis californiae* | California kingsnake | ☑ |
| Reptiles | *Hypsiglena chlorophaea* | Desert nightsnake | ☑ |
| Reptiles | *Sceloporus magister* | Desert spiny lizard | ☑ |
| Reptiles | *Gambelia wislizenii* | Long-nosed leopard lizard | ☑ |
| Reptiles | *Crotalus oreganus concolor* | Midget faded rattlesnake | ☑ |
| Reptiles | *Tantilla horbartsmithi* | Smith's black-headed snake | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.1 Oil & Gas Drilling | Disturbance from exploration and production, and associated spread of noxious weeds | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 11.2 Droughts | Potential for conversion to exotic grasslands | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 03.3 Renewable Energy | Concentrated solar power development | 4.2 Training | Educate development industries about avoiding and/or mitigating wildlife impacts | L |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | L |

**Table 8 - Continued.**

**Shrub** **Greasewood**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Mammals | *Cynomys gunnisoni* | Gunnison's prairie dog | ☐ |
| Reptiles | *Aspidoscelis neotesselata* | Colorado checkered whiptail | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Spizella breweri* | Brewer's sparrow | ☐ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☐ |
| Birds | *Lanius ludovicianus* | Loggerhead shrike | ☑ |
| Birds | *Circus cyaneus* | Northern harrier | ☐ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Amphispiza belli* | Sage sparrow | ☑ |
| Mammals | *Conepatus leuconotus* | Common hog-nosed skunk | ☐ |
| Mammals | *Vulpes macrotis* | Kit fox | ☑ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ☐ |
| Plants | *Lepidium crenatum* | Alkaline pepperwort | ☐ |
| Reptiles | *Hypsiglena chlorophaea* | Desert nightsnake | ☑ |
| Reptiles | *Gambelia wislizenii* | Long-nosed leopard lizard | ☑ |
| Reptiles | *Crotalus oreganus concolor* | Midget faded rattlesnake | ☐ |
| Reptiles | *Tantilla horbartsmithi* | Smith's black-headed snake | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland, groundwater pumping, runoff from fertilizers & pesticides | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for water resource development | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Avoid destruction of large tracts of native habitat | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants | 2.2 Invasive/Problematic Species Control | Control non-native plants using accepted techniques appropriate to site-specific conditions | L |

**Table 8 - Continued.**

**Shrub** **Oak and Mixed Mountain Shrublands**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Tympanuchus phasianellus columbianus* | Columbian sharp-tailed grouse | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☑ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☑ |
| Mammals | *Cynomys gunnisoni* | Gunnison's prairie dog | ☐ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ☑ |
| Birds | *Setophaga graciae* | Grace's warbler | ☑ |
| Birds | *Passerina amoena* | Lazuli bunting | ☑ |
| Birds | *Selasphorus rufus* | Rufous hummingbird | ☑ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Birds | *Oreothlypis virginiae* | Virginia's warbler | ☑ |
| Insects | *Incisalia fotis* | Early elfin | ☑ |
| Insects | *Bombus morrisoni* | Morrison bumblebee | ☑ |
| Insects | *Eurystrymon favonius ontario* | Northern hairstreak | ☑ |
| Insects | *Anisota oslari* | Oslar's oakworm moth | ☑ |
| Insects | *Hesperia ottoe* | Ottoe skipper | ☐ |
| Insects | *Euphilotes spaldingi* | Spalding's blue | ☐ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Mammals | *Idionycteris phyllotis* | Allen's big-eared bat | ☑ |
| Mammals | *Conepatus leuconotus* | Common hog-nosed skunk | ☐ |
| Mammals | *Canis lupus* | Gray wolf | ☑ |
| Mammals | *Ursus arctos* | Grizzly bear | ☑ |
| Mammals | *Sorex preblei* | Preble's shrew | ☑ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ☐ |
| Plants | *Penstemon mensarum* | Grand Mesa penstemon | ☐ |
| Plants | *Astragalus missouriensis var. humistratus* | Missouri milkvetch | ☑ |
| Reptiles | *Thamnophis cyrtopsis* | Blacknecked gartersnake | ☐ |
| Reptiles | *Lampropeltis triangulum taylori* | Utah milksnake | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences) | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | L |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |

**Table 8 - Continued.**

**Shrub** **Sagebrush**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Leucosticte australis* | Brown-capped rosy-finch | ☐ |
| Birds | *Athene cunicularia* | Burrowing owl | ☐ |
| Birds | *Tympanuchus phasianellus columbianus* | Columbian sharp-tailed grouse | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☑ |
| Birds | *Centrocercus urophasianus* | Greater sage-grouse | ☑ |
| Birds | *Centrocercus minimus* | Gunnison sage-grouse | ☑ |
| Mammals | *Mustela nigripes* | Black-footed ferret | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Cynomys gunnisoni* | Gunnison's prairie dog | ☑ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |
| Mammals | *Cynomys leucurus* | White-tailed prairie dog | ☑ |
| Plants | *Eriogonum brandegeei* | Brandegee wild buckwheat | ☐ |
| Plants | *Physaria pulvinata* | Cushion bladderpod | ☑ |
| Plants | *Boechera glareosa* | Dorn's rockcress | ☐ |
| Plants | *Lepidium huberi* | Huber's pepperwort | ☑ |
| Plants | *Astragalus osterhoutii* | Kremmling milkvetch | ☑ |
| Plants | *Gutierrezia elegans* | Lone Mesa snakeweed | ☑ |
| Plants | *Penstemon penlandii* | Penland penstemon | ☑ |
| Plants | *Physaria rollinsii* | Rollins twinpod | ☑ |
| Plants | *Astragalus microcymbus* | Skiff milkvetch | ☑ |
| Plants | *Phacelia gina-glenneae* | Troublesome phacelia | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Spea intermontana* | Great Basin spadefoot | ☑ |
| Birds | *Leucosticte atrata* | Black rosy-finch | ☐ |
| Birds | *Spizella breweri* | Brewer's sparrow | ☑ |
| Birds | *Aimophila cassinii* | Cassin's sparrow | ☐ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☐ |
| Birds | *Calamospiza melanocorys* | Lark bunting | ☐ |
| Birds | *Passerina amoena* | Lazuli bunting | ☑ |
| Birds | *Lanius ludovicianus* | Loggerhead shrike | ☑ |
| Birds | *Circus cyaneus* | Northern harrier | ☑ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Amphispiza belli* | Sage sparrow | ☑ |
| Birds | *Asio flammeus* | Short-eared owl | ☑ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Insects | *Callophrys comstocki* | Comstock's hairstreak | ☐ |
| Insects | *Bombus morrisoni* | Morrison bumblebee | ☑ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Mammals | *Idionycteris phyllotis* | Allen's big-eared bat | ☐ |
| Mammals | *Canis lupus* | Gray wolf | ☐ |
| Mammals | *Vulpes macrotis* | Kit fox | ☑ |
| Mammals | *Sorex preblei* | Preble's shrew | ☐ |
| Mammals | *Brachylagus idahoensis* | Pygmy rabbit | ☑ |
| Mammals | *Lemmiscus curtatus* | Sagebrush vole | ☑ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ☐ |
| Plants | *Cirsium perplexans* | Adobe thistle | ☑ |
| Plants | *Lepidium crenatum* | Alkaline pepperwort | ☐ |
| Plants | *Oxytropis besseyi var. obnapiformis* | Bessey locoweed | ☑ |
| Plants | *Lomatium concinnum* | Colorado desert-parsley | ☑ |
| Plants | *Boechera crandallii* | Crandall's rock-cress | ☑ |
| Plants | *Penstemon fremontii var. glabrescens* | Fremont's beardtongue | ☐ |
| Plants | *Astragalus anisus* | Gunnison milkvetch | ☑ |
| Plants | *Thelypodiopsis juniperorum* | Juniper tumble mustard | ☐ |
| Plants | *Oenothera acutissima* | Narrow-leaf evening primrose | ☑ |
| Plants | *Astragalus naturitensis* | Naturita milkvetch | ☐ |
| Plants | *Penstemon scariosus var. cyanomontanus* | Plateau penstemon | ☐ |
| Plants | *Mertensia humilis* | Rocky Mountain bluebells | ☑ |
| Plants | *Astragalus iodopetalus* | Violet milkvetch | ☑ |
| Plants | *Penstemon acaulis var. yampaensis* | Yampa beardtongue | ☑ |
| Reptiles | *Hypsiglena chlorophaea* | Desert nightsnake | ☐ |
| Reptiles | *Gambelia wislizenii* | Long-nosed leopard lizard | ☑ |
| Reptiles | *Rhinocheilus lecontei* | Long-nosed snake | ☐ |
| Reptiles | *Crotalus oreganus concolor* | Midget faded rattlesnake | ☐ |
| Reptiles | *Tantilla horbartsmithi* | Smith's black-headed snake | ☑ |

**Table 8 - Continued.**

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland, primarily pasture grasses, chaining | 2.3 Habitat & Natural Process Restoration | Restore sagebrush using accepted techniques appropriate to site-specific conditions | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 03.1 Oil & Gas Drilling | Oil and gas drilling | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 04.2 Utility & Service Lines | Oil and gas pipelines | 5.1 Legislation | Promote consideration of biodiversity issues in transportation and land use planning processes | H |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (juniper encroachment) | 2.3 Habitat & Natural Process Restoration | Re-seed native species | H |
| 07.3 Other Ecosystem Modifications | Altered native vegetation (low forb and grass diversity) | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 03.2 Mining & Quarrying | Coal mining | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 04.2 Utility & Service Lines | Overhead utility lines and towers | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants – cheatgrass | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | L |

**Table 8 - Continued.**

**Shrub** **Saltbush**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Leucosticte australis* | Brown-capped rosy-finch | ☐ |
| Birds | *Athene cunicularia* | Burrowing owl | ☐ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Birds | *Charadrius montanus* | Mountain plover | ☐ |
| Plants | *Aletes latilobus* | Canyonlands aletes | ☐ |
| Plants | *Eriogonum pelinophilum* | Clay-loving wild buckwheat | ☑ |
| Plants | *Sclerocactus glaucus* | Colorado hookless cactus | ☑ |
| Plants | *Lygodesmia doloresensis* | Dolores River skeletonplant | ☐ |
| Plants | *Sclerocactus mesae-verdae* | Mesa Verde hookless cactus | ☐ |
| Plants | *Astragalus tortipes* | Sleeping Ute milkvetch | ☑ |
| Plants | *Penstemon scariosus var. albifluvis* | White River penstemon | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Spizella breweri* | Brewer's sparrow | ☐ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☐ |
| Birds | *Lanius ludovicianus* | Loggerhead shrike | ☑ |
| Birds | *Circus cyaneus* | Northern harrier | ☐ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Mammals | *Conepatus leuconotus* | Common hog-nosed skunk | ☐ |
| Mammals | *Vulpes macrotis* | Kit fox | ☑ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ☐ |
| Plants | *Cirsium perplexans* | Adobe thistle | ☐ |
| Plants | *Calochortus ciscoensis* | Cisco sego lily | ☑ |
| Plants | *Eriogonum clavellatum* | Comb Wash buckwheat | ☑ |
| Plants | *Astragalus cronquistii* | Cronquist milkvetch | ☑ |
| Plants | *Astragalus debequaeus* | DeBeque milkvetch | ☐ |
| Plants | *Camissonia eastwoodiae* | Eastwood evening primrose | ☑ |
| Plants | *Astragalus piscator* | Fisher Towers milkvetch | ☐ |
| Plants | *Oreocarya revealii* | Gypsum Valley cat's- eye | ☑ |
| Plants | *Oreocarya osterhoutii* | Osterhout cat's-eye | ☐ |
| Plants | *Mentzelia paradoxensis* | Paradox stickleaf | ☑ |
| Reptiles | *Gambelia wislizenii* | Long-nosed leopard lizard | ☑ |
| Reptiles | *Crotalus oreganus concolor* | Midget faded rattlesnake | ☐ |
| Reptiles | *Tantilla horbartsmithi* | Smith's black-headed snake | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Altered native vegetation, erosion | 2.3 Habitat & Natural Process Restoration | Implement Best Management Practices for livestock grazing | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 03.1 Oil & Gas Drilling | Fragmentation of native habitat due to oil/gas development & associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | L |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | L |
| 07.3 Other Ecosystem Modifications | Vegetation loss from a variety of sources, leading to erosion | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | L |

**Table 8 - Continued.**

**Shrub** **Sandsage**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Athene cunicularia* | Burrowing owl | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Birds | *Tympanuchus pallidicinctus* | Lesser prairie-chicken | ☑ |
| Birds | *Tympanuchus phasianellus jamesi* | Plains sharp-tailed grouse | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Spizella breweri* | Brewer's sparrow | ☐ |
| Birds | *Aimophila cassinii* | Cassin's sparrow | ☑ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☐ |
| Birds | *Tympanuchus cupido* | Greater prairie-chicken | ☑ |
| Birds | *Lanius ludovicianus* | Loggerhead shrike | ☑ |
| Birds | *Numenius americanus* | Long-billed curlew | ☐ |
| Birds | *Colinus virginianus* | Northern bobwhite | ☑ |
| Birds | *Circus cyaneus* | Northern harrier | ☐ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Asio flammeus* | Short-eared owl | ☑ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Birds | *Bartramia longicauda* | Upland sandpiper | ☐ |
| Mammals | *Conepatus leuconotus* | Common hog-nosed skunk | ☐ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ☐ |
| Reptiles | *Rhinocheilus lecontei* | Long-nosed snake | ☑ |
| Reptiles | *Lampropeltis triangulum taylori* | Utah milksnake | ☑ |
| Reptiles | *Kinosternon flavescens* | Yellow mud turtle | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 03.3 Renewable Energy | Disturbance, fragmentation, and loss of native habitat due to wind energy development & associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and exurban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 03.1 Oil & Gas Drilling | Disturbance, fragmentation, and loss of native habitat due to oil/gas development & associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 07.1 Fire & Fire Suppression | Altered native vegetation | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | L |

**Table 8 - Continued.**

**Shrub** **Upland Shrub**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Leucosticte australis* | Brown-capped rosy-finch | ☐ |
| Birds | *Tympanuchus phasianellus columbianus* | Columbian sharp-tailed grouse | ☐ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Euderma maculatum* | Spotted bat | ☐ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ☐ |
| Birds | *Aimophila cassinii* | Cassin's sparrow | ☐ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☐ |
| Birds | *Passerina amoena* | Lazuli bunting | ☑ |
| Birds | *Selasphorus rufus* | Rufous hummingbird | ☑ |
| Birds | *Asio flammeus* | Short-eared owl | ☑ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Birds | *Oreothlypis virginiae* | Virginia's warbler | ☑ |
| Insects | *Incisalia fotis* | Early elfin | ☑ |
| Insects | *Bombus morrisoni* | Morrison bumblebee | ☑ |
| Insects | *Callophrys mossii schryveri* | Moss's elfin | ☑ |
| Insects | *Erynnis martialis* | Mottled duskywing | ☑ |
| Insects | *Agapema homogena* | Rocky Mountain agapema | ☑ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Mammals | *Conepatus leuconotus* | Common hog-nosed skunk | ☑ |
| Mammals | *Canis lupus* | Gray wolf | ☑ |
| Mammals | *Ursus arctos* | Grizzly bear | ☑ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ☐ |
| Plants | *Nuttallia densa* | Arkansas Canyon stickleaf | ☐ |
| Plants | *Draba smithii* | Smith whitlow-grass | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 06.1 Recreational Activities | Recreation | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | M |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 07.1 Fire & Fire Suppression | Altered fire regime | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | L |

**Table 8 - Continued.**

**Grassland** **Foothill and Mountain Grasslands**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Tympanuchus phasianellus columbianus* | Columbian sharp-tailed grouse | ☐ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☑ |
| Birds | *Grus canadensis tabida* | Greater sandhill crane | ☐ |
| Birds | *Charadrius montanus* | Mountain plover | ☐ |
| Mammals | *Mustela nigripes* | Black-footed ferret | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Cynomys gunnisoni* | Gunnison's prairie dog | ☑ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Perognathus fasciatus* | Olive-backed pocket mouse | ☑ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |
| Mammals | *Cynomys leucurus* | White-tailed prairie dog | ☑ |
| Plants | *Ipomopsis polyantha* | Pagosa skyrocket | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ☐ |
| Birds | *Dolichonyx oryzivorus* | Bobolink | ☑ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☑ |
| Birds | *Calamospiza melanocorys* | Lark bunting | ☐ |
| Birds | *Lanius ludovicianus* | Loggerhead shrike | ☑ |
| Birds | *Circus cyaneus* | Northern harrier | ☑ |
| Birds | *Falco mexicanus* | Prairie falcon | ☑ |
| Birds | *Selasphorus rufus* | Rufous hummingbird | ☑ |
| Birds | *Asio flammeus* | Short-eared owl | ☑ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Insects | *Bombus pensylvanicus* | American bumblebee | ☑ |
| Insects | *Atrytone arogos* | Arogos skipper | ☑ |
| Insects | *Euphilotes rita coloradensis* | Colorado blue | ☑ |
| Insects | *Bombus morrisoni* | Morrison bumblebee | ☑ |
| Insects | *Erynnis martialis* | Mottled duskywing | ☐ |
| Insects | *Hesperia leonardus montana* | Pawnee montane skipper | ☐ |
| Insects | *Speyeria idalia* | Regal fritillary | ☐ |
| Insects | *Polites rhesus* | Rhesus skipper | ☐ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Insects | *Pyrgus xanthus* | Xanthus skipper | ☑ |
| Insects | *Bombus fervidus* | Yellow bumblebee | ☑ |
| Insects | *Proserpinus flavofasciata* | Yellow-banded day sphinx | ☑ |
| Mammals | *Ovis canadensis* | Bighorn sheep | ☐ |
| Mammals | *Bison bison* | Bison | ☑ |
| Mammals | *Thomomys bottae rubidus* | Botta's pocket gopher (rubidus ssp) | ☑ |
| Mammals | *Conepatus leuconotus* | Common hog-nosed skunk | ☐ |
| Mammals | *Canis lupus* | Gray wolf | ☐ |
| Mammals | *Ursus arctos* | Grizzly bear | ☑ |
| Mammals | *Sorex preblei* | Preble's shrew | ☐ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ☑ |
| Plants | *Eriogonum coloradense* | Colorado wild buckwheat | ☐ |
| Plants | *Penstemon degeneri* | Degener beardtongue | ☐ |
| Plants | *Penstemon mensarum* | Grand Mesa penstemon | ☐ |
| Plants | *Astragalus missouriensis var. humistratus* | Missouri milkvetch | ☐ |
| Plants | *Botrychium lineare* | Narrowleaf grape fern | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 01.3 Tourism & Recreation Areas | Trails and other open space infrastructure | 2.1 Site/Area Management | Coordinate on ecologically sensitive design of recreational facilities | M |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 07.1 Fire & Fire Suppression | Altered native vegetation | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive or exotic species | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |

**Table 8 - Continued.**

| | | | | |
|---|---|---|---|---|
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Research population parameters and/or monitor status | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |

**Table 8 - Continued.**

**Grassland** **Mixed and Tallgrass Prairies**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Athene cunicularia* | Burrowing owl | ☐ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☑ |
| Birds | *Tympanuchus pallidicinctus* | Lesser prairie-chicken | ☑ |
| Birds | *Charadrius montanus* | Mountain plover | ☐ |
| Birds | *Tympanuchus phasianellus jamesi* | Plains sharp-tailed grouse | ☐ |
| Mammals | *Mustela nigripes* | Black-footed ferret | ☐ |
| Mammals | *Perognathus fasciatus* | Olive-backed pocket mouse | ☑ |
| Reptiles | *Sistrurus catenatus* | Massasauga | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ☐ |
| Birds | *Dolichonyx oryzivorus* | Bobolink | ☑ |
| Birds | *Aimophila cassinii* | Cassin's sparrow | ☑ |
| Birds | *Calcarius ornatus* | Chestnut-collared longspur | ☑ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☑ |
| Birds | *Calamospiza melanocorys* | Lark bunting | ☑ |
| Birds | *Lanius ludovicianus* | Loggerhead shrike | ☑ |
| Birds | *Numenius americanus* | Long-billed curlew | ☐ |
| Birds | *Colinus virginianus* | Northern bobwhite | ☐ |
| Birds | *Circus cyaneus* | Northern harrier | ☑ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Asio flammeus* | Short-eared owl | ☑ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Birds | *Bartramia longicauda* | Upland sandpiper | ☑ |
| Insects | *Bombus pensylvanicus* | American bumblebee | ☑ |
| Insects | *Atrytone arogos* | Arogos skipper | ☐ |
| Insects | *Callophrys comstocki* | Comstock's hairstreak | ☐ |
| Insects | *Bombus morrisoni* | Morrison bumblebee | ☑ |
| Insects | *Hesperia ottoe* | Ottoe skipper | ☑ |
| Insects | *Speyeria idalia* | Regal fritillary | ☑ |
| Insects | *Polites rhesus* | Rhesus skipper | ☑ |
| Insects | *Bombus fraternus* | Southern plains bumblebee | ☑ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Insects | *Bombus fervidus* | Yellow bumblebee | ☑ |
| Mammals | *Cynomys ludovicianus* | Black-tailed prairie dog | ☐ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ☑ |
| Reptiles | *Lampropeltis californiae* | California kingsnake | ☐ |
| Reptiles | *Phrynosoma cornutum* | Texas horned lizard | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.1 Site/Area Protection | Purchase habitat for conservation purpose | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 03.1 Oil & Gas Drilling | Fragmentation of native habitat due to oil/gas development & associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 08.1 Invasive Non-Native/Alien Species | Noxious weeds | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 07.1 Fire & Fire Suppression | Altered fire regime, encroacment by woody plants | 2.3 Habitat & Natural Process Restoration | Restore native prairie using site-specific techniques and context | L |
| 11.2 Droughts | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.) | 8.0 Research & Monitoring | Research population parameters and/or monitor status | L |

**Table 8 - Continued.**

**Grassland** **Shortgrass Prairie**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Athene cunicularia* | Burrowing owl | ✔ |
| Birds | *Aquila chrysaetos* | Golden eagle | ✔ |
| Birds | *Charadrius montanus* | Mountain plover | ✔ |
| Mammals | *Mustela nigripes* | Black-footed ferret | ✔ |
| Mammals | *Perognathus fasciatus* | Olive-backed pocket mouse | ✔ |
| Reptiles | *Aspidoscelis neotesselata* | Colorado checkered whiptail | |
| Reptiles | *Sistrurus catenatus* | Massasauga | ✔ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Scaphiopus couchii* | Couch's spadefoot | ✔ |
| Amphibians | *Anaxyrus debilis* | Green toad | |
| Birds | *Haliaeetus leucocephalus* | Bald eagle | |
| Birds | *Aimophila cassinii* | Cassin's sparrow | ✔ |
| Birds | *Calcarius ornatus* | Chestnut-collared longspur | ✔ |
| Birds | *Buteo regalis* | Ferruginous hawk | ✔ |
| Birds | *Ammodramus savannarum* | Grasshopper sparrow | ✔ |
| Birds | *Calamospiza melanocorys* | Lark bunting | ✔ |
| Birds | *Lanius ludovicianus* | Loggerhead shrike | ✔ |
| Birds | *Numenius americanus* | Long-billed curlew | ✔ |
| Birds | *Rhynchophanes mccownii* | McCown's longspur | ✔ |
| Birds | *Circus cyaneus* | Northern harrier | ✔ |
| Birds | *Falco mexicanus* | Prairie falcon | ✔ |
| Birds | *Asio flammeus* | Short-eared owl | ✔ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ✔ |
| Insects | *Bombus pensylvanicus* | American bumblebee | ✔ |
| Insects | *Euphilotes rita coloradensis* | Colorado blue | ✔ |
| Insects | *Danaus plexippus* | Monarch butterfly | ✔ |
| Insects | *Bombus morrisoni* | Morrison bumblebee | ✔ |
| Insects | *Eurystrymon favonius Ontario* | Northern hairstreak | |
| Insects | *Speyeria idalia* | Regal fritillary | ✔ |
| Insects | *Polites rhesus* | Rhesus skipper | ✔ |
| Insects | *Callophrys mcfarlandi* | Sandia hairstreak | ✔ |
| Insects | *Bombus fraternus* | Southern plains bumblebee | ✔ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ✔ |
| Insects | *Euphyes bimacula* | Two-spotted skipper | |
| Insects | *Bombus occidentalis* | Western bumblebee | ✔ |
| Insects | *Euproserpinus wiesti* | Wiest's sphinx moth | |
| Insects | *Bombus fervidus* | Yellow bumblebee | ✔ |
| Mammals | *Bison bison* | Bison | ✔ |
| Mammals | *Cynomys ludovicianus* | Black-tailed prairie dog | ✔ |
| Mammals | *Vulpes velox* | Swift fox | ✔ |
| Mammals | *Lepus townsendii* | White-tailed jackrabbit | ✔ |
| Plants | *Frasera coloradensis* | Colorado green gentian | ✔ |
| Plants | *Asclepias uncialis ssp. uncialis* | Dwarf milkweed | ✔ |
| Plants | *Oonopsis puebloensis* | Pueblo goldenweed | ✔ |
| Plants | *Oonopsis foliosa var. monocephala* | Rayless goldenweed | ✔ |
| Plants | *Trifolium dasyphyllum ssp. anemophilum* | Whip-root clover | ✔ |
| Reptiles | *Thamnophis cyrtopsis* | Blacknecked gartersnake | |
| Reptiles | *Hypsiglena chlorophaea* | Desert nightsnake | |
| Reptiles | *Rhinocheilus lecontei* | Long-nosed snake | ✔ |
| Reptiles | *Rena dissectus* | New Mexico threadsnake | ✔ |
| Reptiles | *Phrynosoma modestum* | Round-tailed horned lizard | ✔ |
| Reptiles | *Phrynosoma cornutum* | Texas horned lizard | ✔ |

**Table 8 - Continued.**

| | | | |
|---|---|---|---|
| Reptiles | *Lampropeltis triangulum taylori* | Utah milksnake | ✔ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.3 Habitat & Natural Process Restoration | Restore native prairie using site-specific techniques and context | H |
| 03.1 Oil & Gas Drilling | Fragmentation of native habitat due to oil/gas development & associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 01.2 Commercial & Industrial Areas | Urban, suburban, and exurban development | 5.2 Policies & Regulations | Promote zoning that concentrates use and protects habitat | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 02.1 Annual & Perennial Non-Timber Crops | Windbreaks, agricultural methods such as tilling, pitting | 2.3 Habitat & Natural Process Restoration | Restore native prairie using site-specific techniques and context | M |
| 04.1 Roads & Railroads | Roads or Railroads (super slab) | 5.2 Policies & Regulations | Promote consideration of biodiversity issues in transportation and land use planning processes | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 11.2 Droughts | Climate variability (intensification or alteration of normal weather patterns, e.g., droughts) | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | M |
| 03.3 Renewable Energy | Wind energy development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development | L |
| 07.1 Fire & Fire Suppression | Altered native vegetation (woody encroachment, seral stage imbalance, etc.) | 2.3 Habitat & Natural Process Restoration | Restore natural fire regime | L |

**Table 8 - Continued.**

**Riparian and Wetlands** **Playas**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Birds | *Charadrius montanus* | Mountain plover | ☐ |
| Reptiles | *Aspidoscelis neotesselata* | Colorado checkered whiptail | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Falco peregrinus anatum* | American peregrine falcon | ☐ |
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ☐ |
| Birds | *Calamospiza melanocorys* | Lark bunting | ☐ |
| Birds | *Sterna antillarum* | Least tern | ☑ |
| Birds | *Numenius americanus* | Long-billed curlew | ☑ |
| Birds | *Rhynchophanes mccownii* | McCown's longspur | ☐ |
| Birds | *Circus cyaneus* | Northern harrier | ☑ |
| Birds | *Charadrius melodus* | Piping plover | ☑ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Birds | *Plegadis chihi* | White-faced ibis | ☑ |
| Plants | *Cleome multicaulis* | Slender spiderflower | ☐ |
| Reptiles | *Lampropeltis californiae* | California kingsnake | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 03.1 Oil & Gas Drilling | Fragmentation of native habitat due to oil/gas development & associated infrastructure | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 13.1 Complete distribution in Colorado unknown | Complete distribution in Colorado unknown | 8.0 Research & Monitoring | Improve understanding of species/habitat distribution (field inventory, modeling, ground-truthing) | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to cropland | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | M |
| 07.3 Other Ecosystem Modifications | Natural system modification - wetland filling, eutrophication, siltation | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | M |
| 09.3 Agricultural & Forestry Effluents | Fertilizer runoff, herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 01.1 Housing & Urban Areas | Urban, suburban, and exurban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | L |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - siltation and sedimentation | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | L |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | L |
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | L |

**Table 8 - Continued.**

**Riparian and Wetlands** **Riparian Woodlands and Shrublands**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain Population) | ☑ |
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ☑ |
| Birds | *Tympanuchus phasianellus columbianus* | Columbian sharp-tailed grouse | ☐ |
| Birds | *Lagopus leucura altipetens* | Southern white-tailed ptarmigan | ☐ |
| Birds | *Empidonax traillii extimus* | Southwestern willow flycatcher | ☑ |
| Birds | *Coccyzus americanus occidentalis* | Western yellow-billed cuckoo | ☑ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Zapus hudsonius luteus* | New Mexico jumping mouse | ☑ |
| Mammals | *Zapus hudsonius preblei* | Prebles meadow jumping mouse | ☑ |
| Plants | *Spiranthes diluvialis* | Ute ladies'-tresses | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates blairi* | Plains leopard frog | ☑ |
| Amphibians | *Lithobates sylvatica* | Wood frog | ☑ |
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ☑ |
| Birds | *Passerina amoena* | Lazuli bunting | ☑ |
| Birds | *Melanerpes lewis* | Lewis's woodpecker | ☑ |
| Birds | *Colinus virginianus* | Northern bobwhite | ☑ |
| Birds | *Catharus fuscescens* | Veery | ☑ |
| Insects | *Incisalia fotis* | Early elfin | ☑ |
| Insects | *Speyeria nokomis nokomis* | Great Basin silverspot butterfly | ☑ |
| Insects | *Capnia nelsoni* | Nelson's snowfly | ☑ |
| Insects | *Bombus fraternus* | Southern plains bumblebee | ☑ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Mammals | *Lasiurus cinereus* | Hoary bat | ☑ |
| Mammals | *Lepus americanus* | Snowshoe hare | ☑ |
| Reptiles | *Thamnophis sirtalis* | Common gartersnake | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 03.2 Mining & Quarrying | Gravel mining | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (dams and diversions) | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Channelization | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk and Russian olive | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 01.2 Commercial & Industrial Areas | Development along major stream corridors | 5.2 Policies & Regulations | Establish mitigation requirements for developments and other projects that impact species/habitats | M |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion or altered vegetation for hay making | 2.3 Habitat & Natural Process Restoration | Restore riparian vegetation using site-specific techniques and context | M |
| 04.1 Roads & Railroads | Fragmentation (roads) | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects | M |
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | M |
| 09.1 Household Sewage & Urban Waste Water | Water pollution, fertilizer runoff | 5.4 Compliance & Enforcement | Enforce state/federal/local pollution standards | L |
| 09.3 Agricultural & Forestry Effluents | Fertilizer runoff, herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | L |

**Table 8 - Continued.**
**Riparian and Wetlands** **Wetlands**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain Population) | ☑ |
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Birds | *Grus canadensis tabida* | Greater sandhill crane | ☑ |
| Birds | *Lagopus leucura altipetens* | Southern white-tailed ptarmigan | ☐ |
| Plants | *Mimulus gemmiparus* | Budding monkey flower | ☐ |
| Plants | *Oenothera coloradensis ssp. coloradensis* | Colorado butterfly plant | ☑ |
| Plants | *Eutrema penlandii* | Penland alpine fen mustard | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Acris crepitans* | Blanchard's cricket frog | ☐ |
| Amphibians | *Scaphiopus couchii* | Couch's spadefoot | ☑ |
| Amphibians | *Gastrophryne olivacea* | Great Plains narrowmouth toad | ☑ |
| Amphibians | *Lithobates blairi* | Plains leopard frog | ☑ |
| Amphibians | *Lithobates sylvatica* | Wood frog | ☑ |
| Birds | *Botaurus lentiginosus* | American bittern | ☑ |
| Birds | *Falco peregrinus anatum* | American peregrine falcon | ☐ |
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ☐ |
| Birds | *Bucephala islandica* | Barrow's goldeneye | ☑ |
| Birds | *Chlidonias niger* | Black tern | ☑ |
| Birds | *Numenius americanus* | Long-billed curlew | ☐ |
| Birds | *Circus cyaneus* | Northern harrier | ☑ |
| Birds | *Charadrius melodus* | Piping plover | ☐ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Asio flammeus* | Short-eared owl | ☑ |
| Birds | *Plegadis chihi* | White-faced ibis | ☑ |
| Birds | *Grus americana* | Whooping crane | ☑ |
| Insects | *Ochrotrichia trapoiza* | Caddisfly | ☐ |
| Insects | *Epitheca petechialis* | Dot-winged baskettail | ☑ |
| Insects | *Speyeria nokomis nokomis* | Great Basin silverspot butterfly | ☑ |
| Insects | *Libellula nodisticta* | Hoary skimmer | ☑ |
| Insects | *Somatochlora hudsonica* | Hudsonian emerald | ☑ |
| Insects | *Danaus plexippus* | Monarch butterfly | ☑ |
| Insects | *Capnia nelsoni* | Nelson’s snowfly | ☐ |
| Insects | *Sympetrum madidum* | Red-veined meadowfly | ☑ |
| Insects | *Speyeria idalia* | Regal fritillary | ☐ |
| Insects | *Bombus fraternus* | Southern plains bumblebee | ☑ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Ochrotrichia susanae* | Susan's purse-making caddisfly | ☑ |
| Insects | *Euphyes bimacula* | Two-spotted skipper | ☑ |
| Insects | *Boloria improba acrocnema* | Uncompahgre fritillary | ☐ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Mammals | *Sorex hoyi montanus* | Pygmy shrew | ☑ |
| Mammals | *Lontra canadensis* | River otter | ☐ |
| Mammals | *Lepus americanus* | Snowshoe hare | ☐ |
| Mollusks | *Promenetus umbillicatellus* | Cockerell | ☐ |
| Mollusks | *Promenetus exacuous* | Sharp sprite | ☐ |
| Plants | *Limnorchis zothecina* | Alcove bog orchid | ☐ |
| Plants | *Anticlea vaginatus* | Alcove death camas | ☐ |
| Plants | *Salix arizonica* | Arizona willow | ☑ |
| Plants | *Oenothera acutissima* | Narrow-leaf evening primrose | ☐ |
| Plants | *Thelypodium paniculatum* | Northwestern thelypody | ☑ |
| Plants | *Puccinellia parishii* | Parish’s alkali grass | ☑ |
| Plants | *Ptilagrostis porteri* | Porter feathergrass | ☑ |
| Plants | *Cleome multicaulis* | Slender spiderflower | ☑ |
| Reptiles | *Thamnophis sirtalis* | Common gartersnake | ☑ |

**Table 8 - Continued.**

| | | | |
|---|---|---|---|
| Reptiles | *Kinosternon flavescens* | Yellow mud turtle | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 5.2 Policies & Regulations | Establish mitigation requirements for developments and other projects that impact species/habitats | H |
| 01.3 Tourism & Recreation Areas | Roads and trails | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | H |
| 02.1 Annual & Perennial Non-Timber Crops | Conversion to pasture grass or other altered vegetation | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | H |
| 02.3 Livestock Farming & Ranching | Altered native vegetation (grazing intensity) | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) - altered flow and fluctuating water temperatures | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | H |
| 11.2 Droughts | Lack of water due to drought and exacerbated by climate change | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | M |
| 09.3 Agricultural & Forestry Effluents | Fertilizer runoff, herbicide/pesticide spraying or runoff | 2.3 Habitat & Natural Process Restoration | Identify and control point-source and non-point source pollution | M |
| 04.1 Roads & Railroads | Fragmentation | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects | L |

**Table 8 - Continued.**

**Aquatic** **Colorado Plateau - Wyoming Basins Rivers**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Birds | *Grus canadensis tabida* | Greater sandhill crane | ☐ |
| Fish | *Catostomus discobolus* | Bluehead sucker | ☑ |
| Fish | *Gila elegans* | Bonytail chub | ☑ |
| Fish | *Ptychocheilus lucius* | Colorado pikeminnow | ☑ |
| Fish | *Catostomus latipinnis* | Flannelmouth sucker | ☑ |
| Fish | *Gila cypha* | Humpback chub | ☑ |
| Fish | *Catostomus platyrhynchus* | Mountain sucker | ☑ |
| Fish | *Xyrauchen texanus* | Razorback sucker | ☑ |
| Fish | *Gila robusta* | Roundtail chub | ☑ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Euderma maculatum* | Spotted bat | ☐ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Hyla arenicolor* | Canyon tree frog | ☑ |
| Birds | *Falco peregrinus anatum* | American peregrine falcon | ☐ |
| Birds | *Pelecanus erythrorhynchos* | American white pelican | ☐ |
| Birds | *Bucephala islandica* | Barrow's goldeneye | ☐ |
| Birds | *Passerina amoena* | Lazuli bunting | ☐ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Progne subis* | Purple martin | ☐ |
| Birds | *Plegadis chihi* | White-faced ibis | ☑ |
| Insects | *Stylurus intricatus* | Brimstone clubtail | ☑ |
| Insects | *Lachlania saskatchewanensis* | Bushlegged mayfly | ☐ |
| Insects | *Ametropus neavei* | Mayfly, spp. | ☑ |
| Mammals | *Idionycteris phyllotis* | Allen's big-eared bat | ☐ |
| Mammals | *Lontra canadensis* | River otter | ☑ |
| Mollusks | *Ferrissia walkeri* | Cloche ancylid | ☐ |
| Mollusks | *Ferrissia fragilis* | Fragil ancylid | ☐ |
| Mollusks | *Promenetus exacuous* | Sharp sprite | ☐ |
| Reptiles | *Thamnophis cyrtopsis* | Blacknecked gartersnake | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using accepted integrated pest management techniques for aquatic habitats | H |
| 01.3 Tourism & Recreation Areas | Recreation area developments | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 02.1 Annual & Perennial Non-Timber Crops | Irrigated tilled and untilled crops | 2.3 Habitat & Natural Process Restoration | Improve erosion and excess sedimentation conditions | L |
| 02.3 Livestock Farming & Ranching | Domestic livestock grazing | 2.3 Habitat & Natural Process Restoration | Implement streambank or in-stream restoration/improvements | L |

**Table 8 - Continued.**

**Aquatic** **Colorado Plateau - Wyoming Basins Streams**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ✔ |
| Birds | *Aquila chrysaetos* | Golden eagle | |
| Birds | *Centrocercus urophasianus* | Greater sage-grouse | |
| Fish | *Catostomus discobolus* | Bluehead sucker | ✔ |
| Fish | *Oncorhynchus clarkii pleuriticus* | Colorado River cutthroat trout | |
| Fish | *Catostomus latipinnis* | Flannelmouth sucker | ✔ |
| Fish | *Catostomus platyrhynchus* | Mountain sucker | ✔ |
| Fish | *Gila robusta* | Roundtail chub | |
| Mammals | *Myotis thysanodes* | Fringed myotis | |
| Mammals | *Myotis lucifugus* | Little brown myotis | |
| Mammals | *Euderma maculatum* | Spotted bat | |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Hyla arenicolor* | Canyon tree frog | ✔ |
| Birds | *Falco peregrinus anatum* | American peregrine falcon | |
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ✔ |
| Birds | *Bucephala islandica* | Barrow's goldeneye | |
| Birds | *Cypseloides niger* | Black swift | ✔ |
| Birds | *Passerina amoena* | Lazuli bunting | |
| Birds | *Melanerpes lewis* | Lewis's woodpecker | ✔ |
| Birds | *Circus cyaneus* | Northern harrier | ✔ |
| Birds | *Falco mexicanus* | Prairie falcon | |
| Birds | *Buteo swainsoni* | Swainson's hawk | ✔ |
| Insects | *Speyeria nokomis nokomis* | Great Basin silverspot butterfly | |
| Insects | *Libellula nodisticta* | Hoary skimmer | ✔ |
| Mammals | *Idionycteris phyllotis* | Allen's big-eared bat | |
| Mammals | *Lontra canadensis* | River otter | |
| Reptiles | *Thamnophis cyrtopsis* | Blacknecked gartersnake | ✔ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Altered hydrological regime (surface or aquifer) | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 08.1 Invasive Non-Native/Alien Species | Non-native fish | 2.2 Invasive/Problematic Species Control | Control non-native fish using accepted integrated pest management techniques for aquatic habitats | H |
| 01.3 Tourism & Recreation Areas | Urban, suburban, and ex-urban development | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 02.1 Annual & Perennial Non-Timber Crops | Irrigated hay meadows | 2.3 Habitat & Natural Process Restoration | Restore native habitat | L |

**Table 8 - Continued.**

**Aquatic** **Eastern Plains Rivers**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Fish | *Etheostoma cragini* | Arkansas darter | ☐ |
| Fish | *Hybognathus hankinsoni* | Brassy minnow | ☐ |
| Fish | *Platygobio gracilis* | Flathead chub | ☑ |
| Fish | *Lepomis humilis* | Orangespotted sunfish | ☑ |
| Fish | *Etheostoma spectabile* | Orangethroat darter | ☐ |
| Fish | *Hybognathus placitus* | Plains minnow | ☑ |
| Fish | *Fundulus sciadicus* | Plains topminnow | ☑ |
| Fish | *Noturus flavus* | Stonecat | ☐ |
| Fish | *Phenacobius mirabilis* | Suckermouth minnow | ☑ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Zapus hudsonius luteus* | New Mexico jumping mouse | ☐ |
| Mammals | *Zapus hudsonius preblei* | Preble's meadow jumping mouse | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Acris crepitans* | Blanchard's cricket frog | ☑ |
| Amphibians | *Lithobates blairi* | Plains leopard frog | ☑ |
| Birds | *Falco peregrinus anatum* | American peregrine falcon | ☐ |
| Birds | *Pelecanus erythrorhynchos* | American white pelican | ☐ |
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ☑ |
| Birds | *Passerina amoena* | Lazuli bunting | ☐ |
| Birds | *Melanerpes lewis* | Lewis's woodpecker | ☑ |
| Birds | *Numenius americanus* | Long-billed curlew | ☐ |
| Birds | *Circus cyaneus* | Northern harrier | ☑ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Fish | *Etheostoma exile* | Iowa darter | ☑ |
| Insects | *Lachlania saskatchewanensis* | Bushlegged mayfly | ☐ |
| Insects | *Epitheca petechialis* | Dot-winged baskettail | ☐ |
| Insects | *Argia alberta* | Paiute dancer | ☑ |
| Insects | *Mesocapnia frisoni* | Plains snowfly | ☐ |
| Mammals | *Lontra canadensis* | River otter | ☐ |
| Mollusks | *Ferrissia fragilis* | Fragil ancylid | ☑ |
| Reptiles | *Thamnophis cyrtopsis* | Blacknecked gartersnake | ☑ |
| Reptiles | *Thamnophis sirtalis* | Common gartersnake | ☑ |
| Reptiles | *Rhinocheilus lecontei* | Long-nosed snake | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (aquifer) | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface) | 2.3 Habitat & Natural Process Restoration | Restore native habitat using site-specific techniques and context | H |
| 07.2 Dams & Water Management/Use | Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals | 2.3 Habitat & Natural Process Restoration | Collaborate with relevant agencies and stakeholders to adjust operation of dam | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk and Russian olive | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 09.2 Industrial & Military Effluents | Mining and energy production | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 01.1 Housing & Urban Areas | Urban & exurban development | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for urban development, landscaping, etc. | L |
| 02.1 Annual & Perennial Non-Timber Crops | Consumptive use for irrigation | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | L |

**Table 8 - Continued.**

**Aquatic** **Eastern Plains Streams**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ✔ |
| Birds | *Aquila chrysaetos* | Golden eagle | |
| Fish | *Etheostoma cragini* | Arkansas darter | ✔ |
| Fish | *Hybognathus hankinsoni* | Brassy minnow | ✔ |
| Fish | *Platygobio gracilis* | Flathead chub | ✔ |
| Fish | *Lepomis humilis* | Orangespotted sunfish | ✔ |
| Fish | *Etheostoma spectabile* | Orangethroat darter | ✔ |
| Fish | *Hybognathus placitus* | Plains minnow | |
| Fish | *Fundulus sciadicus* | Plains topminnow | ✔ |
| Fish | *Chrosomus erythrogaster* | Southern redbelly dace | |
| Fish | *Noturus flavus* | Stonecat | ✔ |
| Fish | *Phenacobius mirabilis* | Suckermouth minnow | ✔ |
| Mammals | *Myotis lucifugus* | Little brown myotis | |
| Mammals | *Zapus hudsonius luteus* | New Mexico jumping mouse | ✔ |
| Mammals | *Zapus hudsonius preblei* | Preble's meadow jumping mouse | ✔ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Acris crepitans* | Blanchard's cricket frog | ✔ |
| Amphibians | *Gastrophryne olivacea* | Great Plains narrowmouth toad | ✔ |
| Amphibians | *Anaxyrus debilis* | Green toad | ✔ |
| Amphibians | *Lithobates blairi* | Plains leopard frog | ✔ |
| Birds | *Falco peregrinus anatum* | American peregrine falcon | |
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ✔ |
| Birds | *Passerina amoena* | Lazuli bunting | |
| Birds | *Melanerpes lewis* | Lewis's woodpecker | ✔ |
| Birds | *Numenius americanus* | Long-billed curlew | |
| Birds | *Colinus virginianus* | Northern bobwhite | |
| Birds | *Circus cyaneus* | Northern harrier | ✔ |
| Birds | *Falco mexicanus* | Prairie falcon | |
| Birds | *Buteo swainsoni* | Swainson's hawk | ✔ |
| Fish | *Etheostoma exile* | Iowa darter | ✔ |
| Insects | *Epitheca petechialis* | Dot-winged baskettail | |
| Insects | *Libellula nodisticta* | Hoary skimmer | ✔ |
| Insects | *Somatochlora ensigera* | Lemon-faced emerald | ✔ |
| Insects | *Argia alberta* | Paiute dancer | ✔ |
| Insects | *Mesocapnia frisoni* | Plains snowfly | |
| Insects | *Neochoroterpes oklahoma* | Pronggill mayfly | |
| Insects | *Euphyes bimacula* | Two-spotted skipper | ✔ |
| Mammals | *Lontra canadensis* | River otter | |
| Mollusks | *Anodontoides ferussacianus* | Cylindrical papershell | ✔ |
| Mollusks | *Ferrissia fragilis* | Fragil ancylid | ✔ |
| Mollusks | *Uniomerus tetralasmus* | Pondhorn | ✔ |
| Reptiles | *Thamnophis cyrtopsis* | Blacknecked gartersnake | ✔ |
| Reptiles | *Thamnophis sirtalis* | Common gartersnake | ✔ |
| Reptiles | *Hypsiglena chlorophaea* | Desert nightsnake | |
| Reptiles | *Rena dissectus* | New Mexico threadsnake | |
| Reptiles | *Kinosternon flavescens* | Yellow mud turtle | ✔ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.3 Livestock Farming & Ranching | Incompatible grazing | 2.1 Site/Area Management | Implement compatible grazing practices | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (aquifer) | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface) | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 02.1 Annual & Perennial Non-Timber Crops | Irrigation | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | M |
| 08.1 Invasive Non-Native/Alien Species | Invasive plants - tamarisk and Russian olive | 2.2 Invasive/Problematic Species Control | Write and/or implement integrated weed/pest management plan | M |
| 09.3 Agricultural & Forestry Effluents | Fertilizer runoff, herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 01.1 Housing & Urban Areas | Habitat fragmentation | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for urban development, landscaping, etc. | L |

**Table 8 - Continued.**

**Aquatic** **Lakes**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain Population) | ☑ |
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ☑ |
| Fish | *Oncorhynchus clarkii pleuriticus* | Colorado River cutthroat trout | ☑ |
| Fish | *Catostomus latipinnis* | Flannelmouth sucker | ☐ |
| Fish | *Oncorhynchus clarkii stomias* | Greenback cutthroat trout | ☑ |
| Fish | *Chrosomus eos* | Northern redbelly dace | ☐ |
| Fish | *Lepomis humilis* | Orangespotted sunfish | ☐ |
| Fish | *Gila pandora* | Rio Grande chub | ☐ |
| Fish | *Oncorhynchus clarkii virginalis* | Rio Grande cutthroat trout | ☑ |
| Fish | *Chrosomus erythrogaster* | Southern redbelly dace | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates sylvatica* | Wood frog | ☑ |
| Birds | *Bucephala islandica* | Barrow's goldeneye | ☑ |
| Birds | *Plegadis chihi* | White-faced ibis | ☑ |
| Fish | *Couesius plumbeus* | Lake chub | ☑ |
| Insects | *Libellula nodisticta* | Hoary skimmer | ☑ |
| Insects | *Sympetrum madidum* | Red-veined meadowfly | ☑ |
| Mollusks | *Ferrissia walkeri* | Cloche ancylid | ☑ |
| Mollusks | *Promenetus umbillicatellus* | Cockerell | ☑ |
| Mollusks | *Anodontoides ferussacianus* | Cylindrical papershell | ☑ |
| Mollusks | *Ferrissia fragilis* | Fragil ancylid | ☐ |
| Mollusks | *Uniomerus tetralasmus* | Pondhorn | ☑ |
| Mollusks | *Acroloxus coloradensis* | Rocky Mountain capshell | ☑ |
| Mollusks | *Promenetus exacuous* | Sharp sprite | ☑ |
| Mollusks | *Physa gyrina utahensis* | Utah physa | ☑ |
| Reptiles | *Kinosternon flavescens* | Yellow mud turtle | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 09.3 Agricultural & Forestry Effluents | Fertilizer runoff, herbicide/pesticide spraying or runoff | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for transportation projects, urban development, landscaping, etc.. | M |
| 09.3 Agricultural & Forestry Effluents | Nutrient loads | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for agricultural production | M |
| 01.3 Tourism & Recreation Areas | Recreational infrastructure development | 2.1 Site/Area Management | Coordinate on ecologically sensitive design of recreational facilities | L |
| 06.1 Recreational Activities | Recreational use that disturbs species of concern | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | L |
| 09.5 Air-Borne Pollutants | Excess nitrogen deposition | 5.4 Compliance & Enforcement | Enforce state/federal/local pollution standards | L |

**Table 8 - Continued.**

## Aquatic — Mountain Streams

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain Population) | ☑ |
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Birds | *Grus canadensis tabida* | Greater sandhill crane | ☐ |
| Fish | *Oncorhynchus clarkii pleuriticus* | Colorado River cutthroat trout | ☑ |
| Fish | *Oncorhynchus clarkii stomias* | Greenback cutthroat trout | ☑ |
| Fish | *Catostomus platyrhynchus* | Mountain sucker | ☐ |
| Fish | *Gila pandora* | Rio Grande chub | ☐ |
| Fish | *Oncorhynchus clarkii virginalis* | Rio Grande cutthroat trout | ☑ |
| Fish | *Catostomus plebeius* | Rio Grande sucker | ☑ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Zapus hudsonius luteus* | New Mexico jumping mouse | ☑ |
| Mammals | *Zapus hudsonius preblei* | Prebles meadow jumping mouse | ☑ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |
| Plants | *Draba weberi* | Weber's draba | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates sylvatica* | Wood frog | ☑ |
| Birds | *Falco peregrinus anatum* | American peregrine falcon | ☐ |
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ☐ |
| Birds | *Bucephala islandica* | Barrow's goldeneye | ☐ |
| Birds | *Cypseloides niger* | Black swift | ☑ |
| Birds | *Passerina amoena* | Lazuli bunting | ☐ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Progne subis* | Purple martin | ☐ |
| Insects | *Arsapnia arapahoe* | Arapahoe snowfly | ☑ |
| Insects | *Baetis brunneicolor* | Small minnow mayfly | ☐ |
| Mammals | *Ursus arctos* | Grizzly bear | ☐ |
| Mammals | *Lontra canadensis* | River otter | ☑ |
| Mollusks | *Promenetus umbillicatellus* | Cockerell | ☐ |
| Mollusks | *Acroloxus coloradensis* | Rocky Mountain capshell | ☐ |
| Mollusks | *Promenetus exacuous* | Sharp sprite | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime (surface or aquifer) | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 08.1 Invasive Non-Native/Alien Species | Invasive animals | 2.2 Invasive/Problematic Species Control | Control non-native fish using accepted integrated pest management techniques for aquatic habitats | M |

## Aquatic — Reservoirs and Shorelines

**Tier 1 Species**

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Pelecanus erythrorhynchos* | American white pelican | ☑ |
| Birds | *Sterna antillarum* | Least tern | ☑ |
| Birds | *Charadrius melodus* | Piping plover | ☑ |
| Birds | *Charadrius alexandrinus nivosus* | Western snowy plover | ☑ |
| Birds | *Plegadis chihi* | White-faced ibis | ☑ |
| Insects | *Bombus fraternus* | Southern plains bumblebee | ☑ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Mollusks | *Ferrissia walkeri* | Cloche ancylid | ☐ |
| Mollusks | *Ferrissia fragilis* | Fragil ancylid | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.3 Tourism & Recreation Areas | | 2.1 Site/Area Management | Coordinate on ecologically sensitive design of recreational facilities | M |
| 06.1 Recreational Activities | | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | M |

**Table 8 - Continued.**

## Aquatic — Rio Grande Valley Rivers

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Fish | *Gila pandora* | Rio Grande chub | ☑ |
| Fish | *Catostomus plebeius* | Rio Grande sucker | ☑ |
| | | | |

**Tier 2 Species**

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 11.1 Habitat Shifting & Alteration | Altered flows, temperature, and other habitat characteristics related to changing temperature and precipitation regimes | 8.0 Research & Monitoring | Prepare climate change adaptation strategy to identify and address barriers to species movement and habitat shifting | H |
| 02.1 Annual & Perennial Non-Timber Crops | consumptive water use | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | M |
| 01.1 Housing & Urban Areas | consumptive water use | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | L |

## Aquatic — Rio Grande Valley Streams

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Fish | *Gila pandora* | Rio Grande chub | ☑ |
| Fish | *Catostomus plebeius* | Rio Grande sucker | ☑ |
| | | | |

**Tier 2 Species**

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 11.1 Habitat Shifting & Alteration | Altered flows, temperature, and other habitat characteristics related to changing temperature and precipitation regimes | 8.0 Research & Monitoring | Prepare climate change adaptation strategy to identify and address barriers to species movement and habitat shifting | H |
| 02.1 Annual & Perennial Non-Timber Crops | consumptive water use | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | M |
| 01.1 Housing & Urban Areas | consumptive water use | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | L |

**Table 8 - Continued.**

**Aquatic** **Transition Streams**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Lithobates pipiens* | Northern leopard frog | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Fish | *Etheostoma cragini* | Arkansas darter | ☐ |
| Fish | *Hybognathus hankinsoni* | Brassy minnow | ☑ |
| Fish | *Luxilus cornutus* | Common shiner | ☑ |
| Fish | *Platygobio gracilis* | Flathead chub | ☑ |
| Fish | *Chrosomus eos* | Northern redbelly dace | ☑ |
| Fish | *Lepomis humilis* | Orangespotted sunfish | ☐ |
| Fish | *Etheostoma spectabile* | Orangethroat darter | ☐ |
| Fish | *Fundulus sciadicus* | Plains topminnow | ☑ |
| Fish | *Chrosomus erythrogaster* | Southern redbelly dace | ☑ |
| Fish | *Noturus flavus* | Stonecat | ☑ |
| Fish | *Phenacobius mirabilis* | Suckermouth minnow | ☐ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☐ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Zapus hudsonius luteus* | New Mexico jumping mouse | ☐ |
| Mammals | *Zapus hudsonius preblei* | Prebles meadow jumping mouse | ☑ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Falco peregrinus anatum* | American peregrine falcon | ☐ |
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ☑ |
| Birds | *Passerina amoena* | Lazuli bunting | ☐ |
| Birds | *Melanerpes lewis* | Lewis's woodpecker | ☑ |
| Birds | *Strix occidentalis lucida* | Mexican spotted owl | ☑ |
| Birds | *Circus cyaneus* | Northern harrier | ☑ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Oreothlypis virginiae* | Virginia's warbler | ☐ |
| Fish | *Etheostoma exile* | Iowa darter | ☑ |
| Insects | *Arsapnia arapahoe* | Arapahoe snowfly | ☐ |
| Insects | *Celastrina humulus* | Hops feeding azure | ☑ |
| Insects | *Callophrys mossii schryveri* | Moss's elfin | ☐ |
| Insects | *Mesocapnia frisoni* | Plains snowfly | ☑ |
| Mammals | *Lontra canadensis* | River otter | ☐ |
| Mollusks | *Physa gyrina utahensis* | Utah physa | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 07.2 Dams & Water Management/Use | Altered hydrological regime | 2.3 Habitat & Natural Process Restoration | Restore or maintain suitable hydrological regime | H |
| 11.1 Habitat Shifting & Alteration | Altered flows, temperature, and other habitat characteristics related to changing temperature and precipitation regimes | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | H |
| 01.1 Housing & Urban Areas | Altered hydrological regime | 1.2 Resource & Habitat Protection | Acquire water rights or instream flow rights | L |

**Table 8 - Continued.**

**Other** **Agriculture**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Tympanuchus phasianellus columbianus* | Columbian sharp-tailed grouse | ☐ |
| Birds | *Centrocercus urophasianus* | Greater sage-grouse | ☐ |
| Birds | *Grus canadensis tabida* | Greater sandhill crane | ☑ |
| Birds | *Centrocercus minimus* | Gunnison sage-grouse | ☐ |
| Birds | *Tympanuchus pallidicinctus* | Lesser prairie-chicken | ☐ |
| Birds | *Charadrius montanus* | Mountain plover | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Haliaeetus leucocephalus* | Bald eagle | ☐ |
| Birds | *Patagioenas fasciata* | Band-tailed pigeon | ☐ |
| Birds | *Dolichonyx oryzivorus* | Bobolink | ☑ |
| Birds | *Spizella breweri* | Brewer's sparrow | ☐ |
| Birds | *Aimophila cassinii* | Cassin's sparrow | ☐ |
| Birds | *Calcarius ornatus* | Chestnut-collared longspur | ☐ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☐ |
| Birds | *Tympanuchus cupido* | Greater prairie-chicken | ☑ |
| Birds | *Calamospiza melanocorys* | Lark bunting | ☑ |
| Birds | *Melanerpes lewis* | Lewis's woodpecker | ☐ |
| Birds | *Lanius ludovicianus* | Loggerhead shrike | ☐ |
| Birds | *Numenius americanus* | Long-billed curlew | ☐ |
| Birds | *Rhynchophanes mccownii* | McCown's longspur | ☐ |
| Birds | *Colinus virginianus* | Northern bobwhite | ☑ |
| Birds | *Circus cyaneus* | Northern harrier | ☑ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Asio flammeus* | Short-eared owl | ☐ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☑ |
| Birds | *Bartramia longicauda* | Upland sandpiper | ☐ |
| Birds | *Plegadis chihi* | White-faced ibis | ☑ |
| Birds | *Grus americana* | Whooping crane | ☑ |
| Insects | *Bombus pensylvanicus* | American bumblebee | ☑ |
| Insects | *Danaus plexippus* | Monarch butterfly | ☑ |
| Insects | *Bombus fraternus* | Southern plains bumblebee | ☑ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Insects | *Bombus fervidus* | Yellow bumblebee | ☑ |
| Mammals | *Vulpes velox* | Swift fox | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Lack of plant and structural diversity within fields and within landscapes | 2.1 Site/Area Management | Encourage multi-species cover crops in annual farming operations | H |
| 02.1 Annual & Perennial Non-Timber Crops | Lack of plant and structural diversity within fields and within landscapes | 2.1 Site/Area Management | Plant marginally productive cropland to permanent wildlife cover | H |
| 02.1 Annual & Perennial Non-Timber Crops | Loss of habitat from agricultural de-watering | 1.2 Resource & Habitat Protection | Use conservation easements or co-op agreements to secure water rights in key areas | H |
| 02.1 Annual & Perennial Non-Timber Crops | Direct mortality caused by harvest operations | 2.1 Site/Area Management | Encourage delayed harvest until after bird nesting | M |
| 02.1 Annual & Perennial Non-Timber Crops | Direct mortality caused by harvest operations | 2.1 Site/Area Management | Encourage use of wildlife friendly harvest techniques | M |
| 02.1 Annual & Perennial Non-Timber Crops | Lack of plant and insect diversity within fields | 2.1 Site/Area Management | Encourage use of Integrated Pest Management in agricultural operations | M |
| 02.1 Annual & Perennial Non-Timber Crops | Lack of plant and structural diversity within landscapes | 2.1 Site/Area Management | Encourage more diverse crop rotations | L |

**Table 8 - Continued.**

**Other** **Alpine**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Leucosticte australis* | Brown-capped rosy-finch | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Birds | *Lagopus leucura altipetens* | Southern white-tailed ptarmigan | ☑ |
| Mammals | *Ochotona princeps* | American pika | ☑ |
| Mammals | *Gulo gulo* | Wolverine | ☑ |
| Plants | *Descurainia kenheilii* | Heil's tansy mustard | ☑ |
| Plants | *Eutrema penlandii* | Penland alpine fen mustard | ☐ |
| Plants | *Oreoxis humilis* | Pikes Peak spring parsley | ☑ |
| Plants | *Aliciella sedifolia* | Stonecrop gilia | ☑ |
| Plants | *Draba weberi* | Weber's draba | ☑ |
| Plants | *Physaria scrotiformis* | West Silver bladderpod | ☑ |
| Plants | *Draba malpighiacea* | Whitlow-grass | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Leucosticte atrata* | Black rosy-finch | ☑ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Selasphorus rufus* | Rufous hummingbird | ☑ |
| Insects | *Bombus suckleyi* | Suckley cuckoo bumblebee | ☑ |
| Insects | *Boloria improba acrocnema* | Uncompahgre fritillary | ☑ |
| Insects | *Bombus occidentalis* | Western bumblebee | ☑ |
| Mammals | *Martes americana* | American marten | ☐ |
| Mammals | *Ovis canadensis* | Bighorn sheep | ☐ |
| Mammals | *Ursus arctos* | Grizzly bear | ☑ |
| Plants | *Physaria alpina* | Avery Peak twinpod | ☑ |
| Plants | *Draba exunguiculata* | Clawless draba | ☑ |
| Plants | *Delphinium ramosum var. alpestre* | Colorado larkspur | ☑ |
| Plants | *Eriogonum coloradense* | Colorado wild buckwheat | ☑ |
| Plants | *Castilleja puberula* | Downy Indian paintbrush | ☑ |
| Plants | *Ipomopsis globularis* | Globe gilia | ☑ |
| Plants | *Draba grayana* | Gray's Peak whitlow-grass | ☑ |
| Plants | *Telesonix jamesii* | James telesonix | ☐ |
| Plants | *Townsendia rothrockii* | Rothrock townsend-daisy | ☑ |
| Plants | *Draba graminea* | San Juan whitlow-grass | ☑ |
| Plants | *Saussurea weberi* | Weber saussurea | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 09.5 Air-Borne Pollutants | Anthropogenic nitrogen deposition | 5.4 Compliance & Enforcement | Enforce state/federal/local pollution standards | H |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Prepare climate change adaptation strategy to identify and address barriers to species movement and habitat shifting | H |
| 11.3 Temperature Extremes | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | H |
| 06.1 Recreational Activities | Altered vegetation from hiking, camping, etc. | 5.4 Compliance & Enforcement | Manage public use to be compatible with biodiversity | M |
| 01.3 Tourism & Recreation Areas | Roads, trails, ski areas | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | L |
| 02.3 Livestock Farming & Ranching | Altered native vegetation - Sheep grazing | 2.1 Site/Area Management | Implement compatible grazing practices | L |

**Table 8 - Continued.**

**Other** **Barrens**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Plants | *Corispermum navicula* | Boat-shaped bugseed | ☐ |
| Plants | *Eriogonum brandegeei* | Brandegee wild buckwheat | ☑ |
| Plants | *Physaria pulvinata* | Cushion bladderpod | ☐ |
| Plants | *Phacelia submutica* | DeBeque phacelia | ☑ |
| Plants | *Boechera glareosa* | Dorn's rockcress | ☑ |
| Plants | *Physaria congesta* | Dudley Bluffs bladderpod | ☑ |
| Plants | *Penstemon gibbensii* | Gibben's beardtongue | ☑ |
| Plants | *Gutierrezia elegans* | Lone Mesa snakeweed | ☐ |
| Plants | *Packera mancosana* | Mancos shale packera | ☑ |
| Plants | *Sclerocactus mesae-verdae* | Mesa Verde hookless cactus | ☑ |
| Plants | *Phacelia formosula* | North Park phacelia | ☑ |
| Plants | *Ipomopsis polyantha* | Pagosa skyrocket | ☐ |
| Plants | *Penstemon debilis* | Parachute penstemon | ☑ |
| Plants | *Physaria obcordata* | Piceance twinpod | ☑ |
| Plants | *Physaria rollinsii* | Rollins twinpod | ☐ |
| Plants | *Physaria scrotiformis* | West Silver bladderpod | ☐ |
| Plants | *Penstemon scariosus var. albifluvis* | White River penstemon | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Plants | *Physaria bellii* | Bell's twinpod | ☑ |
| Plants | *Lomatium concinnum* | Colorado desert-parsley | ☐ |
| Plants | *Astragalus debequaeus* | DeBeque milkvetch | ☐ |
| Plants | *Townsendia fendleri* | Fendler's townsend-daisy | ☑ |
| Plants | *Nuttallia chrysantha* | Golden blazing star | ☑ |
| Plants | *Penstemon grahamii* | Graham beardtongue | ☑ |
| Plants | *Townsendia glabella* | Gray's townsend-daisy | ☑ |
| Plants | *Oreocarya revealii* | Gypsum Valley cat's- eye | ☐ |
| Plants | *Oreocarya osterhoutii* | Osterhout cat's-eye | ☑ |
| Plants | *Physaria pruinosa* | Pagosa bladderpod | ☑ |
| Plants | *Lupinus crassus* | Payson lupine | ☐ |
| Plants | *Physaria parviflora* | Piceance bladderpod | ☑ |
| Plants | *Oonopsis puebloensis* | Pueblo goldenweed | ☐ |
| Plants | *Mentzelia rhizomata* | Roan Cliffs blazing star | ☑ |
| Plants | *Oxybaphus rotundifolius* | Round-leaf four o'clock | ☑ |
| Plants | *Thalictrum heliophilum* | Sun-loving meadow rue | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.1 Housing & Urban Areas | Housing, urban and ex-urban development | 1.2 Resource & Habitat Protection | Acquire conservation easement for habitat protection | H |
| 03.1 Oil & Gas Drilling | Habitat fragmentation and degradation | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | H |
| 11.1 Habitat Shifting & Alteration | Habitat shifting and alteration due to climate change | 8.0 Research & Monitoring | Prepare climate change adaptation strategy to identify and address barriers to species movement and habitat shifting | H |
| 06.1 Recreational Activities | Motorized recreation (OHV) | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | M |

**Table 8 - Continued.**

**Other** **Cliffs and Canyons**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Leucosticte australis* | Brown-capped rosy-finch | ☐ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☑ |
| Mammals | *Myotis thysanodes* | Fringed myotis | ☑ |
| Mammals | *Myotis lucifugus* | Little brown myotis | ☐ |
| Mammals | *Euderma maculatum* | Spotted bat | ☑ |
| Mammals | *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | ☑ |
| Plants | *Mimulus gemmiparus* | Budding monkey flower | ☑ |
| Plants | *Aletes latilobus* | Canyonlands aletes | ☑ |
| Plants | *Astragalus deterior* | Cliff-palace milkvetch | ☑ |
| Plants | *Astragalus humillimus* | Mancos milkvetch | ☑ |
| Plants | *Hackelia gracilenta* | Mesa Verde stickseed | ☐ |
| Plants | *Erigeron wilkenii* | Wilken fleabane | ☑ |
| Reptiles | *Aspidoscelis neotesselata* | Colorado checkered whiptail | ☑ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Amphibians | *Hyla arenicolor* | Canyon tree frog | ☐ |
| Arachnids | *Hypochilus bonneti* | A lampshade spider | ☑ |
| Birds | *Falco peregrinus anatum* | American peregrine falcon | ☑ |
| Birds | *Cypseloides niger* | Black swift | ☑ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☐ |
| Birds | *Strix occidentalis lucida* | Mexican spotted owl | ☑ |
| Birds | *Falco mexicanus* | Prairie falcon | ☑ |
| Insects | *Euphilotes rita coloradensis* | Colorado blue | ☑ |
| Mammals | *Idionycteris phyllotis* | Allen's big-eared bat | ☐ |
| Mammals | *Nyctinomops macrotis* | Big free-tailed bat | ☑ |
| Mammals | *Ovis canadensis* | Bighorn sheep | ☑ |
| Plants | *Limnorchis zothecina* | Alcove bog orchid | ☑ |
| Plants | *Anticlea vaginatus* | Alcove death camas | ☑ |
| Plants | *Telesonix jamesii* | James telesonix | ☑ |
| Plants | *Erigeron kachinensis* | Kachina daisy | ☑ |
| Plants | *Aletes humilis* | Larimer aletes | ☑ |
| Plants | *Aletes macdougalii ssp. breviradiatus* | Mesa Verde aletes | ☑ |
| Plants | *Astragalus naturitensis* | Naturita milkvetch | ☑ |
| Plants | *Potentilla rupincola* | Rocky Mountain cinquefoil | ☑ |
| Plants | *Draba smithii* | Smith whitlow-grass | ☑ |
| Reptiles | *Crotalus oreganus concolor* | Midget faded rattlesnake | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | Trail development, climbing | 5.4 Compliance & Enforcement | Manage public use to be compatible with biodiversity | H |
| 11.2 Droughts | Lack of water for seep habitats | 8.0 Research & Monitoring | Research population parameters and/or monitor status | H |
| 03.2 Mining & Quarrying | Rock quarrying | 2.1 Site/Area Management | Manage to limit disturbance, especially to roost sites, maternity colonies, and hibernacula | M |
| 03.3 Renewable Energy | Wind turbines in Eastern Colorado outcrop areas | 5.3 Private Sector Standards & Codes | Implement Best Management Practices for energy development and mining | M |
| 04.1 Roads & Railroads | Fragmentation | 2.3 Habitat & Natural Process Restoration | Maintain appropriate patch size and habitat mosaic | L |

**Table 8 - Continued.**

**Other** **Conservation Reserve Program**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Tympanuchus phasianellus columbianus* | Columbian sharp-tailed grouse | ☑ |
| Birds | *Aquila chrysaetos* | Golden eagle | ☐ |
| Birds | *Centrocercus urophasianus* | Greater sage-grouse | ☐ |
| Birds | *Centrocercus minimus* | Gunnison sage-grouse | ☑ |
| Birds | *Tympanuchus pallidicinctus* | Lesser prairie-chicken | ☑ |
| Birds | *Tympanuchus phasianellus jamesi* | Plains sharp-tailed grouse | ☑ |
| Reptiles | *Aspidoscelis neotesselata* | Colorado checkered whiptail | ☐ |
| Reptiles | *Sistrurus catenatus* | Massasauga | ☐ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Birds | *Dolichonyx oryzivorus* | Bobolink | ☐ |
| Birds | *Spizella breweri* | Brewer's sparrow | ☐ |
| Birds | *Aimophila cassinii* | Cassin's sparrow | ☐ |
| Birds | *Calcarius ornatus* | Chestnut-collared longspur | ☐ |
| Birds | *Buteo regalis* | Ferruginous hawk | ☐ |
| Birds | *Ammodramus savannarum* | Grasshopper sparrow | ☑ |
| Birds | *Tympanuchus cupido* | Greater prairie-chicken | ☐ |
| Birds | *Calamospiza melanocorys* | Lark bunting | ☐ |
| Birds | *Rhynchophanes mccownii* | McCown's longspur | ☐ |
| Birds | *Colinus virginianus* | Northern bobwhite | ☐ |
| Birds | *Circus cyaneus* | Northern harrier | ☐ |
| Birds | *Falco mexicanus* | Prairie falcon | ☐ |
| Birds | *Amphispiza belli* | Sage sparrow | ☐ |
| Birds | *Buteo swainsoni* | Swainson's hawk | ☐ |
| Mammals | *Vulpes velox* | Swift fox | ☐ |
| Reptiles | *Rhinocheilus lecontei* | Long-nosed snake | ☐ |
| Reptiles | *Tantilla horbartsmithi* | Smith's black-headed snake | ☐ |
| Reptiles | *Phrynosoma cornutum* | Texas horned lizard | ☐ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 02.1 Annual & Perennial Non-Timber Crops | Decreasing plant diversity and structure; monocultures | 2.1 Site/Area Management | Use Mid-Contract Management provisions to increase plant diversity and wildlife benefits | H |
| 02.1 Annual & Perennial Non-Timber Crops | Decreasing plant diversity/monocultures | 2.1 Site/Area Management | Plant more diverse seed mixes | H |
| 02.1 Annual & Perennial Non-Timber Crops | Stands converting to undesirable grass species; lack of cover | 2.1 Site/Area Management | Avoid haying CRP; plant diverse seed mixes that avoid aggressive grasses | H |
| 02.1 Annual & Perennial Non-Timber Crops | Decrease in CRP acres enrolled | 4.3 Awareness & Communications | Provide additional outreach to landowners to increase enrollment | M |
| 02.1 Annual & Perennial Non-Timber Crops | Decrease in CRP acres enrolled | 6.4 Conservation Payments | Provide additional enrollment incentives to landowners, offer alternatives for establishing/maintaining similar habitat type | M |
| 02.1 Annual & Perennial Non-Timber Crops | Stands converting to undesirable grass species; lack of cover | 2.1 Site/Area Management | Graze only with a prescribed grazing plan that benefits wildlife habitat | M |
| 02.1 Annual & Perennial Non-Timber Crops | Decreasing plant diversity/monocultures | 2.1 Site/Area Management | Target placement and design seed mixes in CRP to provide habitat for priority wildlife species | L |

**Other** **Hot Springs**

**Tier 1 Species**

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Mollusks | *Physa cupreonitens* | Hot Springs physa | ☑ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 01.3 Tourism & Recreation Areas | Recreational infrastructure | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | H |
| 03.3 Renewable Energy | Geothermal power development | 5.2 Policies & Regulations | Establish mitigation requirements for developments and other projects that impact species/habitats | L |

**Table 8 - Continued.**

**Other** **Sand Dunes**

**Tier 1 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Plants | *Corispermum navicula* | Boat-shaped bugseed | ✔ |

**Tier 2 Species**

| Group | Species | Common Name | Primary |
|---|---|---|---|
| Insects | *Amblyderus werneri* | Great Sand Dunes anthicid beetle | ✔ |
| Insects | *Cicindela theatina* | San Luis Dunes tiger beetle | ✔ |
| Insects | *Euproserpinus wiesti* | Wiest's sphinx moth | ✔ |

| General Threat | Specific Threat | General Conservation Action | Specific Conservation Action | Priority |
|---|---|---|---|---|
| 06.1 Recreational Activities | OHV use | 2.1 Site/Area Management | Manage public use to be compatible with biodiversity | M |
| 11.1 Habitat Shifting & Alteration | Potential for increased dune & sheet movement | 8.0 Research & Monitoring | Conduct primary research on species and habitat responses to changing climate | M |
| 02.3 Livestock Farming & Ranching | Conversion to cropland, or other stabilization practices | 2.1 Site/Area Management | Implement compatible grazing practices | L |

# Chapter 7: Monitoring

Utmost in priority for achieving the goals of the SWAP is the ability to monitor progress toward benchmark measures of success and population security thresholds for species and habitats. This clearly reflects the need for a comprehensive system that allows information from past and future inventories, surveys, research, and management actions to be accumulated, consolidated at multiple scales, and easily and rapidly distributed and compared to benchmarks. Many of the elements needed for such a system are already in place.

CPW and CNHP maintain databases that house detailed biological and location information on wildlife species and habitats in the state. The Crucial Habitat Assessment Tool (CHAT), developed by the Western Governors' Association and multiple conservation partners, prioritizes habitats by importance to vulnerable wildlife species[17]. The Colorado Ownership, Management, and Protection database (COMaP) consolidates ownership data on protected lands in the state[18]. These data management tools can be used together to support a comprehensive monitoring program to gauge progress toward conservation goals.

## Species Monitoring

For species, Colorado's monitoring will first employ existing surveys and inventories, including monitoring being done by CPW and conservation partners (Table 9). For many of our highest priority SGCN, long-term monitoring efforts are on-going. In addition to the monitoring efforts listed in Table 9, CPW resource stewardship staff conduct a variety of monitoring programs on State Park Lands, including raptor monitoring, bird surveys (including song birds, waterfowl, migratory birds), and presence/absence of small mammals and amphibians. In a number of cases, monitoring or research will need to be the first step when existing status of, and threats to, SGCN are unknown. There are three Tier 1 and 41 Tier 2 vertebrate and mollusk SGCN not currently covered by existing monitoring efforts (identified by blanks in Table 9). Development of monitoring programs will be a priority conservation action for many of these species.

CPW's Colorado Natural Areas Program (CNAP) provides monitoring of rare species, especially rare plants, which is further outlined in the Rare Plant SWAP (Appendix A). CNAP and some state parks also periodically inventory invertebrates and use volunteers to monitor butterflies. However, of the non-mollusk invertebrate SGCN, very few species are regularly monitored (Appendix B), and all of those are monitored only at the local scale. Because CPW does not have

[17] http://westgovchat.org

[18] http://centroid1.warnercnr.colostate.edu/COMaP_v9/download_comap9.html

legislative authority over these species groups, we rely upon our conservation partners to fill this gap. The Colorado Butterfly Monitoring Network[19], launched in 2013 by the Butterfly Pavilion, and the Xerces Society's BumbleBee Watch[20] are two examples of how Coloradoans can help meet this need.

## Habitat Monitoring

There are currently very few monitoring programs for habitat at a statewide scale. The U.S. Forest Service's national Forest Inventory and Analysis is implemented across all forest types in Colorado by the Colorado State Forest Service[21]. The Colorado State Forest Service also surveys forest insect and disease outbreaks[22]. Habitat monitoring on State Parks is conducted by CPW resource stewardship staff through vegetation plot monitoring. CNAP conducts long-term monitoring of numerous representative and rare plant communities which are identified and designated within the state's natural areas system. Federal, state, and local public land managers monitor lands within their jurisdictions to varying degrees, but no formal program exists for monitoring habitats across ownership boundaries. As natural resource stewardship evolves over the coming years, identifying new ways to coordinate monitoring of habitats is needed.

## Measuring Conservation Success

To facilitate monitoring the effectiveness of implemented conservation efforts at a statewide scale, periodic assessments of the conservation status of SGCN and key habitats will be conducted following methods developed for the State of Colorado's Biodiversity report (Rondeau et al. 2011). The State of Colorado's Biodiversity presents a measure of the effectiveness of conservation action for select species and ecosystems, following a systematic and repeatable scorecard approach. Methods behind the analysis were developed by the Colorado Natural Heritage Program and The Nature Conservancy, with input from CPW. Species and ecosystems were assessed for *biodiversity status*, *threats*, and current *level of protection*. Each of these three main categories was analyzed according to several sub-categories, as appropriate for plants, animals, and ecosystems. Sub-categories for biodiversity status include indicators of both size and condition (e.g., abundance, number of populations, landscape setting, and so on). Threats were evaluated for scope, severity, and immediacy. Protection status was assessed based on the proportion of known populations on lands that are legally protected from conversion (note that this measure reflects the long-term security of the existing land use in a legal framework; it is not suggestive of the relative quality of a given occurrence).

[19] http://www.nab-net.org/program/colorado-butterfly-monitoring-network

[20] www.BumbleBeeWatch.org

[21] http://csfs.colostate.edu/forest-management/forest-inventory-analysis/

[22] http://csfs.colostate.edu/forest-management/common-forest-insects-diseases/

All factors, taken together, were combined to provide an overall indication of how effective past and current conservation actions have been in the context of current land use and human activity, as well as what types of conservation strategies might be most effective in the future. Ultimately, species and ecosystems were categorized as Effectively Conserved, Moderately Conserved, Under Conserved, or Poorly Conserved. It is important to understand that these are relative scores from a statewide perspective. These methods do not address regional, watershed, or local status and context. Likewise, they do not address listing factors associated with the Endangered Species Act, and are not appropriate for that purpose. The strength of the scorecard approach is that it supports periodic re-assessment of ecosystems and species status as a way to evaluate progress toward conservation goals. Rondeau et al. (2011) provides additional details on methods and current results (the Executive Summary for the 2011 report is attached as Appendix G; the full report can be downloaded from http://www.cnhp.colostate.edu). Note that conditions have already changed for some species and ecosystems reviewed in the 2011 report. Keeping the analysis as well as the underlying data and assumptions current is a high priority for monitoring the status of SGCN and their habitats and the effectiveness of implemented conservation actions.

Our goal is to update the biodiversity status analysis every five to 10 years. This, in conjunction with scheduled review of the SWAP (especially review of species' status relative to Tier 1 and Tier 2 SGCN designation), will provide the information needed to identify conservation successes and emerging needs, prioritize resource expenditures, and direct partner collaboration.

**Table 9. Existing monitoring plans for SGCN.**

Focus: SS = Single Species; MS = Multi-species. Agency/Organizations: BCNA = Boulder County Nature Association; BLM = Bureau of Land Management; CNHP = Colorado Natural Heritage Program; CPW = Colorado Parks & Wildlife; IWJV = Intermountain West Joint Venture; RMBO = Rocky Mountain Bird Observatory; UDWR = Utah Division of Wildlife Resources; USACOE = U.S. Army Corps of Engineers; USFS = U.S. Forest Service; USFWS = U.S. Fish & Wildlife Service; USGS = U.S. Geological Service; WAFWA = Western Association of Fish & Wildlife Agencies; WYGF = Wyoming Game & Fish.

For each species that has only blank cells in this table, development of a monitoring plan has been added as a conservation action for the species in Table 7.

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| **AMPHIBIANS – TIER 1** | | | | | | |
| *Anaxyrus boreas boreas* | Boreal toad (Southern Rocky Mountain population) | (1) Conservation plan and agreement for the management and recovery of the southern Rocky Mountain population of the boreal toad (Bufo boreas boreas). 2001. Boreal Toad Recovery Team, Loeffler, C. (ed.). 76 pp. + appendices.<br>(2) Boreal toad survey and monitoring project summary 1999 - 2012. Lambert and Schneider 2013. Colorado Natural Heritage Program report for Colorado Parks and Wildlife. | SS | X | (1) Multi-state: CO, WY, NM<br>(2) Statewide | (1) CPW and 8 other agency signatories<br>(2) CNHP, CPW |
| *Lithobates pipiens* | Northern leopard frog | Dosch, K.L., P.T.J. Johnson, and V. McKenzie. 2008. Northern leopard frog (Lithobates [=Rana] pipiens) sampling protocol for Colorado. University of Colorado, Boulder, CO. 42pp. | SS | | Statewide | CPW |
| **BIRDS – TIER 1** | | | | | | |
| *Leucosticte australis* | Brown-capped rosy-finch | Indian Peaks four season bird counts, 20 year summary (1982-2001) | MS | X | Local | BCNA |
| *Athene cunicularia* | Burrowing owl | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/<br>(3) Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife. | MS | X | (1) Multi-state<br>(2) North America<br>(3) Statewide | (1) CPW, USFS, RMBO, BLM<br>(2) USGS<br>(3) CPW |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Tympanuchus phasianellus columbianus* | Columbian sharp-tailed grouse | (1) Hoffman, R. W., K. A. Griffin, J. M. Knetter, M. A. Schroeder, A. D. Apa, J. D. Robinson, S. P. Espinosa, T. J. Christiansen, R. D. Northrup, D. A. Budeau, and M. J. Chutter. 2015. Guidelines for the Management of Columbian Sharp-Tailed Grouse Populations and Their Habitats. WAFWA Sage and Columbian Sharp-tailed Grouse Technical Committee, Western Association of Fish and Wildlife Agencies<br>(2) Columbian sharp-tailed grouse conservation plan: Routt, Moffat, and Rio Blanco Counties, Northwest Colorado<br>(3) Annual Lek Surveys - unpublished internal report, no citation | SS | X | Statewide | CPW |
| *Aquila chrysaetos* | Golden eagle | (1) Nielson, R. M., Mcmanus, L., Rintz, T., Mcdonald, L. L., Murphy, R. K., Howe, W. H. and Good, R. E. 2014. Monitoring abundance of golden eagles in the western United States. The Journal of Wildlife Management, 78: 721–730. doi: 10.1002/jwmg.704<br>(2) Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife<br>(3) Winter Raptor Survey http://bcna.org/raptorlinks.html | (1) SS<br>(2) MS<br>(3) MS | (2) X<br>(3) X | (1) Western U.S.<br>(2) Statewide<br>(3) Local | (1) USFWS<br>(2) CPW<br>(3) BCNA |
| *Centrocercus urophasianus* | Greater sage-grouse | (1) Colorado Greater Sage-Grouse Steering Committee. 2008. Colorado Greater sage-grouse conservation plan. Colorado Parks and Wildlife, Denver, Colorado, USA.<br>(2) Annual Lek Surveys - unpublished internal report, no citation | SS | X | Statewide | CPW |
| *Grus canadensis tabida* | Greater sandhill crane | (1) Pacific Flyway wide fall staging counts in production areas (currently limited in Colorado to the upper Yampa River valley, the San Luis Valley, and the Delta vicinity): Subcommittee on Rocky Mountain Greater Sandhill Cranes. 2007. Management plan of the Pacific and Central Flyways for the Rocky Mountain population of greater sandhill cranes. [Joint] Subcommittees, Rocky Mountain Population Greater Sandhill Cranes, Pacific Flyway Study Committee, Central Flyway Webless Migratory Game Bird Tech. Committee [c/o USFWS, MBMO], Portland, OR. 97pp.<br>(2) Yampa Valley breeding population monitoring (a revised monitoring protocol is being pilot tested beginning in 2015): Graham, V. K. 1992. Recovery Plan for the Colorado population of the greater sandhill crane. Colorado Parks and Wildlife, Grand Junction, CO. | SS | X | (1) Multi-state<br>(2) NW Region | (1) USFWS<br>(2) CPW |
| *Centrocercus minimus* | Gunnison sage-grouse | (1) Gunnison Sage-Grouse Rangewide Steering Committee. 2005. Gunnison sage-grouse rangewide conservation plan. Colorado Parks and Wildlife, Denver, Colorado, USA.<br>(2) Annual Lek Surveys - unpublished internal report, no citation | SS | X | (1) Range-wide<br>(2) Range in CO | CPW, UDWR |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Tympanuchus pallidicinctus* | Lesser prairie-chicken | (1) Range-wide Aerial Surveys: http://www.wafwa.org/documents/LPC-aerial-survey-results-2014.pdf<br>(2) Annual Lek Surveys - unpublished internal report, no citation | SS | X | (1) Range-wide<br>(2) Range in Colorado | (1) WAFWA<br>(2) CPW |
| *Charadrius montanus* | Mountain plover | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Tympanuchus phasianellus jamesii* | Plains sharp-tailed grouse | Annual Lek Surveys - unpublished internal report, no citation. | SS | X | Weld, Logan, Morgan Counties | CPW |
| *Lagopus leucura altipetens* | Southern white-tailed ptarmigan | (1) White-tailed ptarmigan 2012-2013 progress report. Seglund, A.E. and P. Street. CPW 35pp.<br>(2) White-tailed ptarmigan summary report 2011 and project proposal 2012-2014. Seglund A.E. CPW 19pps. Reports outline monitoring using occupancy and mark resight techniques. | SS | X | Statewide | CPW |
| *Empidonax traillii extimus* | Southwestern willow flycatcher | Federal survey protocol: http://pubs.usgs.gov/tm/tm2a10/ | SS | | Rangewide | USFWS, USGS |
| *Coccyzus americanus occidentalis* | Western yellow-billed cuckoo | Federal survey protocol. | SS | | Rangewide | USFWS |
| **FISH – TIER 1** | | | | | | |
| *Etheostoma cragini* | Arkansas darter | (1) Colorado Parks and Wildlife.Krieger, D., T. Nesler, C. Bennett, G. Dowler and J. Melby. 2001. Arkansas Darter (Etheostoma cragini) Recovery Plan. Colorado Parks and Wildlife. 23 pp.<br>(2) DRAFT Conservation Plan for the Native Fishes of the Arkansas River Basin, CO. 2013. Colorado Parks and Wildlife. | (1) SS<br>(2) MS | X | Range in CO | CPW |
| *Catostomus discobolus* | Bluehead sucker | Range-Wide Conservation Agreement and Strategy for Roundtail Chub (*Gila robusta*), bluehead Sucker (*Castomus discobolus*), and Flannelmouth Sucker (*Castomus latipinnis*). 2005. Prepared fo the Colorado River Fish and Wildlife Council, by Utah Department of Natural Resources. 61pp. | MS | X | Rangewide | Rotating lead, CPW is current chair |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Gila elegans* | Bonytail chub | Upper Colorado River Endangered Fish Recovery Program. 2014. Recovery Implementation Program Section 7 Consultation, Sufficient Progress, and Historic Projects Agreement, October 15, 1993 (revised March 8, 2000), and Recovery Implementation Program Recovery Action Plan (RIPRAP) | MS | X | Upper Colorado River Basin | USFWS |
| *Hybognathus hankinsoni* | Brassy minnow | DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | MS | X | So. Platte Basin in CO | CPW |
| *Ptychocheilus lucius* | Colorado pikeminnow | (1) Upper Colorado River Endangered Fish Recovery Program. 2014. Recovery Implementation Program Section 7 Consultation, Sufficient Progress, and Historic Projects Agreement, October 15, 1993 (revised March 8, 2000), and Recovery Implementation Program Recovery Action Plan (RIPRAP)<br>(2) San Juan River Basin Recovery Implementation Program. 2014. Long Range Plan. | MS | X | Rangewide in Upper CO Basin incl. San Juan | USFWS |
| *Oncorhynchus clarkii pleuriticus* | Colorado River cutthroat trout | CRCT Coordination Team. 2006. Conservation strategy for Colorado River cutthroat trout (Oncorhynchus clarkii pleuriticus) in the States of Colorado, Utah, and Wyoming. Colorado Parks and Wildlife, Fort Collins. 24p. | SS | X | Rangewide | WYGF |
| *Luxilus cornutus* | Common shiner | DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | MS | X | Range in CO | CPW |
| *Catostomus latipinnis* | Flannelmouth sucker | Range-Wide Conservation Agreement and Strategy for Roundtail Chub (*Gila robusta*), bluehead Sucker (*Castomus discobolus*), and Flannelmouth Sucker (*Castomus latipinnis*). 2005. Prepared fo the Colorado River Fish and Wildlife Council, by Utah Department of Natural Resources. 61pp. | MS | X | Rangewide | Rotating lead, CPW is current chair |
| *Platygobio gracilus* | Flathead chub | DRAFT Conservation Plan for the Native Fishes of the Arkansas River Basin, CO. 2013. Colorado Parks and Wildlife. | MS | X | Range in CO | CPW |
| *Oncorhynchus clarkii stomias* | Greenback cutthroat trout | (1) U.S. Fish and Wildlife Service. 1998. Greenback cutthroat trout recovery plan. U.S. Fish and Wildlife Service, Denver, Colorado.<br>(2) Recovery Outline (in prep) | SS | X | Rangewide | USFWS, CPW |
| *Gila cypha* | Humpback chub | Upper Colorado River Endangered Fish Recovery Program. 2014. Recovery Implementation Program Section 7 Consultation, Sufficient Progress, and Historic Projects Agreement, October 15, 1993 (revised March 8, 2000), and Recovery Implementation Program Recovery Action Plan (RIPRAP) | MS | X | Upper Colorado River Basin | USFWS |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Catostomus playtrhynchus* | Mountain sucker | Monitoring as part of routine sampling. | | | Statewide | CPW |
| *Phoxinus eos* | Northern redbelly dace | DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | MS | X | Range in CO | CPW |
| *Lepomis humilis* | Orangespotted sunfish | 1) DRAFT Conservation Plan for the Native Fishes of the Arkansas River Basin, CO. 2013. Colorado Parks and Wildlife.<br>2) DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | MS | X | (1) Arkansas Basin in CO<br>(2) South Platte Basin in CO | CPW |
| *Etheostoma spectabile* | Orangethroat darter | Monitoring as part of routine sampling. | | | Statewide | CPW |
| *Hybognathus placitus* | Plains minnow | (1) DRAFT Conservation Plan for the Native Fishes of the Arkansas River Basin, CO. 2013. Colorado Parks and Wildlife.<br>(2) DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | MS | X | (1) Arkansas Basin in CO<br>(2) So. Platte Basin in CO | CPW |
| *Fundulus sciadicus* | Plains topminnow | DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | | | | |
| *Xyrauchen texanus* | Razorback sucker | (1) Upper Colorado River Endangered Fish Recovery Program. 2014. Recovery Implementation Program Section 7 Consultation, Sufficient Progress, and Historic Projects Agreement, October 15, 1993 (revised March 8, 2000), and Recovery Implementation Program Recovery Action Plan (RIPRAP)<br>(2) San Juan River Basin Recovery Implementation Program. 2014. Long Range Plan. | MS | X | Rangewide in Upper CO Basin incl. San Juan | USFWS |
| *Gila pandora* | Rio Grande chub | Monitoring as part of routine sampling. | | | Statewide | CPW |
| *Oncorhynchus clarkii virginalis* | Rio Grande cutthroat trout | RGCT Conservation Team. 2013. Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*) Conservation Strategy. Colorado Parks and Wildlife, Denver, CO. | SS | X | Rangewide | CPW |
| *Catostomus plebeius* | Rio Grande sucker | Langlois, D., J. Alves and J. Apker. 1994. Rio Grande sucker recovery plan. Colorado Parks and Wildlife, Denver. 22 pp. | SS | X | Range in CO | CPW |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Gila robusta* | Roundtail chub | Range-Wide Conservation Agreement and Strategy for Roundtail Chub (*Gila robusta*), bluehead Sucker (*Castomus discobolus*), and Flannelmouth Sucker (*Castomus latipinnis*). 2005. Prepared for the Colorado River Fish and Wildlife Council, Utah Department of Natural Resources. 61pp. | MS | X | Rangewide | Rotating lead, CPW is current chair |
| *Phoxinus erythrogaster* | Southern redbelly dace | DRAFT Conservation Plan for the Native Fishes of the Arkansas River Basin, CO. 2013. Colorado Parks and Wildlife. | MS | X | Range in CO | CPW |
| *Noturus flavus* | Stonecat | DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | MS | X | So. Platte Basin in CO | CPW |
| *Phenacobius mirabilis* | Suckermouth minnow | (1) DRAFT Conservation Plan for the Native Fishes of the Arkansas River Basin, CO. 2013. Colorado Parks and Wildlife.<br>(2) DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | MS | X | (1) Arkansas Basin in CO<br>(2) So. Platte Basin in CO | CPW |
| **MAMMALS – TIER 1** | | | | | | |
| *Ochotona princeps* | American pika | American Pika surveys 2008-2012 Colorado Parks and Wildlife. Seglund, A. 33pp. Outlines monitoring protocol using occupancy. | SS | X | Statewide | CPW |
| *Mustela nigripes* | Black-footed ferret | Black-footed Ferret Recovery Plan, 2nd revision. 2013. U.S. Fish and Wildlife Service, Denver, CO. | SS | X | Rangewide | USFWS, CPW |
| *Myotis thysanodes* | Fringed myotis | (1) NABat (USGS draft)<br>(2) CPW WNS Surveillance Plan, http://cpw.state.co.us/Documents/Research/WildlifeHealth/CPW_BatWNSsurveillanceplan_20112012.pdf<br>(3) Surveillance, monitoring and life history investigations of bats within Colorado, multiple reports | MS | (1) X | (1) Rangewide<br>(2) Site, Statewide<br>(3) Regional | (1) USGS, CPW<br>(2) CPW<br>(3) CPW, BLM, CNHP |
| *Cynomys gunnisoni* | Gunnison's prairie dog | Protocol for conducting prairie dog occupancy surveys. 2007. Andelt, W.F. and A.E. Seglund. Colorado Parks and Wildlife. 14pp. | SS | X | Rangewide | CPW |
| *Myotis lucifigus* | Little brown bat | (1) NABat (USGS draft)<br>(2) CPW WNS Surveillance Plan, http://cpw.state.co.us/Documents/Research/WildlifeHealth/CPW_BatWNSsurveillanceplan_20112012.pdf<br>(3) Surveillance, monitoring and life history investigations of bats within Colorado, multiple reports | MS | (1) X | (1) Rangewide<br>(2) Site, Statewide<br>(3) Regional | (1) USGS, CPW<br>(2) CPW<br>(3) CPW, BLM, CNHP |
| *Lynx canadensis* | Lynx | Protocol for Monitoring Canada Lynx in Colorado. 2014. Ivan, J., and T. Shenk. Colorado Parks and Wildlife. 37 pp. | SS | X | Statewide | CPW, USFS, BLM |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Zapus hudsonius luteus* | New Mexico meadow jumping mouse | (1) Species Status Assessment Report for the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*). 2014. U.S. Fish and Wildlife Service, Albuquerque, NM.<br>(2) USFWS Recovery Outline: New Mexico Meadow Jumping Mouse - status pending<br>http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A0BX | SS | | Rangewide | USFWS |
| *Perognathus fasciatus* | Olive-backed pocket mouse | | | | | |
| *Zapus hudsonius preblei* | Prebles meadow jumping mouse | None currently (development of monitoring plan is an action under the current draft of the Recovery Plan) | | | | |
| *Lontra canadensis* | River otter | State of Colorado River Otter Recovery Plan. 2003. Colorado Parks and Wildlife. 51pp.<br>http://cpw.state.co.us/Documents/WildlifeSpecies/SpeciesOfConcern/RecoveryPlans/CDOW2003Riverotterrecoveryplan.pdf#search=river%20otter | SS | X | Basin | CPW |
| *Euderma maculatum* | Spotted bat | (1) NABat (USGS draft)<br>(2) CPW WNS Surveillance Plan,<br>http://cpw.state.co.us/Documents/Research/WildlifeHealth/CPW_BatWNSsurveillanceplan_20112012.pdf<br>(3) Surveillance, monitoring and life history investigations of bats within Colorado, multiple reports | MS | (1) X | (1) Rangewide<br>(2) Site, Statewide<br>(3) Regional | (1) USGS, CPW<br>(2) CPW<br>(3) CPW, BLM, CNHP |
| *Corynorhinus townsendii pallescens* | Townsend's big-eared bat ssp. | (1) NABat (USGS draft)<br>(2) CPW WNS Surveillance Plan,<br>http://cpw.state.co.us/Documents/Research/WildlifeHealth/CPW_BatWNSsurveillanceplan_20112012.pdf<br>(3) Surveillance, monitoring and life history investigations of bats within Colorado, multiple reports | MS | (1) X | (1) Rangewide<br>(2) Site, Statewide<br>(3) Regional | (1) USGS, CPW<br>(2) CPW<br>(3) CPW, BLM, CNHP |
| *Cynomys leucurus* | White-tailed prairie dog | Protocol for conducting prairie dog occupancy surveys. 2007. Andelt, W.F. and A.E. Seglund. Colorado Parks and Wildlife. 14pp. | SS | X | Rangewide | CPW |
| *Gulo gulo* | Wolverine | | | | | |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| **REPTILES – TIER 1** | | | | | | |
| *Aspidoscelis neotesselata* | Colorado checkered whiptail | Draft Great Plains Reptile Monitoring Protocol (D. Martin) | MS | X | Regional | CSU, CPW |
| *Sistrurus catenatus* | Massasauga | Draft Great Plains Reptile Monitoring Protocol (D. Martin) | MS | X | Regional | CSU, CPW |
| **AMPHIBIANS – TIER 2** | | | | | | |
| *Hyla arenicolor* | Canyon tree frog | | | | | |
| *Scaphiopus couchii* | Couch's spadefoot | | | | | |
| *Spea intermontana* | Great Basin spadefoot | | | | | |
| *Gastrophryne olivacea* | Great Plains narrowmouth toad | | | | | |
| *Anaxyrus debilis* | Green toad | | | | | |
| *Acris crepitans* | Northern cricket frog | | | | | |
| *Lithobates blairi* | Plains leopard frog | | | | | |
| *Lithobates sylvatica* | Wood frog | | | | | |
| **BIRDS – TIER 2** | | | | | | |
| *Botaurus lentiginosus* | American bittern | | | | | |
| *Falco peregrinus anatum* | American peregrine falcon | (1) Post-delisting Monitoring Plan: http://www.fws.gov/endangered/esa-library/pdf/Peregrineplan2003.pdf<br>(2) Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife | (1) SS<br>(2) MS | X | (1) U.S.<br>(2) Statewide | (1) USFWS<br>(2) CPW |
| *Pelecanus erythrorhynchos* | American white pelican | (1) http://www.fws.gov/mountain-prairie/species/birds/western_colonial/Atlas_WCWS_interior_1-23-2014_FINAL.pdf<br>(2) Project Colony Watch http://rmbo.org/v3/avian/CitizenScience/ColonyWatch.aspx | MS | | (1) Intertior Western U.S.<br>(2) Colorado | (1) USFWS<br>(2) RMBO |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Haliaeetus leucocephalus* | Bald eagle | (1) Post-delisting Monitoring Plan: http://www.fws.gov/midwest/eagle/protect/pdf/BEPDMP_100511_OMBFINALfor%20posting_Jan2013Final.pdf<br>(2) Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife.<br>(3) Winter Raptor Survey http://bcna.org/raptorlinks.html | (1) SS<br>(2) MS<br>(3) MS | X | (1) U.S.<br>(2) Statewide<br>(3) Local | (1) USFWS<br>(2) CPW<br>(3) BCNA |
| *Patagioenas fasciata* | Band-tailed pigeon | | | | | |
| *Bucephala islandica* | Barrow's goldeneye | | | | | |
| *Leucosticte atrata* | Black rosy-finch | | | | | |
| *Cypseloides niger* | Black swift | | | | | |
| *Chlidonias niger* | Black tern | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | | (1) Intertior Western U.S.<br>(2) Colorado | (1) USFWS<br>(2) RMBO |
| *Dolichonyx oryzivorus* | Bobolink | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Aegolius funereus* | Boreal owl | Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife. | MS | X | Statewide | CPW |
| *Spizella breweri* | Brewer's sparrow | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/<br>(3) 50-years of bird banding data from the Allegra Collister Nature Preserve, Boulder County, 2011 | MS | X | (1) Multi-state<br>(2) North America<br>(3) Local | (1) CPW, USFS, RMBO, BLM<br>(2) USGS<br>(3) BCNA |
| *Peucaea cassinii* | Cassin's finch | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Aimophila cassinii* | Cassin's sparrow | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Calcarius ornatus* | Chestnut-collared longspur | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Buteo regalis* | Ferruginous hawk | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/<br>(3) Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife.<br>(4) Winter Raptor Survey: http://bcna.org/raptorlinks.html | MS | X | (1) Multi-state<br>(2) North America<br>(3) Statewide<br>(4) Local | (1) CPW, USFS, RMBO, BLM<br>(2) USGS<br>(3) CPW<br>(4) BCNA |
| *Otus flammeolus* | Flammulated owl | Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife. | MS | X | Statewide | CPW |
| *Setophaga graciae* | Grace's warbler | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Ammodramus savannarum* | Grasshopper sparrow | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Vireo vicinior* | Gray vireo | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Tympanuchus cupido* | Greater prairie-chicken | (1) Greater prairie-chicken inventory assessment. 2005. Stratman, M. Colorado Parks and Wildlife. 15pp.<br>(2) Annual Lek Surveys - unpublished internal report, no citation | SS | X | Rangewide | CPW |
| *Baeolophus ridgwayi* | Juniper titmouse | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Calamospiza melanocorys* | Lark bunting | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx (2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state (2) North America | (1) CPW, USFS, RMBO, BLM (2) USGS |
| *Passerina amoena* | Lazuli bunting | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx (2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state (2) North America | (1) CPW, USFS, RMBO, BLM (2) USGS |
| *Sterna antillarum* | Least tern | (1) Endangered Species Management Plan for Piping Plovers and Interior Least Terns (John Martin Reservoir Project and John Martin State Park). US Army Corps of Engineers. May 22, 2002 (2) Piping Plover and Interior Least Tern Recovery Plan. State of Colorado, Jennifer Slater. September 1994. http://cpw.state.co.us/Documents/WildlifeSpecies/SpeciesOfConcern/RecoveryPlans/PipingPloverLeastTernRecoveryPlan.pdf (3) Piping Plover and Least Tern Monitoring, Protection, and Habitat Improvement At John Martin Reservoir and Southeast Colorado. Duane Nelson. October 14, 2014, September 30, 2013. | MS | X | CO | (1) CPW (2) US Army Corps of Engineers |
| *Melanerpes lewis* | Lewis's woodpecker | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx (2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state (2) North America | (1) CPW, USFS, RMBO, BLM (2) USGS |
| *Lanius ludovicianus* | Loggerhead shrike | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx (2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state (2) North America | (1) CPW, USFS, RMBO, BLM (2) USGS |
| *Numenius americanus* | Long-billed curlew | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx (2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state (2) North America | (1) CPW, USFS, RMBO, BLM (2) USGS |
| *Rhynchophanes mccownii* | McCown's longspur | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx (2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state (2) North America | (1) CPW, USFS, RMBO, BLM (2) USGS |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Strix occidentalis lucida* | Mexican spotted owl | (1) Federal survey protocol: http://www.fws.gov/mountain-prairie/endspp/protocols/MexicanSpottedOwlSurveyProtocol2012.pdf<br>(2) Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife. | (1) SS<br>(2) MS | (2) X | (1) Rangewide<br>(2) Statewide | (1) USFWS<br>(2) CPW |
| *Colinus virginianus* | Northern bobwhite | Management procedures for northern bobwhites in eastern Colorado. 1984. Snyder, W. Special Report #56. Colorado Parks and Wildlife. 22pp. | SS | X | Statewide | CPW |
| *Accipiter gentilis* | Northern goshawk | Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife. | MS | X | Statewide | CPW |
| *Circus cyaneus* | Northern harrier | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/<br>(3) Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife.<br>(4) Winter Raptor Survey http://bcna.org/raptorlinks.html | MS | X | (1) Multi-state<br>(2) North America<br>(3) Statewide<br>(4) Local | (1) CPW, USFS, RMBO, BLM<br>(2) USGS<br>(3) CPW<br>(4) BCNA |
| *Contopus cooperi* | Olive-sided flycatcher | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Gymnorhinus cyanocephalus* | Pinyon jay | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Charadrius melodus* | Piping plover | (1) Endangered Species Management Plan for Piping Plovers and Interior Least Terns (John Martin Reservoir Project and John Martin State Park). US Army Corps of Engineers. May 22, 2002<br>(2) Piping Plover and Interior Least Tern Recovery Plan. State of Colorado, Jennifer Slater. September 1994. http://cpw.state.co.us/Documents/WildlifeSpecies/SpeciesOfConcern/RecoveryPlans/PipingPloverLeastTernRecoveryPlan.pdf<br>(3) Piping Plover and Least Tern Monitoring, Protection, and Habitat Improvement At John Martin Reservoir and Southeast Colorado. Duane Nelson. October 14, 2014, September 30, 2013. | MS | X | CO | (1) CPW<br>(2) USACOE |
| *Falco mexicanus* | Prairie falcon | (1) Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife.<br>(2) Winter Raptor Survey http://bcna.org/raptorlinks.html | MS | X | (1) Statewide<br>(2) Local | (1) CPW<br>(2) BCNA |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Progne subis* | Purple martin | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Selasphorus rufus* | Rufous hummingbird | Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | North America | USGS |
| *Amphispiza belli* | Sage sparrow | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Asio flammeus* | Short-eared owl | Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife. | MS | X | Statewide | CPW |
| *Buteo swainsoni* | Swainson's hawk | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/<br>(3) Raptor Monitoring Strategy, 2015 Draft, Colorado Parks and Wildlife. | MS | X | (1) Multi-state<br>(2) North America<br>(3) Statewide | (1) CPW, USFS, RMBO, BLM<br>(2) USGS<br>(3) CPW |
| *Bartramia longicauda* | Upland sandpiper | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Catharus fuscescens* | Veery | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Oreothlypis virginiae* | Virginia's warbler | (1) Integrated Monitoring in BCRs: http://rmbo.org/v3/avian/Projects/IntegratedMonitoringinBirdConservationRegions.aspx<br>(2) Breeding Bird Survey: https://www.pwrc.usgs.gov/bbs/ | MS | X | (1) Multi-state<br>(2) North America | (1) CPW, USFS, RMBO, BLM<br>(2) USGS |
| *Charadrius alexandrinus nivosus* | Western snowy plover | (1) Snowy Plover Survey Summary, Blanca Wetlands, San Luis Valley, 2014 BLM unpublished report<br>(2) International Snowy Plover Survey Protocol, Discrete Site Survey Methodologies, 2007 USFWS | SS | X | (1) Regional<br>(2) Statewide | (1) BLM<br>(2) USFWS, IWJV |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Plegadis chihi* | White-faced ibis | (1) http://www.fws.gov/mountain-prairie/species/birds/western_colonial/Atlas_WCWS_interior_1-23-2014_FINAL.pdf<br>(2) Project Colony Watch http://rmbo.org/v3/avian/CitizenScience/ColonyWatch.aspx | MS | | (1) Intertior Western U.S.<br>(2) Colorado | (1) USFWS<br>(2) RMBO |
| *Grus americana* | Whooping crane | Annual Survey: http://www.fws.gov/refuge/aransas/science/whooping_crane_surveys.html | SS | X | Wintering Grounds | USFWS |
| **FISH – TIER 2** | | | | | | |
| *Etheostoma exile* | Iowa darter | DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | | | | |
| *Couesius plumbeus* | Lake chub | DRAFT Conservation Plan for the Native Fishes of the South Platte River Basin, CO. 2013. Colorado Parks and Wildlife. | | | | |
| **MAMMALS – TIER 2** | | | | | | |
| *Sciurus aberti* | Abert's squirrel | | | | | |
| *Idionycteris phyllotis* | Allen's big-eared bat | (1) NABat (USGS draft)<br>(2) CPW WNS Surveillance Plan, http://cpw.state.co.us/Documents/Research/WildlifeHealth/CPW_BatWNSsurveillanceplan_20112012.pdf<br>(3) Surveillance, monitoring and life history investigations of bats within Colorado, multiple reports | MS | (1) X | (1) Rangewide<br>(2) Site, Statewide<br>(3) Regional | (1) USGS, CPW<br>(2) CPW<br>(3) CPW, BLM, CNHP |
| *Martes americana* | American marten | | | | | |
| *Nyctinomops macrotis* | Big free-tailed bat | (1) NABat (USGS draft)<br>(2) CPW WNS Surveillance Plan, http://cpw.state.co.us/Documents/Research/WildlifeHealth/CPW_BatWNSsurveillanceplan_20112012.pdf<br>(3) Surveillance, monitoring and life history investigations of bats within Colorado, multiple reports | MS | (1) X | (1) Rangewide<br>(2) Site, Statewide<br>(3) Regional | (1) USGS, CPW<br>(2) CPW<br>(3) CPW, BLM, CNHP |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Ovis canadensis* | Bighorn sheep | (1) Stiver, J. R. 2011. Bighorn sheep management plan: Data analysis unit RBS-8, Pikes Peak/DomeRock/Beaver Creek Sheep Herd. Colorado Parks and Wildlife. Colorado Springs, CO 42 pp. http://cpw.state.co.us/Documents/Hunting/BigGame/DAU/BighornSheep/RBS-8DAUplan.pdf (2) Stiver, J. R. 2014. Bighorn sheep management plan: Data analysis unit RBS-14, Rampart Herd. Colorado Parks and Wildlife. Colorado Springs, CO. 27 pp. http://cpw.state.co.us/Documents/Hunting/BigGame/DAU/BighornSheep/RBS-14DAUPlanFinal.pdf (3) Diamond, B. and B. Banulis. 2012. Bighorn Sheep Management Plan: Data Analysis Unit RBS-21, San Juans West, Game Management Units S-21 & S-33. Colorado Parks and Wildlife. Montrose, CO. 106 pp. http://cpw.state.co.us/Documents/Hunting/BigGame/DAU/BighornSheep/RBS21DAUplan_SanJuansWest.pdf (4) George, J. L., R. Kahn, M. W. Miller, and B. Watkins. 2009. Colorado Bighorn Sheep Management Plan 2009-2019. Colorado Parks and Wildlife. Denver, CO. 88 pp. | SS | X | Local, Statewide | CPW |
| *Bison bison* | Bison | | | | | |
| *Cynomys ludovicianus* | Black-tailed prairie dog | USGS Protocol, McDonald, L.L., Stanley, T.R., Otis, D.L., Biggins, D.E., Stevens, P.D., Koprowski, J.L., and Ballard, Warren. 2011. Recommended methods for range-wide monitoring of prairie dogs in the United States: U.S. Geological Survey Scientific Investigations Report 2011-5063, 36p. | SS | X | Rangewide | CPW |
| *Thomomys bottae rubidus* | Botta's pocket gopher (*rubidus* ssp) | | | | | |
| *Conepatus leuconotus* | Common hog-nosed skunk | | | | | |
| *Sorex nanus* | Dwarf shrew | | | | | |
| *Canis lupus* | Gray wolf - two subspecies (Northern and Mexican) | Respond to sighting reports - no formal monitoring program | | | | CPW |
| *Ursus arctos* | Grizzly bear | Respond to sighting reports - no formal monitoring program | | | | CPW |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Lasiurus cinereus* | Hoary bat | (1) NABat (USGS draft)<br>(2) CPW WNS Surveillance Plan, http://cpw.state.co.us/Documents/Research/WildlifeHealth/CPW_BatWNSsurveillanceplan_20112012.pdf<br>(3) Surveillance, monitoring and life history investigations of bats within Colorado, multiple reports | MS | (1) X | (1) Rangewide<br>(2) Site, Statewide<br>(3) Regional | (1) USGS, CPW<br>(2) CPW<br>(3) CPW, BLM, CNHP |
| *Vulpes macrotis* | Kit fox | (1) Kit Fox 2007 survey report southwestern region. Seglund A.E. and J. Garner. CPW 17pp.<br>(2) 2008 year-end survey report non-invasive sampling survey results for kit fox in west-central colorado. Reed- Eckert, M. CPW 22pp. | SS | X | Local | CPW |
| *Sorex preblei* | Preble's shrew | | | | | |
| *Brachylagus idahoensis* | Pygmy rabbit | | | | | |
| *Sorex hoyi montanus* | Pygmy shrew | | | | | |
| *Clethrionomys gapperi* | Red-backed vole | | | | | |
| *Lemmiscus curtatus* | Sagebrush vole | | | | | |
| *Lepus americanus* | Snowshoe hare | SW Region Long term pellet counts (Wait) | SS | X | Basin | CPW |
| *Vulpes velox* | Swift fox | Conservation assessment and conservation strategy for swift fox in the United States-2011 update. Dowd Stukel, E., ed. 2011. South Dakota Department of Game, Fish, and Parks, Pierre. 100pp. http://cpw.state.co.us/learn/Pages/SwiftFoxConservationTeam.aspx | SS | X | Rangewide | CPW |
| *Lepus townsendii* | White-tailed jackrabbit | | | | | |
| **REPTILES – TIER 2** | | | | | | |
| *Thamnophis cyrtopsis* | Black-necked gartersnake | | | | | |
| *Lampropeltis californiae* | California kingsnake | Draft Great Plains Reptile Monitoring Protocol (D. Martin) | MS | X | Regional | CSU, CPW |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Thamnophis sirtalis* | Common gartersnake | | | | | |
| *Hypsiglena chlorophaea* | Desert nightsnake | Draft Great Plains Reptile Monitoring Protocol (D. Martin) | MS | X | Regional | CSU, CPW |
| *Sceloporus magister* | Desert spiny lizard | | | | | |
| *Gambelia wislizenii* | Long-nosed leopard lizard | | | | | |
| *Rhinocheilus lecontei* | Long-nosed snake | Draft Great Plains Reptile Monitoring Protocol (D. Martin) | MS | X | Regional | CSU, CPW |
| *Crotalus oreganus concolor* | Midget faded rattlesnake | | | | | |
| *Lampropeltis triangulum* | Milksnake | Draft Great Plains Reptile Monitoring Protocol (D. Martin) | MS | X | Regional | CSU, CPW |
| *Rena dissectus* | New Mexico threadsnake | Draft Great Plains Reptile Monitoring Protocol (D. Martin) | MS | X | Regional | CSU, CPW |
| *Phrynosoma modestum* | Round-tailed horned lizard | Draft Great Plains Reptile Monitoring Protocol (D. Martin) | MS | X | Regional | CSU, CPW |
| *Tantilla horbartsmithi* | Smith's black-headed snake | | | | | |
| *Phrynosoma cornutum* | Texas horned lizard | Draft Great Plains Reptile Monitoring Protocol (D. Martin) | MS | X | Regional | CSU, CPW |
| *Kinosternon flavescens* | Yellow mud turtle | | | | | |
| **MOLLUSKS – TIER 2** | | | | | | |
| *Ferrissia walkeri* | Cloche ancylid | | | | | |
| *Promenetus umbillicatellus* | Cockerell | | | | | |
| *Anodontoides ferussacianus* | Cylindrical papershell | | | | | |

| Species | Common Name | Document Citation | Focus | Long-term | Geographic Scope | Agency or Organization leads |
|---|---|---|---|---|---|---|
| *Ferrissia fragilis* | Fragil ancylid | | | | | |
| *Physa cupreonitens* | Hot springs physa | | | | | |
| *Uniomerus tetralasmus* | Pondhorn | | | | | |
| *Acroloxus coloradensis* | Rocky Mountain capshell | | | | | |
| *Promenetus exacuous* | Sharp sprite | | | | | |
| *Physa gyrina utahensis* | Utah physa | | | | | |

# Chapter 8: Conservation Opportunity Areas

This chapter presents a series of maps to help guide conservation efforts across the state. These maps are useful for broad-scale analysis of where conservation efforts might be most warranted and most successful. ***It is important to note that these maps take into consideration only those environmental factors that can be mapped at a statewide scale using available data***.

The first six maps indicate relative condition of freshwater, terrestrial upland, and wetland/riparian habitats. This information can be used to identify areas at a broad scale that are likely to be in higher quality condition, and therefore good candidates for land protection strategies, as well as those that are more likely in degraded condition and in need of restoration. The final two maps display SGCN concentration areas for aquatic and terrestrial species, respectively.

## Freshwater Habitats

The freshwater condition map for Colorado, developed by The Nature Conservancy and included here with permission, provides a general indication of the condition of freshwater ecosystems in Colorado (Figure 13). Details on data inputs and methods can be found in TNC (2012). The map displays relative level of impact for each stream reach based on multiple mappable landscape measures, each of which were ranked on a scale of Very Good to Poor (Table 10). A stream reach with a good or very good rank (minimal or low impact) may benefit from prioritized protection efforts. It is important to note that even a stream reach with a poor ranking may provide important habitat and support species of concern. However, the poor ranking indicates that those species may be at risk, and serves as a guideline for identifying places that could benefit from restoration efforts. Map categories range from minimal impact (very good condition) to high impact (very poor condition), according to the definitions in Table 11.

**Table 10. Measures included in the freshwater condition map. All factors are weighted equally.**

| Natural Flow Regime | Riparian Condition | Development | Connectivity | Water Quality |
|---|---|---|---|---|
| • Consumptive Use (Agricultural Use, Municipal Use, Trans-basin Diversions)<br>• Reservoir Storage | • Riparian Land Use<br>• Non-native Plants – Tamarisk – in the Riparian Vegetation | • Land Use<br>• Road Density<br>• Road Crossings<br>• Oil and Gas<br>• Mining | • Instream Barriers to Fish Movement | • Streams with a 303d and/or Monitoring and Evaluation Designation |

**Table 11. Definitions of map categories for freshwater condition.**

| Level of Impact | Summary Measure |
|---|---|
| Minimal | All measures in Very Good or Good category |
| Low | >=1 category is Fair; all others Very Good or Good |
| Moderate | 1-2 categories are Poor; all others Very Good, Good, or Fair |
| High | >2 categories are Poor |

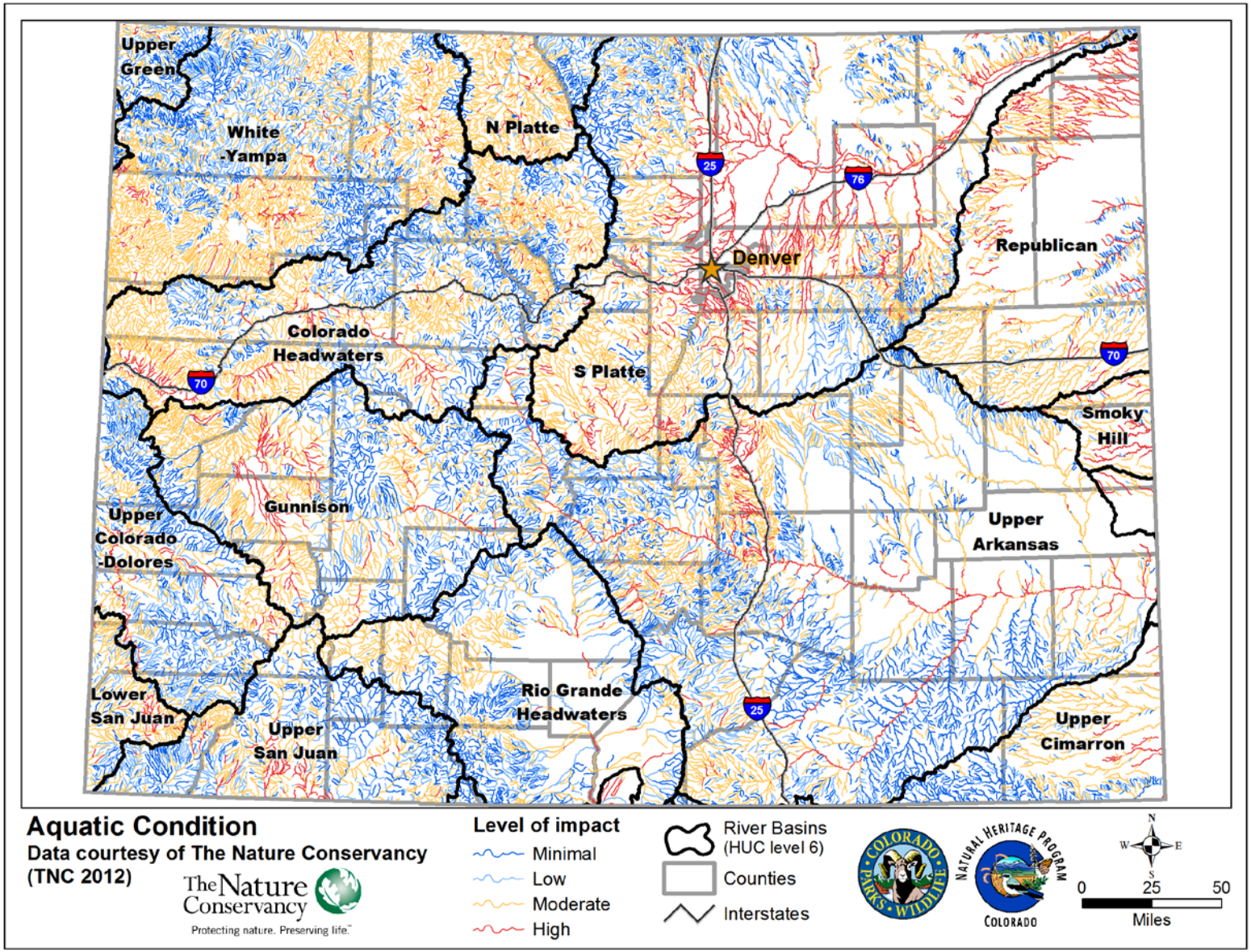



**Figure 13. Condition of freshwater habitats in Colorado.**

# Terrestrial Landscape Integrity Model

This map is the terrestrial upland counter-part to the aquatic condition map. This model was originally created for Rondeau et al. 2011[23], but has been updated for inclusion in the SWAP. This model is based on mapped locations of seven land-use impacts: urban development, crop agriculture, roads, oil and gas wells, above-ground transmission lines and pipelines, surface mines, and wind turbines. Data used to map these land uses are listed in Table 12. Distance decay curves representing the area that effects extend beyond the footprint of the land use were incorporated (Figure 14). This was done in recognition that impacts from any particular land-use disturbance extend some distance out from the source of the impact, but lessen over that distance. The resulting model (Figure 15) provides a statewide perspective for location and relative degree of human impact on the landscape. The assumption is that where impacts are higher, general condition of remaining habitat is likely to be decreased, and vice versa. See Rondeau et al. (2011) for detailed analysis methods.

**Table 12. Source data for land uses represented in the landscape integrity model.**

| Land Use | Source Data |
|---|---|
| High/med intensity development | SWReGAP high/medium development types |
| Low intensity development | SWReGAP low intensity development types |
| Agriculture* | SWReGAP agriculture |
| Roads - primary & secondary | 2013 TIGER/Line roads |
| Roads - local & rural | 2013 TIGER/Line roads |
| Oil & gas wells - active | Colorado Oil & Gas Commission (2015) |
| Oil & gas wells - inactive | Colorado Oil & Gas Commission (2015) |
| Gas pipelines | 2013 TIGER\Line utilities |
| Transmission lines | Powerline Corridors in the Western United States and Canada (Connelly et al. 2004) |
| Surface Mines - active | Colo. Division of Reclamation, Mining, & Safety (2013) |
| Surface Mines - inactive | Colo. Division of Reclamation, Mining, & Safety (2013) |
| Wind Turbines | USGS Onshore Industrial Wind Turbine Locations for the United States (2014) |

*The agriculture category in SWReGAP includes cropland and irrigated hay fields.

[23] http://www.cnhp.colostate.edu/download/documents/2011/Scorecard_march1_2012_final.pdf

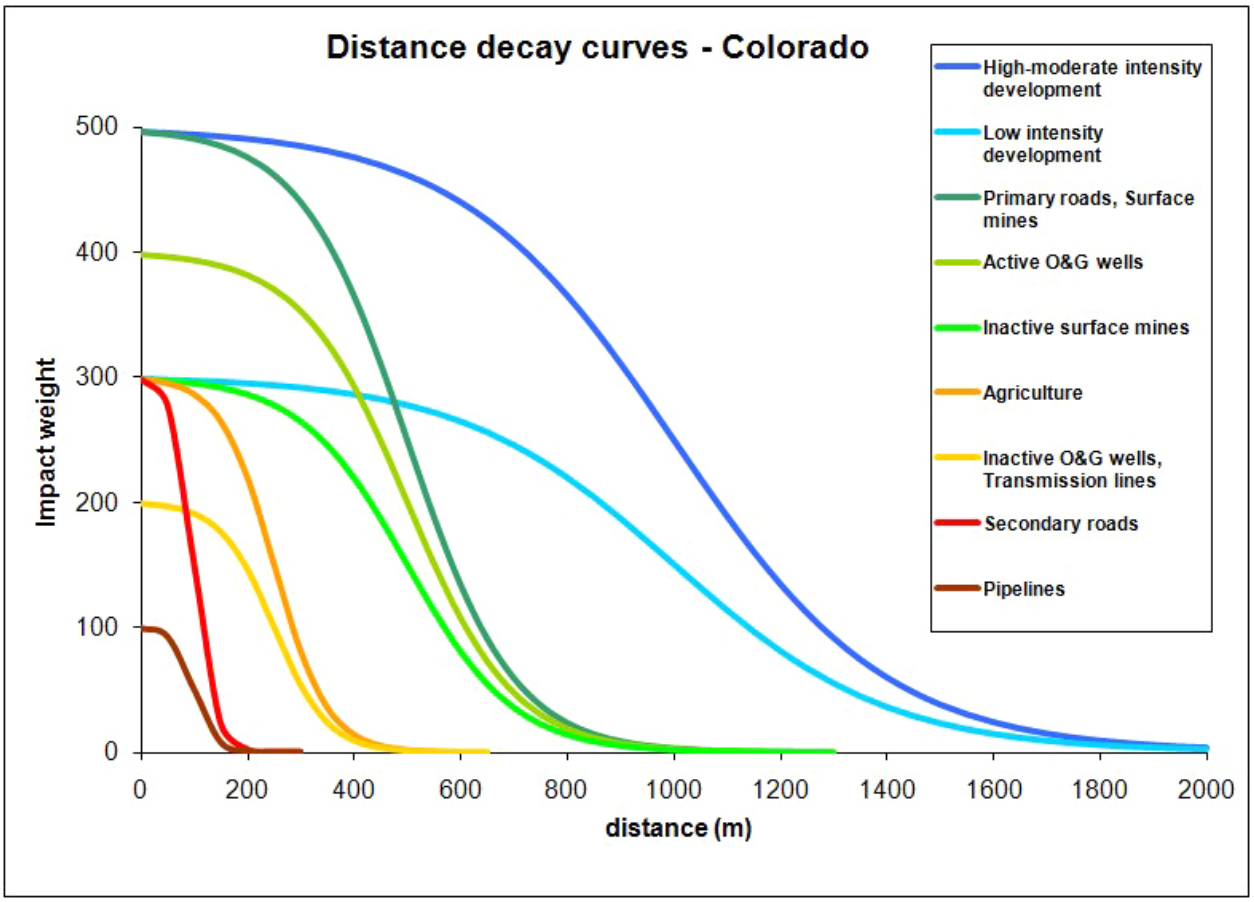



**Figure 14. Distance decay curves for land uses represented in the landscape integrity model.**

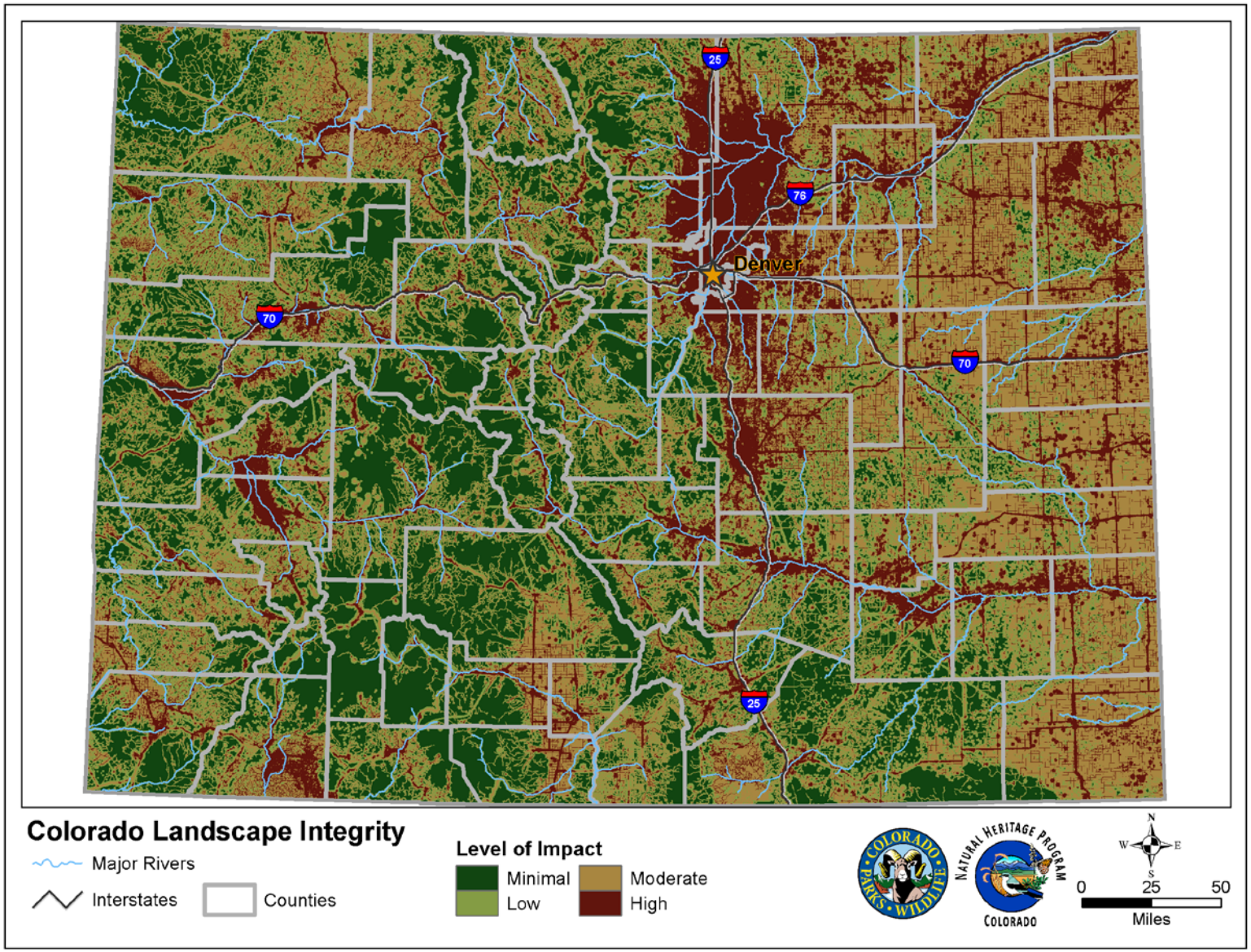



**Figure 15. Landscape integrity model for Colorado.**

# Wetland and Riparian Habitats

Through a partnership among the USFWS, CPW, and CNHP, fine-scale mapping of wetlands based on the U.S. Fish and Wildlife Service's National Wetland Inventory Program has been completed for Colorado (USFWS 2010, as edited by CNHP in 2014). In addition, the Rocky Mountain Bird Observatory and Playa Lakes Joint Venture have developed a GIS data layer for playas on Colorado's eastern plains (RMBO 2009). These data were used in conjunction with a wetland-specific landscape integrity model to produce Figure 16, which depicts level of human impact on wetland and riparian habitats. For each wetland/riparian polygon, the mean value of the overlapping portion of the wetland landscape integrity layer was calculated to estimate general level of impact for that habitat patch. Work is currently underway to explore field and mapping methods for determining wetland quality (Lemly et al. 2011). This goal is complicated by the fact that quality measures from a floristic standpoint and from a wildlife standpoint are not necessarily equivalent. Results of this exploration were not complete in time for inclusion in this iteration of Colorado's SWAP. Our hope is that the next SWAP revision will include a more robust treatment of condition for these high priority habitats.

The wetland-specific landscape integrity model for Colorado is meant to reflect the impact to wetland and riparian habitats from cumulative, mappable, anthropogenic changes to the land and water. This model is based on the inputs listed in Table 13.

**Table 13. Data sources for the wetland-specific landscape integrity model.**

| Land Use | Source Data |
|---|---|
| Housing & commercial development | LANDFIRE Current Vegetation for Colorado (2006) |
| Low intensity development | SWReGAP low intensity development types |
| Agriculture - tilled, fallow tilled, orchards & vineyards | LANDFIRE Current Vegetation for Colorado (2013) |
| Oil & gas wells | Colorado Oil & Gas Commission (2015) |
| Wind turbines | CNHP (2011) |
| Active sand & gravel mines | Colo. Division of Reclamation, Mining, & Safety (2008) |
| Other active mines | Colo. Division of Reclamation, Mining, & Safety (2008) |
| Reservoir storage as a proportion of mean annual flows | The Nature Conservancy (2012) |
| Altered flow as a proportion of mean annual flows | The Nature Conservancy (2012) |
| Density of dams & diversions | The Nature Conservancy (2012) |
| Water wells - active | The Nature Conservancy (2012) |
| Tamarisk infestations | The Nature Conservancy (2012) |

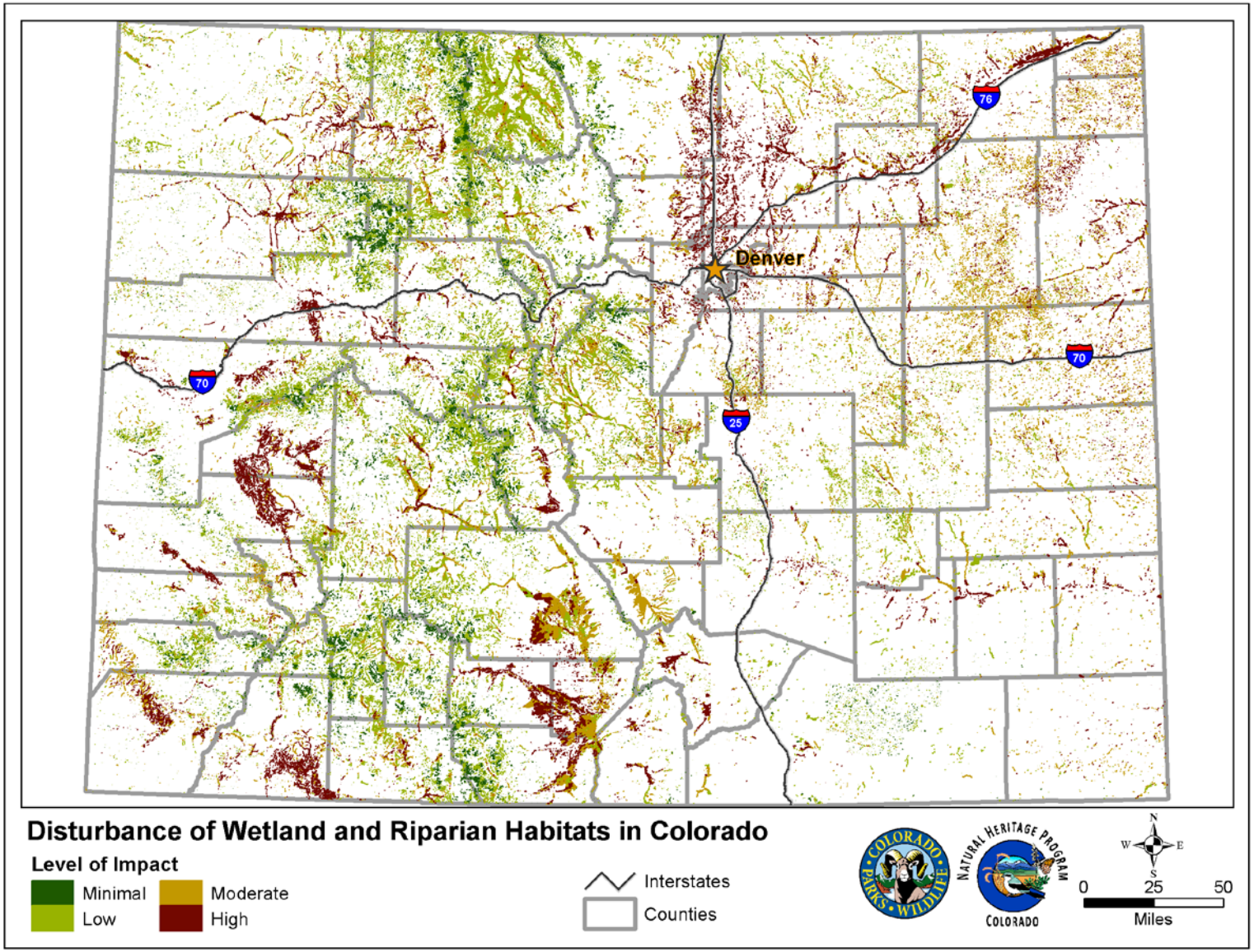



**Figure 16. Level of disturbance to wetland and riparian habitats**. Due to the small size of many wetland and riparian habitats, the polygons have been exaggerated to be visible on this statewide map.

# Terrestrial Upland Habitats

Rondeau et al. (2011) developed a map of distinct patches of matrix-forming and large patch ecological systems, derived from Southwest Regional GAP vegetation data layer. These ecological system patches are roughly equivalent to the terrestrial habitats as defined in this SWAP. These maps show comparative condition for discrete patches of each habitat type, according to biodiversity status scores originally developed for Rondeau et al. 2011. Components of biodiversity status are sub-scores for patch size, patch condition, landscape context, and landscape integrity. General methods described below are summarized from Rondeau et al. 2011.

## Habitat Patches

CNHP used the Southwest Regional Gap Analysis Project (SWReGAP) landcover dataset (USGS 2004) to produce a generalized vegetation map from which we could identify discrete ecological system patches. To the generalized map, we then added current highway data to represent existing fragmentation of the landscape. Of the resulting discrete patches of each ecological system type, we retained only patches larger than the minimum size judged to be viable as an ecological system at the landscape scale, according to methods in Rondeau (2001) and CNHP (2005a).

## Size

Patches that met minimum size criteria were scored from 5 to 10, depending on size (Table 14). Patches that did not meet minimum size requirements were not included as viable in Rondeau et al. 2011. However, they have been added to these maps (Figures 17 - 19) and ranked as "Poor" without regard to the other sub-scores.

**Table 14. Total acres, minimum patch size, number of patches, and largest patch size for each habitat.**

| Habitat Type | Habitat Name | Total acres | Minimum patch size (ac.) | No. patches | Largest patch (ac.) |
|---|---|---|---|---|---|
| Forest | Aspen | 3,580,854 | 20,000 | 1,564 | 513,422 |
| Forest | Lodgepole | 2,199,719 | 30,000 | 643 | 264,169 |
| Forest | Mixed Conifer | 881,470 | 2,500 | 1,562 | 39,416 |
| Forest | Pinyon-Juniper | 6,753,665 | 30,000 | 1,300 | 512,906 |
| Forest | Ponderosa | 3,220,299 | 30,000 | 1,153 | 516,244 |
| Forest | Spruce-Fir | 4,880,993 | 20,000 | 956 | 458,277 |
| Grass | Grasslands | 3,020,774 | 5,000 | 1,551 | 281,180 |
| Grass | Shortgrass | 11,855,161 | 50,000 | 1,827 | 1,072,828 |
| Other | Alpine Tundra | 1,681,811 | 10,000 | 480 | 250,971 |
| Shrub | Montane-Foothills Shrub | 388,143 | 1,000 | 562 | 43,507 |
| Shrub | Greasewood | 443,159 | 1,000 | 367 | 136,846 |
| Shrub | Oak & Mixed Mtn Shrub | 2,717,457 | 5,000 | 1224 | 206,256 |
| Shrub | Sagebrush | 5,564,595 | 30,000 | 1,995 | 924,242 |
| Shrub | Saltbush | 763,237 | 1,000 | 356 | 77,768 |
| Shrub | Sandsage | 1,959,449 | 14,000 | 672 | 179,704 |
| Shrub | Semi-desert Steppe | 776,043 | 5,000 | 243 | 172,992 |

## Patch Condition

Patch condition was scored by using the LANDFIRE Fire Regime Condition Class dataset (USFS 2007) that maps degree of departure from historic fire regime. The fire condition metric is most meaningful for forests, but was included for all habitats except alpine, greasewood, salt shrub, and shrub-steppe. This metric was judged to be not meaningful for these habitats because alpine does not typically burn, and LANDFIRE dataset does not represent these three shrubland types well. The Condition sub-score in Rondeau et al. 2011 only reflected degree of departure from normal fire regime. Since that analysis was completed, Colorado has experienced a number of significant insect outbreaks and wildfires. Thus, for forest habitats, the condition sub-score was updated by incorporating degree of tree mortality due to insect infestation and disease as mapped by the U.S. Forest Service aerial surveys from 2008-2014. While not added to the sub-score, the aerial extents of recent large-scale fires and mud-slides (2012-2014, Rocky Mountain Incident Management data) were overlaid on ecosystem patches as a highly transparent white, so they

would lighten the color (and therefore the apparent condition) just for the footprint of the disaster, and not the ecosystem patch as a whole.

## Landscape Context and Integrity

Landscape context was scored by calculating the proportion of the landscape within ½ mile of a patch that is covered with natural vegetation. Landscape integrity was calculated using a GIS layer that represents the cumulative impacts from oil and gas wells, gas pipelines, surface mines, urban development, agriculture, roads, transmission lines, and wind turbines (i.e., the Landscape Integrity map, Figure 15, in this chapter).

## Overall Biodiversity Status

The four sub-scores were averaged to produce the biodiversity status scores, which are used to represent the overall habitat condition presented on Figures 17-19. These scores, ranging from 0 to 10, have been classified as:

| | |
|---|---|
| 0 - 2.5 | Poor |
| > 2.5 - 5.0 | Fair |
| > 5.0 - 7.5 | Good |
| > 7.5 - 10 | Very Good |

For these maps, the patch condition and landscape integrity sub-scores from Rondeau et al. 2011 were updated with new information and the biodiversity status score re-calculated.

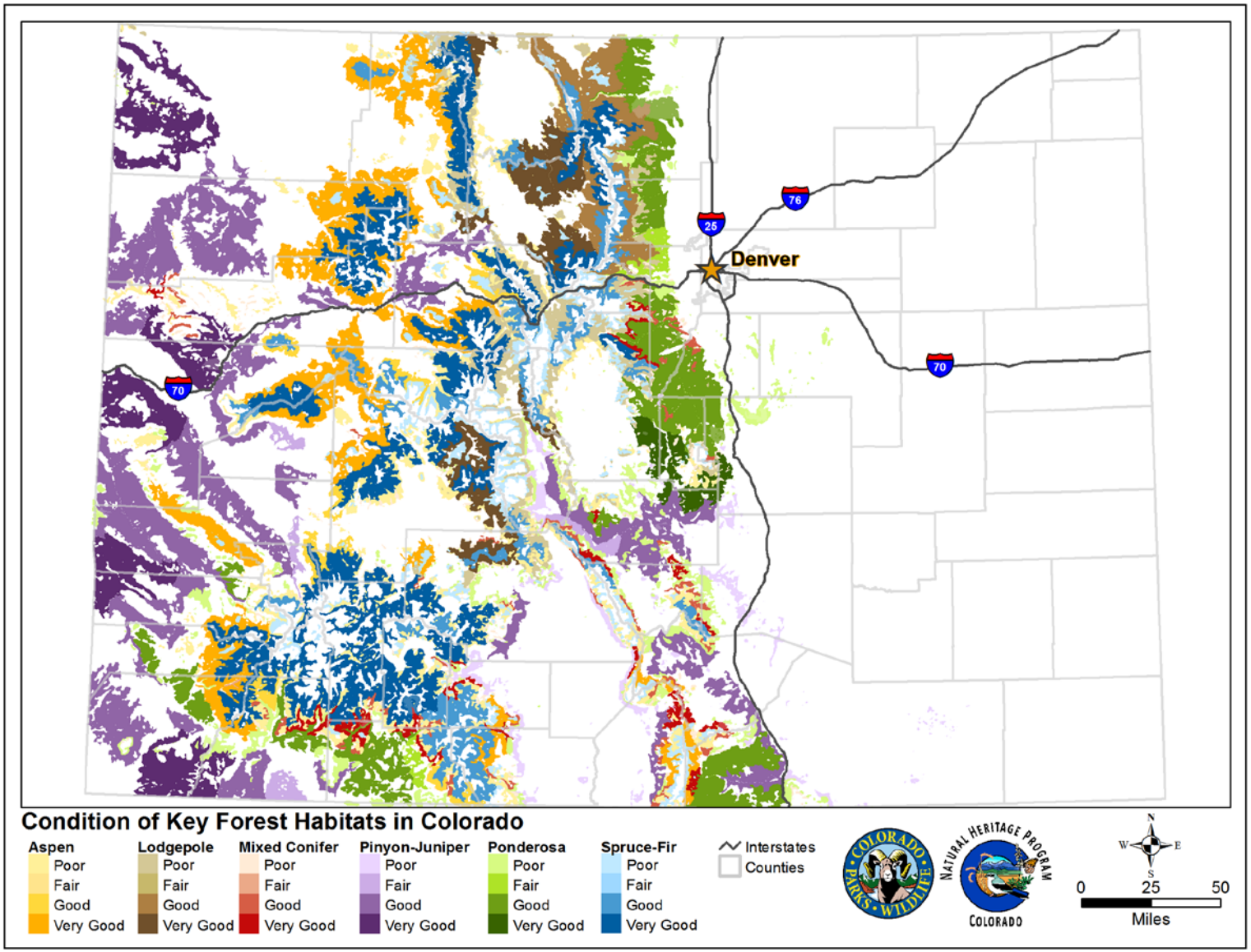



**Figure 17. Terrestrial upland habitat condition - Forests.**

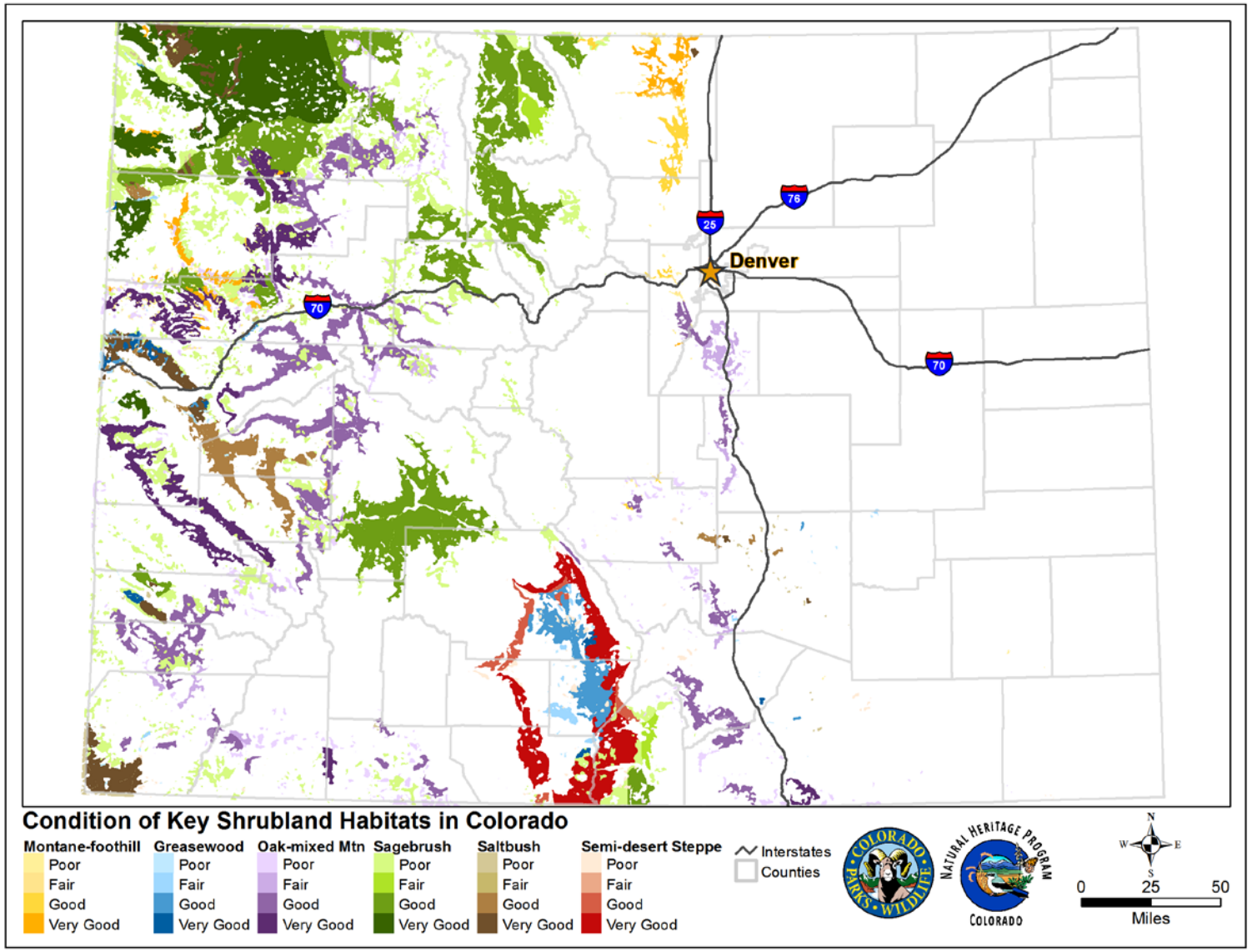



**Figure 18. Terrestrial upland habitat condition – Shrublands**

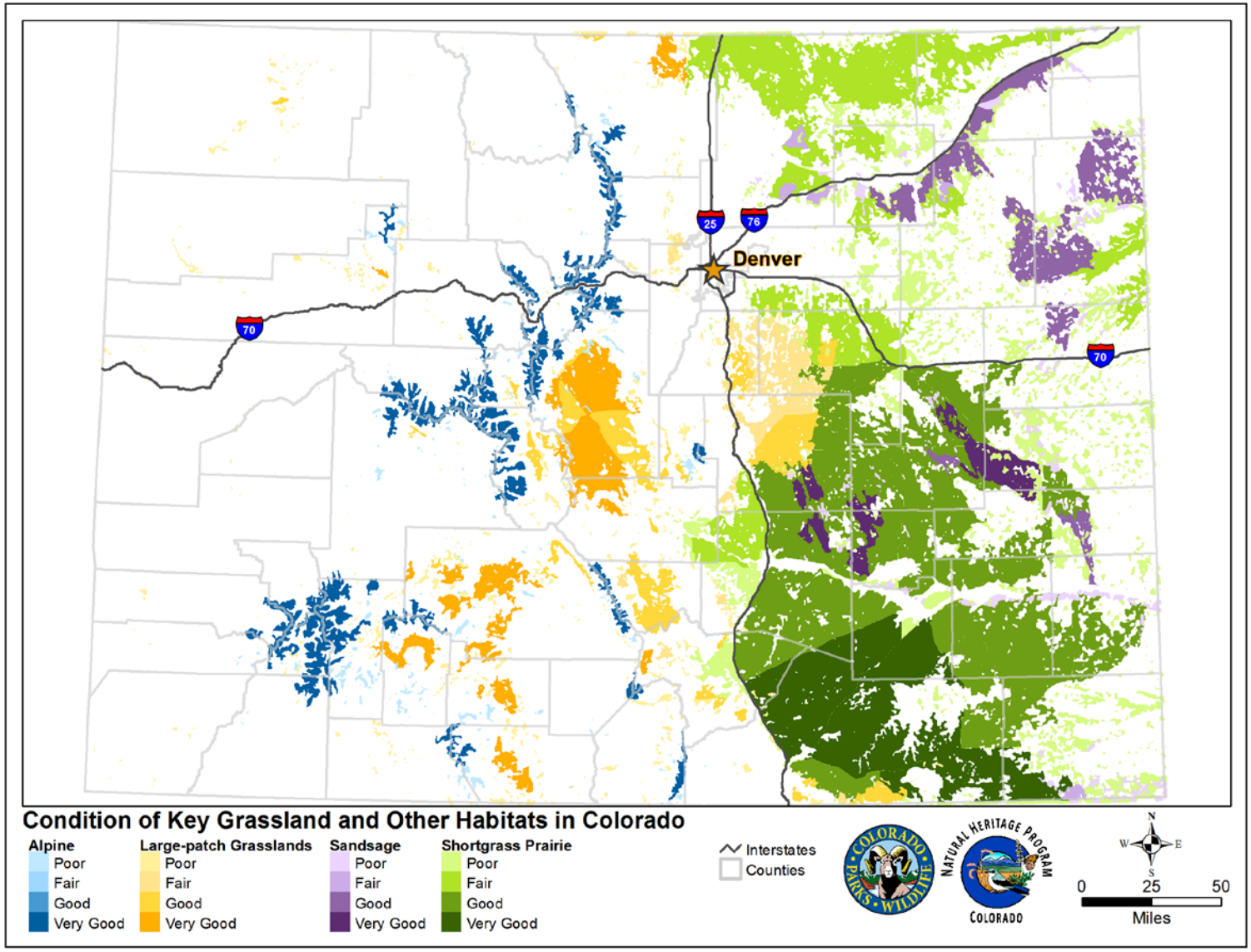



**Figure 19. Terrestrial upland habitat condition – Grasslands and Other Habitats**

# High Priority Watersheds for Aquatic SGCN

This map represents the number of Tier 1 fish species known to occur in each HUC10 watershed in the state, according to data available in CPW's fish database as of December 2014 (Figure 20). There are 25 fish species on the Tier 1 SGCN list; a maximum of eight different species occur in the same watershed. This map is an indicator of species richness only; it does not consider relative habitat quality, or population metrics such as density or abundance, across watersheds.

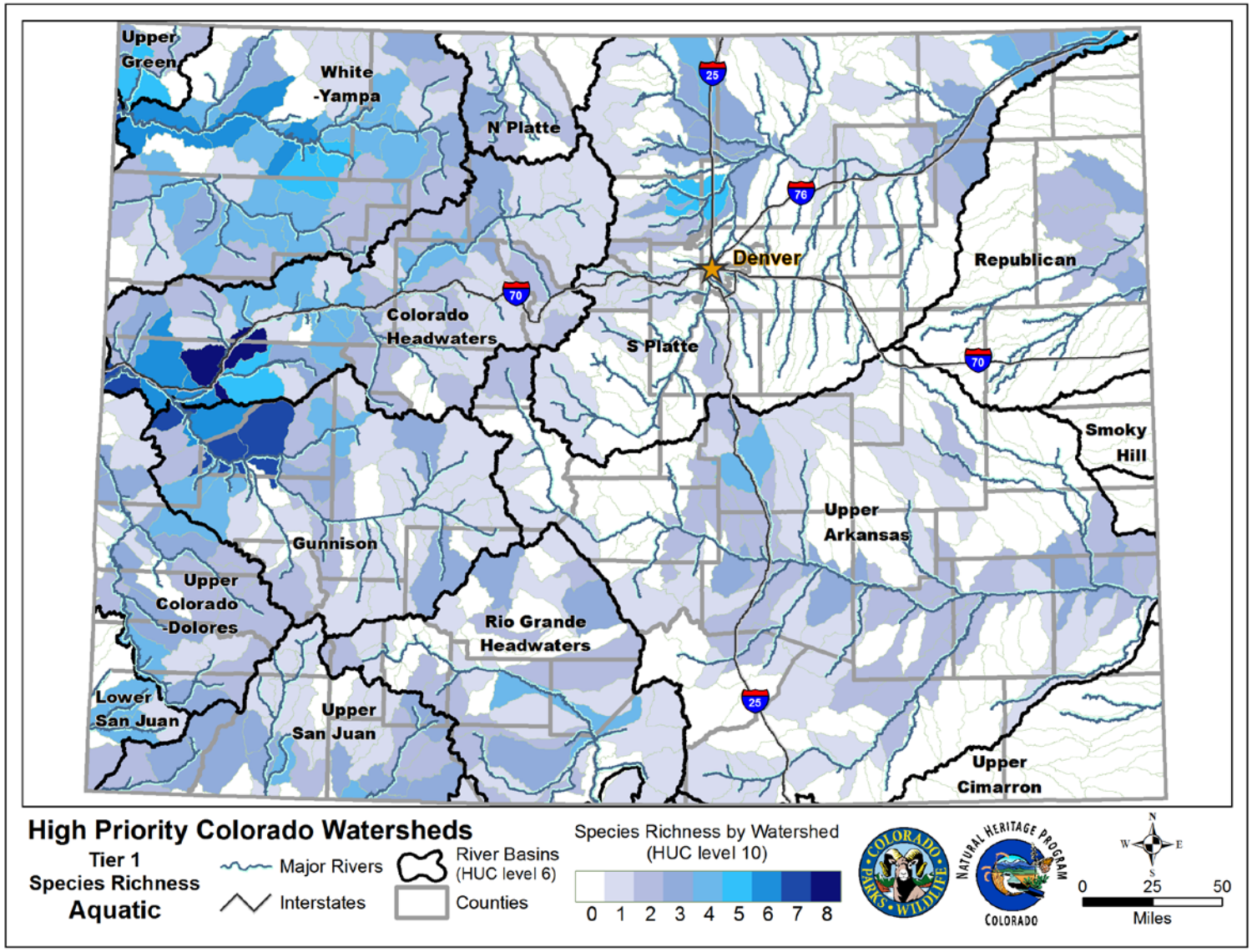



**Figure 20. Priority watersheds for aquatic Tier 1 SGCN.**

# Crucial Habitat Assessment Tool

The first iteration of the Crucial Habitat Assessment Tool[24] (CHAT) map was developed in 2013, in collaboration with the Western Governors' Association and 18 other states, for the purpose of creating a regional spatial data tool to identify crucial wildlife habitat across the western U.S. As part of Colorado's CHAT effort, a map of Species of Greatest Conservation Need was developed. The original SGCN CHAT layer for Colorado has been updated to reflect the newly revised list of Tier 1 SGCN, and to incorporate improved distribution data for those species (Figure 22). Using State Wildlife Grant funds, we developed species distribution models for 16 Tier 1 SGCN. These newly-developed models, pre-existing species distribution models, and documented distribution data for Tier 1 terrestrial vertebrate and plant SGCN have been combined at the resolution of 640 acre hexagons across the state. Each hexagon was then placed into one of five habitat priority categories based on criteria listed in Table 15.

As defined by the Western Governors' Wildlife Council (2013), crucial habitats are places containing the resources, including food, water, cover, shelter and important wildlife corridors, that are necessary for the survival and reproduction of aquatic and terrestrial wildlife and to prevent unacceptable declines, or facilitate future recovery of wildlife populations, or are important ecological systems with high biological diversity value. Crucial habitats are categorized according to the following definitions using the criteria in Table 15. See Table 16 for criteria as applied for each SGCN.

**Category 1**: Habitats, including wildlife corridors, that are rare or fragile and are essential to achieving and/or maintaining wildlife species viability or exceptional diversity. The habitat contains a unique combination of location or composition or complexity of the habitat or corridor which cannot be duplicated, and is therefore considered irreplaceable.

**Category 2**: Habitat, including wildlife corridors, which is limiting to a fish or wildlife community, population, or metapopulation. Loss of any of this habitat or corridor could result in a significant local or population-level decline in species distribution, abundance, or productivity. The habitat or corridor is essential to achieving and maintaining fish and wildlife target population or management objectives. Restoration or replacement is difficult, or may be possible only in the very long term.

**Category 3**: Habitat, including wildlife corridors, that contributes significantly to the maintenance of fish or wildlife communities, populations, or metapopulations. Loss of a significant portion of the habitat or corridor could result in local or population-level declines in

[24] http://westgovchat.org

species distribution, abundance, or productivity. Impacts can be minimized or reduced, and habitat or corridors restored or replaced by utilizing appropriate best management practices.

**Common Habitat** [represented on map as Category 4]: Habitat which is relatively common, generally less limiting to fish and wildlife communities, populations, or metapopulations, and generally better suited for land use conversion. Large-scale or cumulative impacts to species or habitat could result in declines in species distribution or abundance, however, the loss may be difficult to measure. Impacts from individual projects or land use actions can be minimized, and habitat restored or replaced, so that effective habitat function or species distribution or abundance is maintained.

**Habitat Significance Unknown** [represented on map as Category 5]: Lands likely to have significant wildlife values, but for which there is insufficient data or a lack of information about the importance of the habitat in meeting conservation objectives.

**Table 15. Criteria for CHAT categories.**

Federal listing codes: LE = Endangered; LT = Threatened, C = Candidate; NatureServe conservation status codes: G1= critically imperiled; G2 = imperiled; G3 = vulnerable; G4 = apparently secure; G5 = demonstrably secure.

| CHAT Category | Criteria |
|---|---|
| 1 | At least one T, E, G1, or G2 species with documented occurrence, or at least two G3 species with documented occurrence |
| 2 | At least one document occurrence of a C or G3 species, or at least two documented occurrences of G4 species |
| 3 | Modeled distribution of at least one G3 species, or documented occurrence of at least one G4 species |
| 4 | Modeled distribution of at least one C or G4 species, or documented occurrence of at least one G5 species |
| 5 | Modeled distribution of at least one G5 species |

**Table 16. CHAT categorization criteria, by species.**

| Species | Federal Listing Status | NatureServe Status Rank | Documented Occurrence | Modeled Distribution |
|---|---|---|---|---|
| **TIER 1 AMPHIBIANS** | | | | |
| Boreal toad | | G1 | X | X |
| Northern leopard frog | | G5 | X | X |
| **TIER 1 BIRDS** | | | | |
| Brown-capped rosy-finch | | G4 | X | X |
| Burrowing owl | | G4 | X | X |
| Columbian sharp-tailed grouse | | G3 | X | X |
| Golden eagle | | G5 | | X |
| Greater sage grouse | C | G3 | X | X |
| Greater sandhill crane | | G4 | X | X |
| Gunnison sage grouse | LT | G1 | X | X |
| Lesser prairie-chicken | C | G3 | X | X |
| Mountain plover | | G3 | X | X |
| Plains sharp-tailed grouse | | G4 | X | X |
| Southern white-tailed ptarmigan | | G5 | X | X |
| Southwestern willow flycatcher | LE | G1 | X | X |
| Western yellow-billed cuckoo | LT | G4 | | X |
| **TIER 1 MAMMALS** | | | | |
| American pika | | G5 | | X |
| Black-footed ferret | LE | G4 | | X |
| Fringed myotis | | G4 | X | X |
| Gunnison's prairie dog | C | G5 | X | X |
| Little brown myotis | | G4 | | X |
| Lynx | LT | G4 | | X |
| New Mexico meadow jumping mouse | | G4 | | X |
| Olive-backed pocket mouse | | G5 | | X |
| Preble's meadow jumping mouse | LT | G2 | X | X |
| Spotted bat | | G4 | X | X |
| Townsend's big-eared bat subsp. | | G3 | X | X |
| White-tailed prairie dog | | G4 | X | X |
| Wolverine | | G4 | | X |
| **TIER 1 REPTILES** | | | | |
| Colorado checkered whiptail | | G2 | X | X |
| Massasauga | C | G3 | X | X |
| **TIER 1 PLANTS** | | | | |
| *Aletes latilobus* | | G1 | X | |
| *Aliciella sedifolia* | | G1 | X | |
| *Astragalus deterior* | | G1 | X | |
| *Astragalus humillimus* | LE | G1 | X | |

| Species | Federal Listing Status | NatureServe Status Rank | Documented Occurrence | Modeled Distribution |
|---|---|---|---|---|
| *Astragalus microcymbus* | C | G1 | X | |
| *Astragalus osterhoutii* | LE | G1 | X | |
| *Astragalus schmolliae* | C | G1 | X | |
| *Astragalus tortipes* | C | G1 | X | |
| *Boechera glareosa* | | G1 | X | |
| *Corispermum navicula* | | G1 | X | |
| *Descurainia kenheilii* | | G1 | X | |
| *Draba malpighiacea* | | G1 | X | |
| *Draba weberi* | | G1 | X | |
| *Erigeron wilkenii* | | G1 | X | |
| *Eriogonum brandegeei* | | G1 | X | |
| *Eriogonum pelinophilum* | LE | G2 | X | |
| *Eutrema penlandii* | LT | G1 | X | |
| *Gutierrezia elegans* | | G1 | X | |
| *Hackelia gracilenta* | | G1 | X | |
| *Ipomopsis polyantha* | LE | G1 | X | |
| *Ipomopsis ramosa* | | G1 | X | |
| *Lepidium huberi** | | G1 | | |
| *Lygodesmia doloresensis* | | G1 | X | |
| *Mimulus gemmiparus* | | G1 | X | |
| *Oenothera coloradensis* ssp. *coloradensis* | LT | G2 | X | |
| *Oreoxis humilis* | | G1 | X | |
| *Packera mancosana* | | G1 | | |
| *Pediocactus knowltonii** | | G1 | | |
| *Penstemon debilis* | LT | G1 | X | |
| *Penstemon gibbensii* | | G1 | X | |
| *Penstemon penlandii* | LE | G1 | X | |
| *Penstemon scariosus* var. *albifluvis* | C | G1 | X | |
| *Phacelia formosula* | LE | G1 | X | |
| *Phacelia submutica* | LT | G2 | X | |
| *Physaria congesta* | LT | G1 | X | |
| *Physaria obcordata* | LT | G1 | X | |
| *Physaria pulvinata* | | G1 | X | |
| *Physaria rollinsii* | | G1 | X | |
| *Physaria scrotiformis* | | G1 | X | |
| *Sclerocactus glaucus* | | G2 | X | |
| *Sclerocactus mesae-verdae* | LT | G2 | X | |
| *Spiranthes diluvialis* | LT | G2 | X | |

* No locational data for these species exist for Colorado, so they are not represented on the CHAT map.

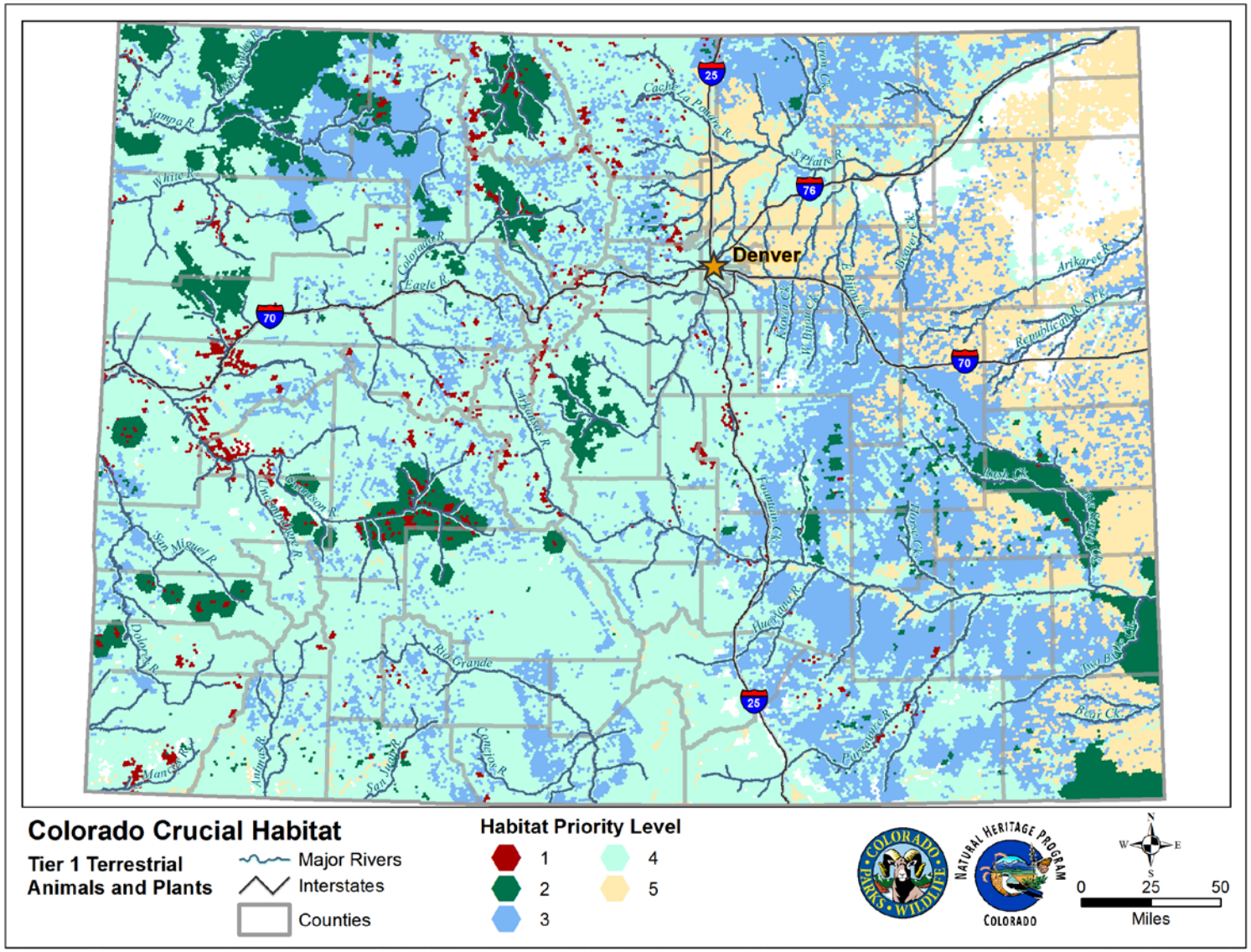



**Figure 21. Crucial habitat for Tier 1 terrestrial animal and plant SGCN.** Areas in white on the map indicate places where there are no documented occurrences or modeled habitat for any Tier 1 SGCN.

# Chapter 9: Review, Coordination, and Public Participation

## Review and Updates to the SWAP

Guidance provided by USFWS and the AFWA *Best Practices for State Wildlife Action Plans* document for updating SWAPs distinguishes between major revisions and minor revisions. Major revisions include any change to the SGCN list or the threats assessment, or any change that could result in changes to conservation actions or their priority. We have generated our SGCN list and the subsequent analyses with an eye to potential changes in conservation issues over the next decade. Thus, we do not anticipate the need to conduct major revisions over the 10-year life of this plan. If that need were to occur, we would follow USFWS guidance in conducting major revisions. Meanwhile, as new information becomes available relative to required SWAP elements, it will be incorporated into the SWAP database for use in the next scheduled SWAP update.

## Partner Coordination & Public Participation

Development of the 2006 SWAP was a multi-pronged approach that engaged technical experts and general stakeholders separately. This was an appropriate approach at the time because SWAPs were a new concept that required a greater level of philosophical exploration and understanding by all parties than is needed today. Also, the 2006 SWAP was the first statewide, strategic wildlife conservation plan intended for use by all relevant parties ever developed for Colorado.

Over the past decade, familiarity with and use of the SWAP has become routine by many agencies, conservation partners, and stakeholders. Colorado is fortunate to have a relatively well-connected community of conservation practitioners, with a great deal of cross-over in terms of scientific and/or land management expertise among agencies and NGOs. This, combined with the fact that the development of the 2015 SWAP was a revision of an existing document, as opposed to a "starting from scratch" effort, negated the need to distinguish between technical experts and other stakeholders. Thus, we focused the majority of our public participation efforts on improving the scientific content rather than conducting in-person general public information activities. To better facilitate involvement by all interested parties, we organized our collaboration efforts around online participation, as described below.

## Stakeholder Identification

During the SWAP revision process, we developed a list of almost 400 stakeholders that included representatives from all levels of government, as well as non-governmental organizations, Native American tribes, the private sector, interest groups, and private citizens (Table 17). This list included all those who participated in the development of the 2006 SWAP, agency and NGO scientists and land managers identified by CPW staff as important collaborators, members of the Colorado Sportsmen's Roundtable, and many others. On May 9, 2014, a press release was published notifying the public of the SWAP revision process, and inviting participation. All who responded to this notice with a request to be added to the stakeholder list were included. Table 17 presents a tally of the number of stakeholder representatives by organization type. A full list of stakeholder agencies and organizations is included in Appendix H.

**Table 17. Summary of stakeholders by organization type.**

| Partner/Stakeholder Category | Number of Representatives |
|---|---|
| Federal Agencies | 79 |
| State Agencies (not including CPW) | 13 |
| Local Governments | 27 |
| Native American Tribes | 2 |
| Non-governmental Organizations | 135 |
| Universities | 48 |
| Private Consulting Firms | 28 |
| Private Citizens | 61 |
| Industry | 1 |

## Stakeholder Comment Opportunities

To support broad public participation, CPW created a dedicated webpage on the Colorado Parks and Wildlife homepage[25] as well as a dedicated email address for direct communication with stakeholders. The SWAP webpage hosted background information on the SWAP, and instructions for stakeholder involvement in the revision process. All review drafts of SWAP

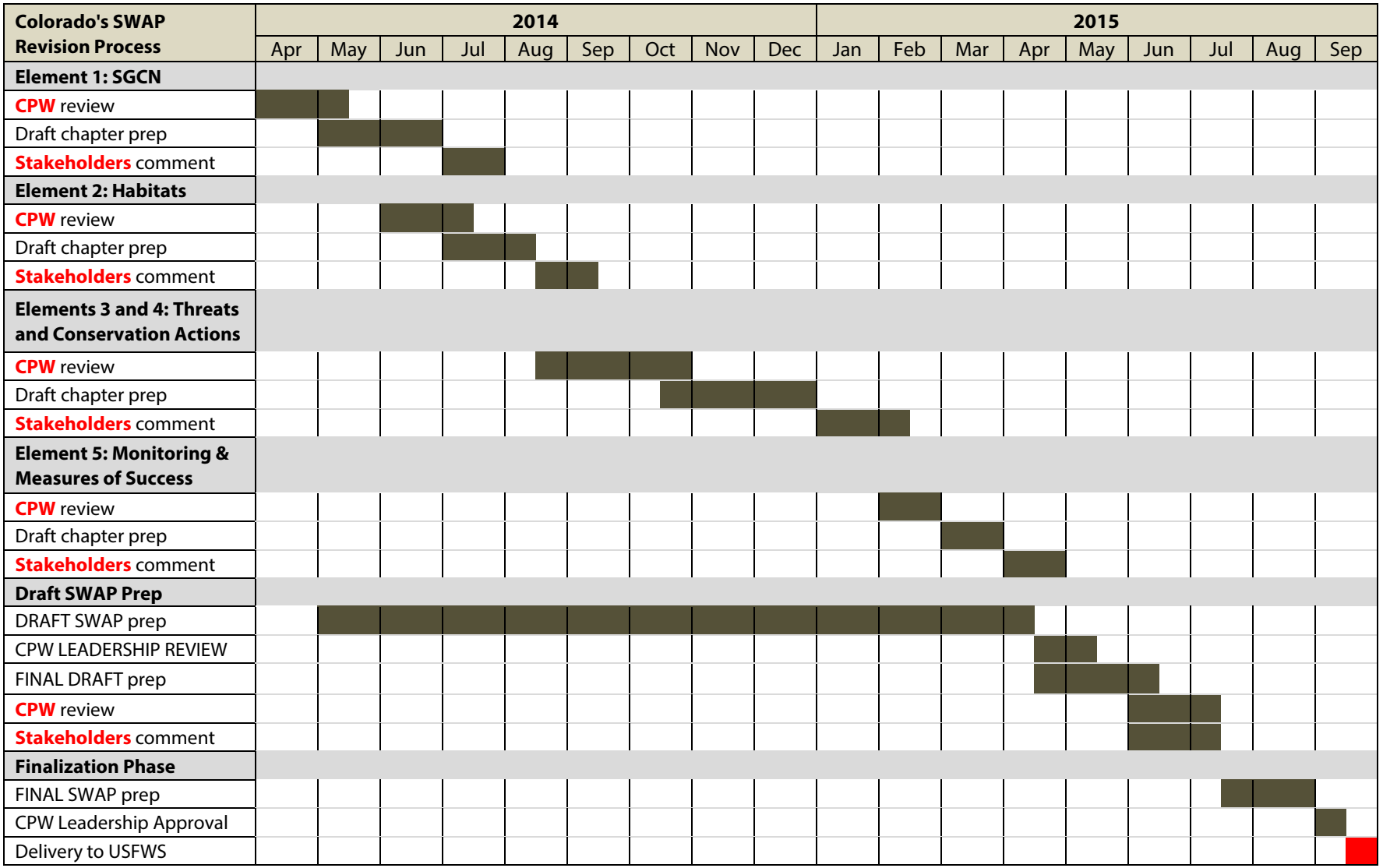
[25] http://cpw.state.co.us/aboutus/Pages/StateWildlifeActionPlan.aspx

components were posted for public access, and emailed directly to all stakeholders on the SWAP distribution list.

On June 9, 2014, an email was sent to all stakeholders inviting them to join a SWAP revision kick-off webinar. The purpose of the webinar was to introduce the revision process, to alert stakeholders to the scheduled comment periods, and to explain the procedures for submitting comments. The webinar was recorded and posted to the SWAP webpage for stakeholders who were unable to attend the original webinar.

Stakeholders had four opportunities to provide comments on draft components of the SWAP, and one opportunity to provide final comments on the draft SWAP in its entirety, according to the schedule presented in Table 18. The emails inviting stakeholder input for each comment period are included in Appendix I. After each review period, stakeholder comments were compiled and summarized, along with CPW responses to each comment. These summaries were then posted on the SWAP webpage to allow stakeholders to track the development of each SWAP chapter.

**Table 18. Schedule of SWAP revision milestones and stakeholder comment opportunities.**



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