

# Chapter 6: Threats and Actions for Habitats

## Summary of Threats

Of 36<sup>15</sup> 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.

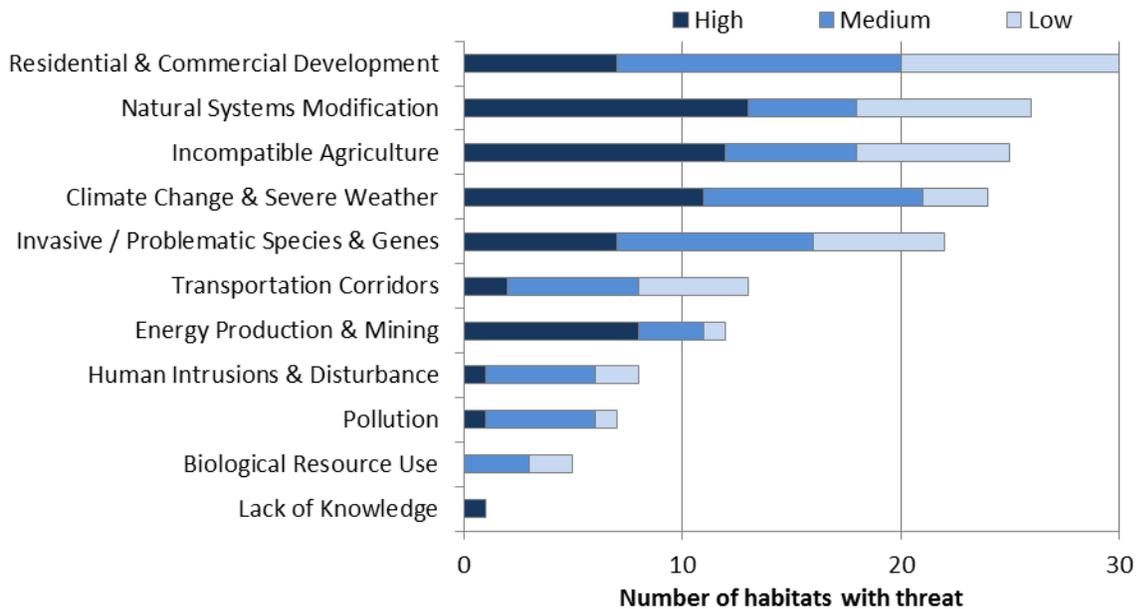


Figure 9. Threats to habitats by priority.

<sup>15</sup> 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.

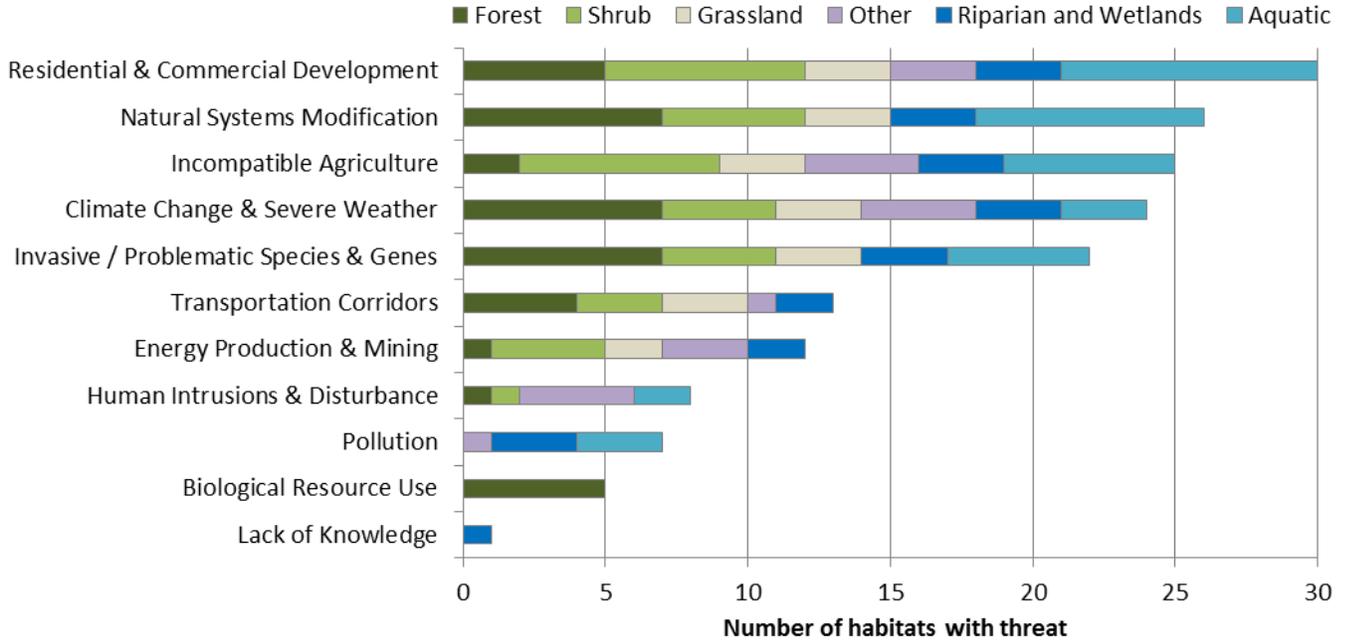


Figure 10. Threats to habitats by habitat type.

## 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.

Colorado's 2015 State Wildlife Action Plan

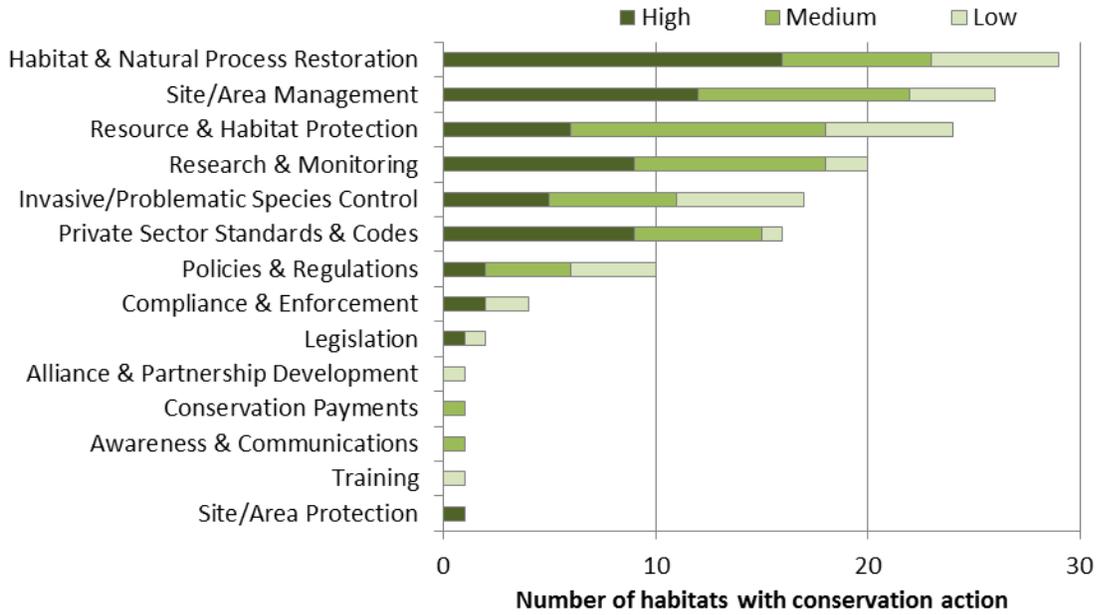


Figure 11. Conservation actions needed for habitats by priority.

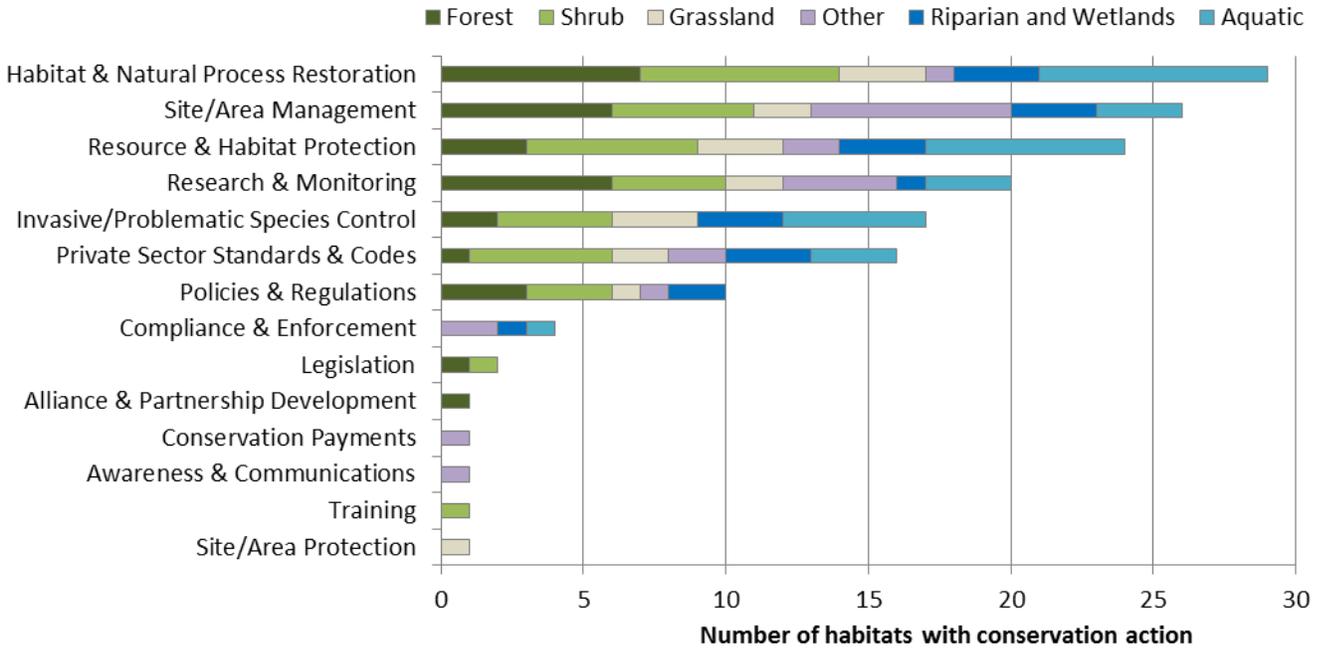


Figure 12. Conservation actions needed for habitats by habitat type.

## 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

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##### *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

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### **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 19<sup>th</sup> 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**

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### ***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**

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### **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-juniper 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**

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### ***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**

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### ***Threats***

#### **5 Biological Resource Use**

Timber harvest in spruce-fir forests has declined significantly since the late 19<sup>th</sup> 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 (Rocheftort 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**

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### **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**

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### **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**

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### ***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 tolerant 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**

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### ***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 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**

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### ***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 sagebrush 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**

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### ***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**

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### ***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 sandsage from urban development, agriculture, and energy development.

## Upland Shrub

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### 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**

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#### ***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

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### 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<sub>2</sub> 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**

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### ***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**

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#### ***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**

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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**

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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 and 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**

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#### ***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 affect 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<sup>th</sup> 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<sup>16</sup>. 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).

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<sup>16</sup> 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**

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### ***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 affect 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 19<sup>th</sup> 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

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### **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**

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#### **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**

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### ***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 limited in extent.

#### **2 Incompatible Agriculture**

In southwestern Colorado, sheep grazing is a stressor 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**

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### **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

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### ***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

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### ***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**

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### ***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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Anaxyrus boreas boreas</i>	Boreal toad (Southern Rocky Mountain Population)	<input type="checkbox"/>	Amphibians	<i>Lithobates sylvatica</i>	Wood frog	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input type="checkbox"/>
Mammals	<i>Ochotona princeps</i>	American pika	<input type="checkbox"/>	Birds	<i>Aegolius funereus</i>	Boreal owl	<input type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Birds	<i>Peucaea cassinii</i>	Cassin's finch	<input checked="" type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Otus flammeolus</i>	Flammulated owl	<input checked="" type="checkbox"/>
Mammals	<i>Euderma maculatum</i>	Spotted bat	<input type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>	Birds	<i>Accipiter gentilis</i>	Northern goshawk	<input checked="" type="checkbox"/>
Mammals	<i>Gulo gulo</i>	Wolverine	<input type="checkbox"/>	Birds	<i>Contopus cooperi</i>	Olive-sided flycatcher	<input checked="" type="checkbox"/>
Plants	<i>Ipomopsis ramosa</i>	Coral ipomopsis	<input type="checkbox"/>	Birds	<i>Progne subis</i>	Purple martin	<input checked="" type="checkbox"/>
Plants	<i>Draba malpighiacea</i>	Whitlow-grass	<input type="checkbox"/>	Birds	<i>Oreothlypis virginiae</i>	Virginia's warbler	<input type="checkbox"/>
				Insects	<i>Pyrgus xanthus</i>	Xanthus skipper	<input type="checkbox"/>
				Mammals	<i>Sorex nanus</i>	Dwarf shrew	<input checked="" type="checkbox"/>
				Mammals	<i>Canis lupus</i>	Gray wolf	<input checked="" type="checkbox"/>
				Mammals	<i>Ursus arctos</i>	Grizzly bear	<input checked="" type="checkbox"/>
				Mammals	<i>Lasiurus cinereus</i>	Hoary bat	<input checked="" type="checkbox"/>
				Plants	<i>Penstemon mensarum</i>	Grand Mesa penstemon	<input checked="" type="checkbox"/>
				Plants	<i>Botrychium lineare</i>	Narrowleaf grape fern	<input checked="" type="checkbox"/>
				Plants	<i>Draba smithii</i>	Smith whitlow-grass	<input type="checkbox"/>
				Plants	<i>Delphinium robustum</i>	Wahatoya Creek larkspur	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Anaxyrus boreas boreas</i>	Boreal toad (Southern Rocky Mountain Population)	<input type="checkbox"/>	Amphibians	<i>Lithobates sylvatica</i>	Wood frog	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input type="checkbox"/>
Mammals	<i>Ochotona princeps</i>	American pika	<input type="checkbox"/>	Birds	<i>Aegolius funereus</i>	Boreal owl	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Birds	<i>Peucaea cassinii</i>	Cassin's finch	<input checked="" type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Accipiter gentilis</i>	Northern goshawk	<input checked="" type="checkbox"/>
Mammals	<i>Lynx canadensis</i>	Lynx	<input checked="" type="checkbox"/>	Birds	<i>Contopus cooperi</i>	Olive-sided flycatcher	<input checked="" type="checkbox"/>
Mammals	<i>Gulo gulo</i>	Wolverine	<input type="checkbox"/>	Insects	<i>Coloradia luskii</i>	Lusk's pinemoth	<input type="checkbox"/>
				Insects	<i>Agapema homogena</i>	Rocky Mountain agapema	<input type="checkbox"/>
				Mammals	<i>Martes americana</i>	American marten	<input checked="" type="checkbox"/>
				Mammals	<i>Sorex nanus</i>	Dwarf shrew	<input checked="" type="checkbox"/>
				Mammals	<i>Canis lupus</i>	Gray wolf	<input checked="" type="checkbox"/>
				Mammals	<i>Ursus arctos</i>	Grizzly bear	<input checked="" type="checkbox"/>
				Mammals	<i>Clethrionomys gapperi</i>	Red-backed vole	<input checked="" type="checkbox"/>
				Mammals	<i>Lepus americanus</i>	Snowshoe hare	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Anaxyrus boreas boreas</i>	Boreal toad (Southern Rocky Mountain Population)	<input type="checkbox"/>	Amphibians	<i>Lithobates sylvatica</i>	Wood frog	<input type="checkbox"/>
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	<input type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Peucaea cassinii</i>	Cassin's finch	<input checked="" type="checkbox"/>
Mammals	<i>Ochotona princeps</i>	American pika	<input type="checkbox"/>	Birds	<i>Otus flammeolus</i>	Flammulated owl	<input type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input checked="" type="checkbox"/>	Birds	<i>Strix occidentalis lucida</i>	Mexican spotted owl	<input checked="" type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input checked="" type="checkbox"/>	Birds	<i>Accipiter gentilis</i>	Northern goshawk	<input checked="" type="checkbox"/>
Mammals	<i>Lynx canadensis</i>	Lynx	<input checked="" type="checkbox"/>	Birds	<i>Contopus cooperi</i>	Olive-sided flycatcher	<input checked="" type="checkbox"/>
Mammals	<i>Euderma maculatum</i>	Spotted bat	<input type="checkbox"/>	Birds	<i>Oreothlypis virginiae</i>	Virginia's warbler	<input checked="" type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input checked="" type="checkbox"/>	Insects	<i>Coloradia luski</i>	Lusk's pinemoth	<input type="checkbox"/>
Mammals	<i>Gulo gulo</i>	Wolverine	<input type="checkbox"/>	Insects	<i>Agapema homogena</i>	Rocky Mountain agapema	<input type="checkbox"/>
Plants	<i>Ipomopsis ramosa</i>	Coral ipomopsis	<input type="checkbox"/>	Insects	<i>Pyrgus xanthus</i>	Xanthus skipper	<input type="checkbox"/>
Plants	<i>Hackelia gracilentia</i>	Mesa Verde stickseed	<input type="checkbox"/>	Mammals	<i>Idionycteris phyllotis</i>	Allen's big-eared bat	<input type="checkbox"/>
				Mammals	<i>Sorex nanus</i>	Dwarf shrew	<input checked="" type="checkbox"/>
				Mammals	<i>Canis lupus</i>	Gray wolf	<input checked="" type="checkbox"/>
				Mammals	<i>Ursus arctos</i>	Grizzly bear	<input checked="" type="checkbox"/>
				Mammals	<i>Lasiurus cinereus</i>	Hoary bat	<input checked="" type="checkbox"/>
				Mammals	<i>Clethrionomys gapperi</i>	Red-backed vole	<input checked="" type="checkbox"/>
				Plants	<i>Astragalus sparsiflorus</i>	Front Range milkvetch	<input checked="" type="checkbox"/>
				Plants	<i>Telesonix jamesii</i>	James telesonix	<input type="checkbox"/>
				Plants	<i>Botrychium lineare</i>	Narrowleaf grape fern	<input type="checkbox"/>
				Plants	<i>Ipomopsis aggregata ssp. weberi</i>	Rabbit Ears gilia	<input checked="" type="checkbox"/>
				Plants	<i>Draba smithii</i>	Smith whitlow-grass	<input type="checkbox"/>
				Plants	<i>Astragalus iodopetalus</i>	Violet milkvetch	<input type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input checked="" type="checkbox"/>	Amphibians	<i>Spea intermontana</i>	Great Basin spadefoot	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input checked="" type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input checked="" type="checkbox"/>
Mammals	<i>Euderma maculatum</i>	Spotted bat	<input type="checkbox"/>	Birds	<i>Aegolius funereus</i>	Boreal owl	<input type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input checked="" type="checkbox"/>	Birds	<i>Peucaea cassinii</i>	Cassin's finch	<input checked="" type="checkbox"/>
Plants	<i>Lygodesmia doloresensis</i>	Dolores River skeletonplant	<input checked="" type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
Plants	<i>Boechnera glareosa</i>	Dorn's rockcress	<input type="checkbox"/>	Birds	<i>Vireo vicinior</i>	Gray vireo	<input checked="" type="checkbox"/>
Plants	<i>Pediocactus knowltonii</i>	Knowlton cactus	<input checked="" type="checkbox"/>	Birds	<i>Baeolophus ridgwayi</i>	Juniper titmouse	<input checked="" type="checkbox"/>
Plants	<i>Astragalus humillimus</i>	Mancos milkvetch	<input type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input checked="" type="checkbox"/>
Plants	<i>Hackelia gracilentia</i>	Mesa Verde stickseed	<input checked="" type="checkbox"/>	Birds	<i>Melanerpes lewis</i>	Lewis's woodpecker	<input checked="" type="checkbox"/>
Plants	<i>Astragalus schmollii</i>	Schmoll milkvetch	<input checked="" type="checkbox"/>	Birds	<i>Strix occidentalis lucida</i>	Mexican spotted owl	<input checked="" type="checkbox"/>
Plants	<i>Penstemon scariosus var. albifluvis</i>	White River penstemon	<input type="checkbox"/>	Birds	<i>Accipiter gentilis</i>	Northern goshawk	<input checked="" type="checkbox"/>
				Birds	<i>Contopus cooperi</i>	Olive-sided flycatcher	<input checked="" type="checkbox"/>
				Birds	<i>Gymnorhinus cyanocephalus</i>	Pinyon jay	<input checked="" type="checkbox"/>
				Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
				Birds	<i>Oreothlypis virginiae</i>	Virginia's warbler	<input checked="" type="checkbox"/>
				Insects	<i>Callophrys comstocki</i>	Comstock's hairstreak	<input checked="" type="checkbox"/>
				Insects	<i>Incisalia fotis</i>	Early elfin	<input type="checkbox"/>
				Insects	<i>Callophrys mossii schryveri</i>	Moss's elfin	<input checked="" type="checkbox"/>
				Insects	<i>Euphilotes spaldingi</i>	Spalding's blue	<input checked="" type="checkbox"/>
				Insects	<i>Pyrgus xanthus</i>	Xanthus skipper	<input type="checkbox"/>
				Mammals	<i>Idionycteris phyllotis</i>	Allen's big-eared bat	<input checked="" type="checkbox"/>
				Mammals	<i>Nyctinomops macrotis</i>	Big free-tailed bat	<input checked="" type="checkbox"/>
				Mammals	<i>Thomomys bottae rubidus</i>	Botta's pocket gopher (rubidus ssp)	<input type="checkbox"/>
				Mammals	<i>Conepatus leuconotus</i>	Common hog-nosed skunk	<input checked="" type="checkbox"/>
				Mammals	<i>Sorex nanus</i>	Dwarf shrew	<input type="checkbox"/>
				Mammals	<i>Canis lupus</i>	Gray wolf	<input checked="" type="checkbox"/>
				Mammals	<i>Lasiurus cinereus</i>	Hoary bat	<input checked="" type="checkbox"/>
				Plants	<i>Lepidium crenatum</i>	Alkaline pepperwort	<input checked="" type="checkbox"/>
				Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	<input checked="" type="checkbox"/>
				Plants	<i>Herrickia horrida</i>	Canadian River spiny aster	<input checked="" type="checkbox"/>
				Plants	<i>Astragalus debequaeus</i>	DeBeque milkvetch	<input checked="" type="checkbox"/>
				Plants	<i>Penstemon degeneri</i>	Degener beardtongue	<input checked="" type="checkbox"/>
				Plants	<i>Camissonia eastwoodiae</i>	Eastwood evening primrose	<input type="checkbox"/>
				Plants	<i>Astragalus piscator</i>	Fisher Towers milkvetch	<input checked="" type="checkbox"/>
				Plants	<i>Penstemon fremontii var. glabrescens</i>	Fremont's beardtongue	<input checked="" type="checkbox"/>
				Plants	<i>Nuttallia chrysantha</i>	Golden blazing star	<input type="checkbox"/>
				Plants	<i>Physaria vicina</i>	Good-neighbor bladderpod	<input checked="" type="checkbox"/>
				Plants	<i>Penstemon grahamii</i>	Graham beardtongue	<input type="checkbox"/>
				Plants	<i>Astragalus equisolensis</i>	Horseshoe milkvetch	<input checked="" type="checkbox"/>
				Plants	<i>Thelypodopsis juniperorum</i>	Juniper tumble mustard	<input checked="" type="checkbox"/>
				Plants	<i>Aletes maddougallii ssp. brevibradiatus</i>	Mesa Verde aletes	<input type="checkbox"/>
				Plants	<i>Astragalus naturitensis</i>	Naturita milkvetch	<input type="checkbox"/>
				Plants	<i>Oreocarya osterhoutii</i>	Osterhout cat's-eye	<input type="checkbox"/>

Table 8 - Continued.

Plants	<i>Lupinus crassus</i>	Payson lupine	<input checked="" type="checkbox"/>
Plants	<i>Penstemon scariosus</i> <i>var. cyanomontanus</i>	Plateau penstemon	<input checked="" type="checkbox"/>
Plants	<i>Astragalus rafaensis</i>	San Rafael milkvetch	<input checked="" type="checkbox"/>
Reptiles	<i>Thamnophis cyrtopsis</i>	Blacknecked gartersnake	<input type="checkbox"/>
Reptiles	<i>Hypsiglena</i> <i>chlorophaea</i>	Desert nightsnake	<input checked="" type="checkbox"/>
Reptiles	<i>Gambelia wislizenii</i>	Long-nosed leopard lizard	<input checked="" type="checkbox"/>
Reptiles	<i>Crotalus oregonus</i> <i>concolor</i>	Midget faded rattlesnake	<input checked="" type="checkbox"/>
Reptiles	<i>Rena dissectus</i>	New Mexico threadsnake	<input checked="" type="checkbox"/>
Reptiles	<i>Phrynosoma</i> <i>modestum</i>	Round-tailed horned lizard	<input checked="" type="checkbox"/>
Reptiles	<i>Tantilla horbartsmithi</i>	Smith's black-headed snake	<input checked="" type="checkbox"/>
Reptiles	<i>Lampropeltis</i> <i>triangulum taylori</i>	Utah milksnake	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input checked="" type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input checked="" type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input checked="" type="checkbox"/>	Birds	<i>Aegolius funereus</i>	Boreal owl	<input type="checkbox"/>
Mammals	<i>Euderma maculatum</i>	Spotted bat	<input type="checkbox"/>	Birds	<i>Peucaea cassinii</i>	Cassin's finch	<input checked="" type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input checked="" type="checkbox"/>	Birds	<i>Otus flammeolus</i>	Flammulated owl	<input checked="" type="checkbox"/>
Plants	<i>Boechea glareosa</i>	Dorn's rockcress	<input type="checkbox"/>	Birds	<i>Setophaga graciae</i>	Grace's warbler	<input checked="" type="checkbox"/>
Plants	<i>Ipomopsis polyantha</i>	Pagosa skyrocket	<input type="checkbox"/>	Birds	<i>Melanerpes lewis</i>	Lewis's woodpecker	<input checked="" type="checkbox"/>
				Birds	<i>Strix occidentalis lucida</i>	Mexican spotted owl	<input checked="" type="checkbox"/>
				Birds	<i>Accipiter gentilis</i>	Northern goshawk	<input checked="" type="checkbox"/>
				Birds	<i>Contopus cooperi</i>	Olive-sided flycatcher	<input checked="" type="checkbox"/>
				Birds	<i>Gymnorhinus cyanocephalus</i>	Pinyon jay	<input checked="" type="checkbox"/>
				Birds	<i>Oreothlypis virginiae</i>	Virginia's warbler	<input checked="" type="checkbox"/>
				Insects	<i>Incisalia fotis</i>	Early elfin	<input checked="" type="checkbox"/>
				Insects	<i>Coloradia luski</i>	Lusk's pinemoth	<input checked="" type="checkbox"/>
				Insects	<i>Callophrys mossii schryveri</i>	Moss's elfin	<input checked="" type="checkbox"/>
				Insects	<i>Hesperia leonardus montana</i>	Pawnee montane skipper	<input checked="" type="checkbox"/>
				Insects	<i>Agapema homogena</i>	Rocky Mountain agapema	<input type="checkbox"/>
				Insects	<i>Euphilotes spaldingi</i>	Spalding's blue	<input type="checkbox"/>
				Insects	<i>Pyrgus xanthus</i>	Xanthus skipper	<input type="checkbox"/>
				Mammals	<i>Sciurus aberti</i>	Abert's squirrel	<input checked="" type="checkbox"/>
				Mammals	<i>Idionycteris phyllotis</i>	Allen's big-eared bat	<input checked="" type="checkbox"/>
				Mammals	<i>Sorex nanus</i>	Dwarf shrew	<input checked="" type="checkbox"/>
				Mammals	<i>Canis lupus</i>	Gray wolf	<input checked="" type="checkbox"/>
				Mammals	<i>Ursus arctos</i>	Grizzly bear	<input checked="" type="checkbox"/>
				Mammals	<i>Lasiurus cinereus</i>	Hoary bat	<input checked="" type="checkbox"/>
				Plants	<i>Aletes humilis</i>	Larimer aletes	<input type="checkbox"/>
				Plants	<i>Astragalus missouriensis var. humistratus</i>	Missouri milkvetch	<input type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Anaxyrus boreas boreas</i>	Boreal toad (Southern Rocky Mountain Population)	<input type="checkbox"/>	Amphibians	<i>Lithobates sylvatica</i>	Wood frog	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input type="checkbox"/>
Mammals	<i>Ochotona princeps</i>	American pika	<input type="checkbox"/>	Birds	<i>Aegolius funereus</i>	Boreal owl	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Birds	<i>Peucaea cassinii</i>	Cassin's finch	<input checked="" type="checkbox"/>
Mammals	<i>Lynx canadensis</i>	Lynx	<input checked="" type="checkbox"/>	Birds	<i>Otus flammeolus</i>	Flammulated owl	<input type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>	Birds	<i>Contopus cooperi</i>	Olive-sided flycatcher	<input checked="" type="checkbox"/>
Plants	<i>Ipomopsis ramosa</i>	Coral ipomopsis	<input checked="" type="checkbox"/>	Mammals	<i>Martes americana</i>	American marten	<input checked="" type="checkbox"/>
Plants	<i>Physaria scrotiformis</i>	West Silver bladderpod	<input type="checkbox"/>	Mammals	<i>Sorex nanus</i>	Dwarf shrew	<input checked="" type="checkbox"/>
Plants	<i>Draba malpighiacea</i>	Whitlow-grass	<input type="checkbox"/>	Mammals	<i>Canis lupus</i>	Gray wolf	<input checked="" type="checkbox"/>
				Mammals	<i>Ursus arctos</i>	Grizzly bear	<input checked="" type="checkbox"/>
				Mammals	<i>Lasiurus cinereus</i>	Hoary bat	<input checked="" type="checkbox"/>
				Mammals	<i>Sorex hoyi montanus</i>	Pygmy shrew	<input checked="" type="checkbox"/>
				Mammals	<i>Lepus americanus</i>	Snowshoe hare	<input checked="" type="checkbox"/>
				Plants	<i>Townsendia rothrockii</i>	Rothrock townsend-daisy	<input type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input type="checkbox"/>
Mammals	<i>Gulo gulo</i>	Wolverine	<input type="checkbox"/>	Birds	<i>Aegolius funereus</i>	Boreal owl	<input type="checkbox"/>
				Birds	<i>Peucaea cassinii</i>	Cassin's finch	<input checked="" type="checkbox"/>
				Birds	<i>Otus flammeolus</i>	Flammulated owl	<input type="checkbox"/>
				Birds	<i>Contopus cooperi</i>	Olive-sided flycatcher	<input checked="" type="checkbox"/>
				Birds	<i>Gymnorhinus cyanocephalus</i>	Pinyon jay	<input checked="" type="checkbox"/>
				Birds	<i>Oreothlypis virginiae</i>	Virginia's warbler	<input type="checkbox"/>
				Mammals	<i>Sorex nanus</i>	Dwarf shrew	<input type="checkbox"/>
				Mammals	<i>Canis lupus</i>	Gray wolf	<input type="checkbox"/>
				Mammals	<i>Ursus arctos</i>	Grizzly bear	<input type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Leucosticte australis</i>	Brown-capped rosy-finch	<input type="checkbox"/>	Amphibians	<i>Spea intermontana</i>	Great Basin spadefoot	<input checked="" type="checkbox"/>
Birds	<i>Athene cunicularia</i>	Burrowing owl	<input checked="" type="checkbox"/>	Birds	<i>Spizella breweri</i>	Brewer's sparrow	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
Birds	<i>Charadrius montanus</i>	Mountain plover	<input type="checkbox"/>	Birds	<i>Calamospiza melanocorys</i>	Lark bunting	<input checked="" type="checkbox"/>
Mammals	<i>Mustela nigripes</i>	Black-footed ferret	<input type="checkbox"/>	Birds	<i>Lanius ludovicianus</i>	Loggerhead shrike	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Birds	<i>Circus cyaneus</i>	Northern harrier	<input type="checkbox"/>
Mammals	<i>Cynomys gunnisoni</i>	Gunnison's prairie dog	<input checked="" type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
Mammals	<i>Euderma maculatum</i>	Spotted bat	<input type="checkbox"/>	Insects	<i>Hemileuca neumoegei</i>	A buckmoth	<input checked="" type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>	Insects	<i>Callophrys comstocki</i>	Comstock's hairstreak	<input checked="" type="checkbox"/>
Mammals	<i>Cynomys leucurus</i>	White-tailed prairie dog	<input checked="" type="checkbox"/>	Insects	<i>Euphilotes rita emmeli</i>	Desert buckwheat blue	<input checked="" type="checkbox"/>
				Insects	<i>Incisalia fotis</i>	Early elfin	<input type="checkbox"/>
				Insects	<i>Bombus morrisoni</i>	Morrison bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
				Mammals	<i>Nyctinomops macrotis</i>	Big free-tailed bat	<input checked="" type="checkbox"/>
				Mammals	<i>Conepatus leuconotus</i>	Common hog-nosed skunk	<input type="checkbox"/>
				Mammals	<i>Vulpes macrotis</i>	Kit fox	<input checked="" type="checkbox"/>
				Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input type="checkbox"/>
				Reptiles	<i>Thamnophis cyrtopsis</i>	Blacknecked gartersnake	<input type="checkbox"/>
				Reptiles	<i>Lampropeltis californiae</i>	California kingsnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Hypsiglena chlorophaea</i>	Desert nightsnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Sceloporus magister</i>	Desert spiny lizard	<input checked="" type="checkbox"/>
				Reptiles	<i>Gambelia wislizenii</i>	Long-nosed leopard lizard	<input checked="" type="checkbox"/>
				Reptiles	<i>Crotalus oreganus concolor</i>	Midget faded rattlesnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Tantilla horbartsmithi</i>	Smith's black-headed snake	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Spizella breweri</i>	Brewer's sparrow	<input type="checkbox"/>
Mammals	<i>Cynomys gunnisoni</i>	Gunnison's prairie dog	<input type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
Reptiles	<i>Aspidoscelis neotesselata</i>	Colorado checkered whiptail	<input checked="" type="checkbox"/>	Birds	<i>Lanius ludovicianus</i>	Loggerhead shrike	<input checked="" type="checkbox"/>
				Birds	<i>Circus cyaneus</i>	Northern harrier	<input type="checkbox"/>
				Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
				Birds	<i>Amphispiza belli</i>	Sage sparrow	<input checked="" type="checkbox"/>
				Mammals	<i>Conepatus leuconotus</i>	Common hog-nosed skunk	<input type="checkbox"/>
				Mammals	<i>Vulpes macrotis</i>	Kit fox	<input checked="" type="checkbox"/>
				Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input type="checkbox"/>
				Plants	<i>Lepidium crenatum</i>	Alkaline pepperwort	<input type="checkbox"/>
				Reptiles	<i>Hypsiglena chlorophaea</i>	Desert nightsnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Gambelia wislizenii</i>	Long-nosed leopard lizard	<input checked="" type="checkbox"/>
				Reptiles	<i>Crotalus oreganus concolor</i>	Midget faded rattlesnake	<input type="checkbox"/>
				Reptiles	<i>Tantilla horbartsmithi</i>	Smith's black-headed snake	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	<input checked="" type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input checked="" type="checkbox"/>	Birds	<i>Setophaga graciae</i>	Grace's warbler	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input checked="" type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input checked="" type="checkbox"/>
Mammals	<i>Cynomys gunnisoni</i>	Gunnison's prairie dog	<input type="checkbox"/>	Birds	<i>Selasphorus rufus</i>	Rufous hummingbird	<input checked="" type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>	Birds	<i>Oreothlypis virginiae</i>	Virginia's warbler	<input checked="" type="checkbox"/>
				Insects	<i>Incisalia fotis</i>	Early elfin	<input checked="" type="checkbox"/>
				Insects	<i>Bombus morrisoni</i>	Morrison bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Eurystrymon favonius ontario</i>	Northern hairstreak	<input checked="" type="checkbox"/>
				Insects	<i>Anisota oslari</i>	Oslar's oakworm moth	<input checked="" type="checkbox"/>
				Insects	<i>Hesperia ottoe</i>	Ottoe skipper	<input type="checkbox"/>
				Insects	<i>Euphilotes spaldingi</i>	Spalding's blue	<input type="checkbox"/>
				Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
				Mammals	<i>Idionycteris phyllotis</i>	Allen's big-eared bat	<input checked="" type="checkbox"/>
				Mammals	<i>Conepatus leuconotus</i>	Common hog-nosed skunk	<input type="checkbox"/>
				Mammals	<i>Canis lupus</i>	Gray wolf	<input checked="" type="checkbox"/>
				Mammals	<i>Ursus arctos</i>	Grizzly bear	<input checked="" type="checkbox"/>
				Mammals	<i>Sorex preblei</i>	Preble's shrew	<input checked="" type="checkbox"/>
				Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input type="checkbox"/>
				Plants	<i>Penstemon mensarum</i>	Grand Mesa penstemon	<input type="checkbox"/>
				Plants	<i>Astragalus missouriensis</i> var. <i>humistratus</i>	Missouri milkvetch	<input checked="" type="checkbox"/>
				Reptiles	<i>Thamnophis cyrtopsis</i>	Blacknecked gartersnake	<input type="checkbox"/>
				Reptiles	<i>Lampropeltis triangulum taylori</i>	Utah milksnake	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Leucosticte australis</i>	Brown-capped rosy-finch	<input type="checkbox"/>	Amphibians	<i>Spea intermontana</i>	Great Basin spadefoot	<input checked="" type="checkbox"/>
Birds	<i>Athene cunicularia</i>	Burrowing owl	<input type="checkbox"/>	Birds	<i>Leucosticte atrata</i>	Black rosy-finch	<input type="checkbox"/>
Birds	<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	<input checked="" type="checkbox"/>	Birds	<i>Spizella breweri</i>	Brewer's sparrow	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input checked="" type="checkbox"/>	Birds	<i>Aimophila cassinii</i>	Cassin's sparrow	<input type="checkbox"/>
Birds	<i>Centrocercus urophasianus</i>	Greater sage-grouse	<input checked="" type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
Birds	<i>Centrocercus minimus</i>	Gunnison sage-grouse	<input checked="" type="checkbox"/>	Birds	<i>Calamospiza melanocorys</i>	Lark bunting	<input type="checkbox"/>
Mammals	<i>Mustela nigripes</i>	Black-footed ferret	<input type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Birds	<i>Lanius ludovicianus</i>	Loggerhead shrike	<input checked="" type="checkbox"/>
Mammals	<i>Cynomys gunnisoni</i>	Gunnison's prairie dog	<input checked="" type="checkbox"/>	Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>	Birds	<i>Amphispiza belli</i>	Sage sparrow	<input checked="" type="checkbox"/>
Mammals	<i>Cynomys leucurus</i>	White-tailed prairie dog	<input checked="" type="checkbox"/>	Birds	<i>Asio flammeus</i>	Short-eared owl	<input checked="" type="checkbox"/>
Plants	<i>Eriogonum brandegeei</i>	Brandegee wild buckwheat	<input type="checkbox"/>	Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
Plants	<i>Physaria pulvinata</i>	Cushion bladderpod	<input checked="" type="checkbox"/>	Insects	<i>Callophrys comstocki</i>	Comstock's hairstreak	<input type="checkbox"/>
Plants	<i>Boechera glareosa</i>	Dorn's rockcress	<input type="checkbox"/>	Insects	<i>Bombus morrisoni</i>	Morrison bumblebee	<input checked="" type="checkbox"/>
Plants	<i>Lepidium huberi</i>	Huber's pepperwort	<input checked="" type="checkbox"/>	Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
Plants	<i>Astragalus osterhoutii</i>	Kremmling milkvetch	<input checked="" type="checkbox"/>	Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
Plants	<i>Gutierrezia elegans</i>	Lone Mesa snakeweed	<input checked="" type="checkbox"/>	Mammals	<i>Idionycteris phyllotis</i>	Allen's big-eared bat	<input type="checkbox"/>
Plants	<i>Penstemon penlandii</i>	Penland penstemon	<input checked="" type="checkbox"/>	Mammals	<i>Canis lupus</i>	Gray wolf	<input type="checkbox"/>
Plants	<i>Physaria rollinsii</i>	Rollins twinpod	<input checked="" type="checkbox"/>	Mammals	<i>Vulpes macrotis</i>	Kit fox	<input checked="" type="checkbox"/>
Plants	<i>Astragalus microcymbus</i>	Skiff milkvetch	<input checked="" type="checkbox"/>	Mammals	<i>Sorex preblei</i>	Preble's shrew	<input type="checkbox"/>
Plants	<i>Phacelia gina-glenneae</i>	Troublesome phacelia	<input checked="" type="checkbox"/>	Mammals	<i>Brachylagus idahoensis</i>	Pygmy rabbit	<input checked="" type="checkbox"/>
				Mammals	<i>Lemmyscus curtatus</i>	Sagebrush vole	<input checked="" type="checkbox"/>
				Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input type="checkbox"/>
				Plants	<i>Cirsium perplexans</i>	Adobe thistle	<input checked="" type="checkbox"/>
				Plants	<i>Lepidium crenatum</i>	Alkaline pepperwort	<input type="checkbox"/>
				Plants	<i>Oxytropis besseyi</i> var. <i>obnapiformis</i>	Bessey locoweed	<input checked="" type="checkbox"/>
				Plants	<i>Lomatium concinnum</i>	Colorado desert-parsley	<input checked="" type="checkbox"/>
				Plants	<i>Boechera crandallii</i>	Crandall's rock-cress	<input checked="" type="checkbox"/>
				Plants	<i>Penstemon fremontii</i> var. <i>glabrescens</i>	Fremont's beardtongue	<input type="checkbox"/>
				Plants	<i>Astragalus anisus</i>	Gunnison milkvetch	<input checked="" type="checkbox"/>
				Plants	<i>Thelypodopsis juniperorum</i>	Juniper tumble mustard	<input type="checkbox"/>
				Plants	<i>Oenothera acutissima</i>	Narrow-leaf evening primrose	<input checked="" type="checkbox"/>
				Plants	<i>Astragalus naturitensis</i>	Naturita milkvetch	<input type="checkbox"/>
				Plants	<i>Penstemon scariosus</i> var. <i>cyanomontanus</i>	Plateau penstemon	<input type="checkbox"/>
				Plants	<i>Mertensia humilis</i>	Rocky Mountain bluebells	<input checked="" type="checkbox"/>
				Plants	<i>Astragalus iodopetalus</i>	Violet milkvetch	<input checked="" type="checkbox"/>
				Plants	<i>Penstemon acaulis</i> var. <i>yampaensis</i>	Yampa beardtongue	<input checked="" type="checkbox"/>
				Reptiles	<i>Hypsiglena chlorophaea</i>	Desert nightsnake	<input type="checkbox"/>
				Reptiles	<i>Gambelia wislizenii</i>	Long-nosed leopard lizard	<input checked="" type="checkbox"/>
				Reptiles	<i>Rhinocheilus lecontei</i>	Long-nosed snake	<input type="checkbox"/>
				Reptiles	<i>Crotalus oreganus concolor</i>	Midget faded rattlesnake	<input type="checkbox"/>
				Reptiles	<i>Tantilla horbartsmithi</i>	Smith's black-headed snake	<input checked="" type="checkbox"/>

**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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Leucosticte australis</i>	Brown-capped rosy-finch	<input type="checkbox"/>	Birds	<i>Spizella breweri</i>	Brewer's sparrow	<input type="checkbox"/>
Birds	<i>Athene cunicularia</i>	Burrowing owl	<input type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Lanius ludovicianus</i>	Loggerhead shrike	<input checked="" type="checkbox"/>
Birds	<i>Charadrius montanus</i>	Mountain plover	<input type="checkbox"/>	Birds	<i>Circus cyaneus</i>	Northern harrier	<input type="checkbox"/>
Plants	<i>Aletes latilobus</i>	Canyonlands aletes	<input type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Plants	<i>Eriogonum pelinophilum</i>	Clay-loving wild buckwheat	<input checked="" type="checkbox"/>	Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
Plants	<i>Sclerocactus glaucus</i>	Colorado hookless cactus	<input checked="" type="checkbox"/>	Mammals	<i>Conepatus leuconotus</i>	Common hog-nosed skunk	<input type="checkbox"/>
Plants	<i>Lygodesmia doloresensis</i>	Dolores River skeletonplant	<input type="checkbox"/>	Mammals	<i>Vulpes macrotis</i>	Kit fox	<input checked="" type="checkbox"/>
Plants	<i>Sclerocactus mesae-verdae</i>	Mesa Verde hookless cactus	<input type="checkbox"/>	Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input type="checkbox"/>
Plants	<i>Astragalus tortipes</i>	Sleeping Ute milkvetch	<input checked="" type="checkbox"/>	Plants	<i>Cirsium perplexans</i>	Adobe thistle	<input type="checkbox"/>
Plants	<i>Penstemon scariosus var. albifluvis</i>	White River penstemon	<input type="checkbox"/>	Plants	<i>Calochortus ciscoensis</i>	Cisco sego lily	<input checked="" type="checkbox"/>
				Plants	<i>Eriogonum clavellatum</i>	Comb Wash buckwheat	<input checked="" type="checkbox"/>
				Plants	<i>Astragalus cronquistii</i>	Cronquist milkvetch	<input checked="" type="checkbox"/>
				Plants	<i>Astragalus debequaeus</i>	DeBeque milkvetch	<input type="checkbox"/>
				Plants	<i>Camissonia eastwoodiae</i>	Eastwood evening primrose	<input checked="" type="checkbox"/>
				Plants	<i>Astragalus piscator</i>	Fisher Towers milkvetch	<input type="checkbox"/>
				Plants	<i>Oreocarya revealii</i>	Gypsum Valley cat's-eye	<input checked="" type="checkbox"/>
				Plants	<i>Oreocarya osterhoutii</i>	Osterhout cat's-eye	<input type="checkbox"/>
				Plants	<i>Mentzelia paradoxensis</i>	Paradox stickleaf	<input checked="" type="checkbox"/>
				Reptiles	<i>Gambelia wislizenii</i>	Long-nosed leopard lizard	<input checked="" type="checkbox"/>
				Reptiles	<i>Crotalus oreganus concolor</i>	Midget faded rattlesnake	<input type="checkbox"/>
				Reptiles	<i>Tantilla horbartsmithi</i>	Smith's black-headed snake	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Athene cunicularia</i>	Burrowing owl	<input checked="" type="checkbox"/>	Birds	<i>Spizella breweri</i>	Brewer's sparrow	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Aimophila cassinii</i>	Cassin's sparrow	<input checked="" type="checkbox"/>
Birds	<i>Tympanuchus pallidicinctus</i>	Lesser prairie-chicken	<input checked="" type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
Birds	<i>Tympanuchus phasianellus jamesi</i>	Plains sharp-tailed grouse	<input checked="" type="checkbox"/>	Birds	<i>Tympanuchus cupido</i>	Greater prairie-chicken	<input checked="" type="checkbox"/>
				Birds	<i>Lanius ludovicianus</i>	Loggerhead shrike	<input checked="" type="checkbox"/>
				Birds	<i>Numenius americanus</i>	Long-billed curlew	<input type="checkbox"/>
				Birds	<i>Colinus virginianus</i>	Northern bobwhite	<input checked="" type="checkbox"/>
				Birds	<i>Circus cyaneus</i>	Northern harrier	<input type="checkbox"/>
				Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
				Birds	<i>Asio flammeus</i>	Short-eared owl	<input checked="" type="checkbox"/>
				Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
				Birds	<i>Bartramia longicauda</i>	Upland sandpiper	<input type="checkbox"/>
				Mammals	<i>Conepatus leuconotus</i>	Common hog-nosed skunk	<input type="checkbox"/>
				Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input type="checkbox"/>
				Reptiles	<i>Rhinocheilus lecontei</i>	Long-nosed snake	<input checked="" type="checkbox"/>
				Reptiles	<i>Lampropeltis triangulum taylori</i>	Utah milksnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Kinosternon flavescens</i>	Yellow mud turtle	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Leucosticte australis</i>	Brown-capped rosy-finch	<input type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input type="checkbox"/>
Birds	<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	<input type="checkbox"/>	Birds	<i>Aimophila cassinii</i>	Cassin's sparrow	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input checked="" type="checkbox"/>
Mammals	<i>Euderma maculatum</i>	Spotted bat	<input type="checkbox"/>	Birds	<i>Selasphorus rufus</i>	Rufous hummingbird	<input checked="" type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>	Birds	<i>Asio flammeus</i>	Short-eared owl	<input checked="" type="checkbox"/>
				Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
				Birds	<i>Oreothlypis virginiae</i>	Virginia's warbler	<input checked="" type="checkbox"/>
				Insects	<i>Incisalia fotis</i>	Early elfin	<input checked="" type="checkbox"/>
				Insects	<i>Bombus morrisoni</i>	Morrison bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Callophrys mossii schryveri</i>	Moss's elfin	<input checked="" type="checkbox"/>
				Insects	<i>Erynnis martialis</i>	Mottled duskywing	<input checked="" type="checkbox"/>
				Insects	<i>Agapema homogena</i>	Rocky Mountain agapema	<input checked="" type="checkbox"/>
				Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
				Mammals	<i>Conepatus leuconotus</i>	Common hog-nosed skunk	<input checked="" type="checkbox"/>
				Mammals	<i>Canis lupus</i>	Gray wolf	<input checked="" type="checkbox"/>
				Mammals	<i>Ursus arctos</i>	Grizzly bear	<input checked="" type="checkbox"/>
				Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input type="checkbox"/>
				Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	<input type="checkbox"/>
				Plants	<i>Draba smithii</i>	Smith whitlow-grass	<input type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	<input type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input checked="" type="checkbox"/>	Birds	<i>Dolichonyx oryzivorus</i>	Bobolink	<input checked="" type="checkbox"/>
Birds	<i>Grus canadensis tabida</i>	Greater sandhill crane	<input type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input checked="" type="checkbox"/>
Birds	<i>Charadrius montanus</i>	Mountain plover	<input type="checkbox"/>	Birds	<i>Calamospiza melanocorys</i>	Lark bunting	<input type="checkbox"/>
Mammals	<i>Mustela nigripes</i>	Black-footed ferret	<input type="checkbox"/>	Birds	<i>Lanius ludovicianus</i>	Loggerhead shrike	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
Mammals	<i>Cynomys gunnisoni</i>	Gunnison's prairie dog	<input checked="" type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input checked="" type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Selasphorus rufus</i>	Rufous hummingbird	<input checked="" type="checkbox"/>
Mammals	<i>Perognathus fasciatus</i>	Olive-backed pocket mouse	<input checked="" type="checkbox"/>	Birds	<i>Asio flammeus</i>	Short-eared owl	<input checked="" type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>	Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
Mammals	<i>Cynomys leucurus</i>	White-tailed prairie dog	<input checked="" type="checkbox"/>	Insects	<i>Bombus pensylvanicus</i>	American bumblebee	<input checked="" type="checkbox"/>
Plants	<i>Ipomopsis polyantha</i>	Pagosa skyrocket	<input checked="" type="checkbox"/>	Insects	<i>Atrytone arogos</i>	Arogos skipper	<input checked="" type="checkbox"/>
				Insects	<i>Euphilotes rita coloradensis</i>	Colorado blue	<input checked="" type="checkbox"/>
				Insects	<i>Bombus morrisoni</i>	Morrison bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Erynnis martialis</i>	Mottled duskywing	<input type="checkbox"/>
				Insects	<i>Hesperia leonardus montana</i>	Pawnee montane skipper	<input type="checkbox"/>
				Insects	<i>Speyeria idalia</i>	Regal fritillary	<input type="checkbox"/>
				Insects	<i>Polites rhesus</i>	Rhesus skipper	<input type="checkbox"/>
				Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Pyrgus xanthus</i>	Xanthus skipper	<input checked="" type="checkbox"/>
				Insects	<i>Bombus fervidus</i>	Yellow bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Proserpinus flavofasciata</i>	Yellow-banded day sphinx	<input checked="" type="checkbox"/>
				Mammals	<i>Ovis canadensis</i>	Bighorn sheep	<input type="checkbox"/>
				Mammals	<i>Bison bison</i>	Bison	<input checked="" type="checkbox"/>
				Mammals	<i>Thomomys bottae rubidus</i>	Botta's pocket gopher (rubidus ssp)	<input checked="" type="checkbox"/>
				Mammals	<i>Conepatus leuconotus</i>	Common hog-nosed skunk	<input type="checkbox"/>
				Mammals	<i>Canis lupus</i>	Gray wolf	<input type="checkbox"/>
				Mammals	<i>Ursus arctos</i>	Grizzly bear	<input checked="" type="checkbox"/>
				Mammals	<i>Sorex preblei</i>	Preble's shrew	<input type="checkbox"/>
				Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input checked="" type="checkbox"/>
				Plants	<i>Eriogonum coloradense</i>	Colorado wild buckwheat	<input type="checkbox"/>
				Plants	<i>Penstemon degeneri</i>	Degener beardtongue	<input type="checkbox"/>
				Plants	<i>Penstemon mensarum</i>	Grand Mesa penstemon	<input type="checkbox"/>
				Plants	<i>Astragalus missouriensis var. humistratus</i>	Missouri milkvetch	<input type="checkbox"/>
				Plants	<i>Botrychium lineare</i>	Narrowleaf grape fern	<input type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Athene cunicularia</i>	Burrowing owl	<input type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input checked="" type="checkbox"/>	Birds	<i>Dolichonyx oryzivorus</i>	Bobolink	<input checked="" type="checkbox"/>
Birds	<i>Tympanuchus pallidicinctus</i>	Lesser prairie-chicken	<input checked="" type="checkbox"/>	Birds	<i>Aimophila cassinii</i>	Cassin's sparrow	<input checked="" type="checkbox"/>
Birds	<i>Charadrius montanus</i>	Mountain plover	<input type="checkbox"/>	Birds	<i>Calcarius ornatus</i>	Chestnut-collared longspur	<input checked="" type="checkbox"/>
Birds	<i>Tympanuchus phasianellus jamesi</i>	Plains sharp-tailed grouse	<input type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input checked="" type="checkbox"/>
Mammals	<i>Mustela nigripes</i>	Black-footed ferret	<input type="checkbox"/>	Birds	<i>Calamospiza melanocorys</i>	Lark bunting	<input checked="" type="checkbox"/>
Mammals	<i>Perognathus fasciatus</i>	Olive-backed pocket mouse	<input checked="" type="checkbox"/>	Birds	<i>Lanius ludovicianus</i>	Loggerhead shrike	<input checked="" type="checkbox"/>
Reptiles	<i>Sistrurus catenatus</i>	Massasauga	<input checked="" type="checkbox"/>	Birds	<i>Numenius americanus</i>	Long-billed curlew	<input type="checkbox"/>
				Birds	<i>Colinus virginianus</i>	Northern bobwhite	<input type="checkbox"/>
				Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
				Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
				Birds	<i>Asio flammeus</i>	Short-eared owl	<input checked="" type="checkbox"/>
				Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
				Birds	<i>Bartramia longicauda</i>	Upland sandpiper	<input checked="" type="checkbox"/>
				Insects	<i>Bombus pennsylvanicus</i>	American bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Atrytone arogos</i>	Arogos skipper	<input type="checkbox"/>
				Insects	<i>Callophrys comstocki</i>	Comstock's hairstreak	<input type="checkbox"/>
				Insects	<i>Bombus morrisoni</i>	Morrison bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Hesperia ottoe</i>	Ottoe skipper	<input checked="" type="checkbox"/>
				Insects	<i>Speyeria idalia</i>	Regal fritillary	<input checked="" type="checkbox"/>
				Insects	<i>Polites rhesus</i>	Rhesus skipper	<input checked="" type="checkbox"/>
				Insects	<i>Bombus fraternus</i>	Southern plains bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus fervidus</i>	Yellow bumblebee	<input checked="" type="checkbox"/>
				Mammals	<i>Cynomys ludovicianus</i>	Black-tailed prairie dog	<input type="checkbox"/>
				Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input checked="" type="checkbox"/>
				Reptiles	<i>Lampropeltis californiae</i>	California kingsnake	<input type="checkbox"/>
				Reptiles	<i>Phrynosoma cornutum</i>	Texas horned lizard	<input checked="" type="checkbox"/>

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, encroachment 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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Athene cunicularia</i>	Burrowing owl	<input checked="" type="checkbox"/>	Amphibians	<i>Scaphiopus couchii</i>	Couch's spadefoot	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input checked="" type="checkbox"/>	Amphibians	<i>Anaxyrus debilis</i>	Green toad	<input type="checkbox"/>
Birds	<i>Charadrius montanus</i>	Mountain plover	<input checked="" type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input type="checkbox"/>
Mammals	<i>Mustela nigripes</i>	Black-footed ferret	<input checked="" type="checkbox"/>	Birds	<i>Aimophila cassinii</i>	Cassin's sparrow	<input checked="" type="checkbox"/>
Mammals	<i>Perognathus fasciatus</i>	Olive-backed pocket mouse	<input checked="" type="checkbox"/>	Birds	<i>Calcarius ornatus</i>	Chestnut-collared longspur	<input checked="" type="checkbox"/>
Reptiles	<i>Aspidoscelis neotesselata</i>	Colorado checkered whiptail	<input type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input checked="" type="checkbox"/>
Reptiles	<i>Sistrurus catenatus</i>	Massasauga	<input checked="" type="checkbox"/>	Birds	<i>Ammodramus savannarum</i>	Grasshopper sparrow	<input checked="" type="checkbox"/>
				Birds	<i>Calamospiza melanocorys</i>	Lark bunting	<input checked="" type="checkbox"/>
				Birds	<i>Lanius ludovicianus</i>	Loggerhead shrike	<input checked="" type="checkbox"/>
				Birds	<i>Numenius americanus</i>	Long-billed curlew	<input checked="" type="checkbox"/>
				Birds	<i>Rhynchophanes mccownii</i>	McCown's longspur	<input checked="" type="checkbox"/>
				Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
				Birds	<i>Falco mexicanus</i>	Prairie falcon	<input checked="" type="checkbox"/>
				Birds	<i>Asio flammeus</i>	Short-eared owl	<input checked="" type="checkbox"/>
				Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
				Insects	<i>Bombus pensylvanicus</i>	American bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Euphilotes rita coloradensis</i>	Colorado blue	<input checked="" type="checkbox"/>
				Insects	<i>Danaus plexippus</i>	Monarch butterfly	<input checked="" type="checkbox"/>
				Insects	<i>Bombus morrisoni</i>	Morrison bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Eurystrymon favonius Ontario</i>	Northern hairstreak	<input type="checkbox"/>
				Insects	<i>Speyeria idalia</i>	Regal fritillary	<input checked="" type="checkbox"/>
				Insects	<i>Polites rhesus</i>	Rhesus skipper	<input checked="" type="checkbox"/>
				Insects	<i>Callophrys mcfarlandi</i>	Sandia hairstreak	<input checked="" type="checkbox"/>
				Insects	<i>Bombus fraternus</i>	Southern plains bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Euphyes bimacula</i>	Two-spotted skipper	<input type="checkbox"/>
				Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Euproserpinus wiesti</i>	Wiest's sphinx moth	<input type="checkbox"/>
				Insects	<i>Bombus fervidus</i>	Yellow bumblebee	<input checked="" type="checkbox"/>
				Mammals	<i>Bison bison</i>	Bison	<input checked="" type="checkbox"/>
				Mammals	<i>Cynomys ludovicianus</i>	Black-tailed prairie dog	<input checked="" type="checkbox"/>
				Mammals	<i>Vulpes velox</i>	Swift fox	<input checked="" type="checkbox"/>
				Mammals	<i>Lepus townsendii</i>	White-tailed jackrabbit	<input checked="" type="checkbox"/>
				Plants	<i>Frasera coloradensis</i>	Colorado green gentian	<input checked="" type="checkbox"/>
				Plants	<i>Asclepias uncialis</i> ssp. <i>uncialis</i>	Dwarf milkweed	<input checked="" type="checkbox"/>
				Plants	<i>Oenopsis puebloensis</i>	Pueblo goldenweed	<input checked="" type="checkbox"/>
				Plants	<i>Oenopsis foliosa</i> var. <i>monocephala</i>	Rayless goldenweed	<input checked="" type="checkbox"/>
				Plants	<i>Trifolium dasyphyllum</i> ssp. <i>anemophilum</i>	Whip-root clover	<input checked="" type="checkbox"/>
				Reptiles	<i>Thamnophis cyrtopsis</i>	Blacknecked gartersnake	<input type="checkbox"/>
				Reptiles	<i>Hypsiglena chlorophaea</i>	Desert nightsnake	<input type="checkbox"/>
				Reptiles	<i>Rhinocheilus lecontei</i>	Long-nosed snake	<input checked="" type="checkbox"/>
				Reptiles	<i>Rena dissectus</i>	New Mexico threadsnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Phrynosoma modestum</i>	Round-tailed horned lizard	<input checked="" type="checkbox"/>
				Reptiles	<i>Phrynosoma cornutum</i>	Texas horned lizard	<input checked="" type="checkbox"/>

Table 8 - Continued.

<div style="border: 1px solid black; padding: 2px; display: inline-block;"> Reptiles     <i>Lampropeltis triangulum taylori</i>     Utah milksnake     <input checked="" type="checkbox"/> </div>				
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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Birds	<i>Charadrius montanus</i>	Mountain plover	<input type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input type="checkbox"/>
Reptiles	<i>Aspidoscelis neotesselata</i>	Colorado checkered whiptail	<input checked="" type="checkbox"/>	Birds	<i>Calamospiza melanocorys</i>	Lark bunting	<input type="checkbox"/>
				Birds	<i>Sterna antillarum</i>	Least tern	<input checked="" type="checkbox"/>
				Birds	<i>Numenius americanus</i>	Long-billed curlew	<input checked="" type="checkbox"/>
				Birds	<i>Rhynchophanes mccownii</i>	McCown's longspur	<input type="checkbox"/>
				Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
				Birds	<i>Charadrius melodus</i>	Piping plover	<input checked="" type="checkbox"/>
				Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
				Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
				Birds	<i>Plegadis chihi</i>	White-faced ibis	<input checked="" type="checkbox"/>
				Plants	<i>Cleome multicaulis</i>	Slender spiderflower	<input type="checkbox"/>
				Reptiles	<i>Lampropeltis californiae</i>	California kingsnake	<input type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Anaxyrus boreas boreas</i>	Boreal toad (Southern Rocky Mountain Population)	☑	Amphibians	<i>Lithobates blairi</i>	Plains leopard frog	☑
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	☑	Amphibians	<i>Lithobates sylvatica</i>	Wood frog	☑
Birds	<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	☐	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	☑
Birds	<i>Lagopus leucura altipetens</i>	Southern white-tailed ptarmigan	☐	Birds	<i>Passerina amoena</i>	Lazuli bunting	☑
Birds	<i>Empidonax traillii extimus</i>	Southwestern willow flycatcher	☑	Birds	<i>Melanerpes lewis</i>	Lewis's woodpecker	☑
Birds	<i>Coccyzus americanus occidentalis</i>	Western yellow-billed cuckoo	☑	Birds	<i>Colinus virginianus</i>	Northern bobwhite	☑
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	☐	Birds	<i>Catharus fuscescens</i>	Veery	☑
Mammals	<i>Zapus hudsonius luteus</i>	New Mexico jumping mouse	☑	Insects	<i>Incisalia fotis</i>	Early elfin	☑
Mammals	<i>Zapus hudsonius preblei</i>	Prebles meadow jumping mouse	☑	Insects	<i>Speyeria nokomis nokomis</i>	Great Basin silverspot butterfly	☑
Plants	<i>Spiranthes diluvialis</i>	Ute ladies'-tresses	☑	Insects	<i>Capnia nelsoni</i>	Nelson's snowfly	☑
				Insects	<i>Bombus fraternus</i>	Southern plains bumblebee	☑
				Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	☑
				Insects	<i>Bombus occidentalis</i>	Western bumblebee	☑
				Mammals	<i>Lasiurus cinereus</i>	Hoary bat	☑
				Mammals	<i>Lepus americanus</i>	Snowshoe hare	☑
				Reptiles	<i>Thamnophis sirtalis</i>	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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Anaxyrus boreas boreas</i>	Boreal toad (Southern Rocky Mountain Population)	<input checked="" type="checkbox"/>	Amphibians	<i>Acris crepitans</i>	Blanchard's cricket frog	<input type="checkbox"/>
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	<input checked="" type="checkbox"/>	Amphibians	<i>Scaphiopus couchii</i>	Couch's spadefoot	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Amphibians	<i>Gastrophryne olivacea</i>	Great Plains narrowmouth toad	<input checked="" type="checkbox"/>
Birds	<i>Grus canadensis tabida</i>	Greater sandhill crane	<input checked="" type="checkbox"/>	Amphibians	<i>Lithobates blairi</i>	Plains leopard frog	<input checked="" type="checkbox"/>
Birds	<i>Lagopus leucura altipetens</i>	Southern white-tailed ptarmigan	<input type="checkbox"/>	Amphibians	<i>Lithobates sylvatica</i>	Wood frog	<input checked="" type="checkbox"/>
Plants	<i>Mimulus gemmiparus</i>	Budding monkey flower	<input type="checkbox"/>	Birds	<i>Botaurus lentiginosus</i>	American bittern	<input checked="" type="checkbox"/>
Plants	<i>Oenothera coloradensis ssp. coloradensis</i>	Colorado butterfly plant	<input checked="" type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Plants	<i>Eutrema penlandii</i>	Penland alpine fen mustard	<input checked="" type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input type="checkbox"/>
				Birds	<i>Bucephala islandica</i>	Barrow's goldeneye	<input checked="" type="checkbox"/>
				Birds	<i>Chlidonias niger</i>	Black tern	<input checked="" type="checkbox"/>
				Birds	<i>Numenius americanus</i>	Long-billed curlew	<input type="checkbox"/>
				Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
				Birds	<i>Charadrius melodus</i>	Piping plover	<input type="checkbox"/>
				Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
				Birds	<i>Asio flammeus</i>	Short-eared owl	<input checked="" type="checkbox"/>
				Birds	<i>Plegadis chihi</i>	White-faced ibis	<input checked="" type="checkbox"/>
				Birds	<i>Grus americana</i>	Whooping crane	<input checked="" type="checkbox"/>
				Insects	<i>Ochrotrichia trapoiza</i>	Caddisfly	<input type="checkbox"/>
				Insects	<i>Epitheca petechialis</i>	Dot-winged baskettail	<input checked="" type="checkbox"/>
				Insects	<i>Speyeria nokomis nokomis</i>	Great Basin silverspot butterfly	<input checked="" type="checkbox"/>
				Insects	<i>Libellula nodisticta</i>	Hoary skimmer	<input checked="" type="checkbox"/>
				Insects	<i>Somatochlora hudsonica</i>	Hudsonian emerald	<input checked="" type="checkbox"/>
				Insects	<i>Danaus plexippus</i>	Monarch butterfly	<input checked="" type="checkbox"/>
				Insects	<i>Capnia nelsoni</i>	Nelson's snowfly	<input type="checkbox"/>
				Insects	<i>Sympetrum madidum</i>	Red-veined meadowfly	<input checked="" type="checkbox"/>
				Insects	<i>Speyeria idalia</i>	Regal fritillary	<input type="checkbox"/>
				Insects	<i>Bombus fraternus</i>	Southern plains bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Ochrotrichia susanae</i>	Susan's purse-making caddisfly	<input checked="" type="checkbox"/>
				Insects	<i>Euphyes bimacula</i>	Two-spotted skipper	<input checked="" type="checkbox"/>
				Insects	<i>Boloria improba acrocneuma</i>	Uncompahgre fritillary	<input type="checkbox"/>
				Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
				Mammals	<i>Sorex hoyi montanus</i>	Pygmy shrew	<input checked="" type="checkbox"/>
				Mammals	<i>Lontra canadensis</i>	River otter	<input type="checkbox"/>
				Mammals	<i>Lepus americanus</i>	Snowshoe hare	<input type="checkbox"/>
				Mollusks	<i>Promenetus umbilicatellus</i>	Cockerell	<input type="checkbox"/>
				Mollusks	<i>Promenetus exacuouus</i>	Sharp sprite	<input type="checkbox"/>
				Plants	<i>Limnorchis zothecina</i>	Alcove bog orchid	<input type="checkbox"/>
				Plants	<i>Anticlea vaginatus</i>	Alcove death camas	<input type="checkbox"/>
				Plants	<i>Salix arizonica</i>	Arizona willow	<input checked="" type="checkbox"/>
				Plants	<i>Oenothera acutissima</i>	Narrow-leaf evening primrose	<input type="checkbox"/>
				Plants	<i>Thelypodium paniculatum</i>	Northwestern thelypod	<input checked="" type="checkbox"/>
				Plants	<i>Puccinellia parishii</i>	Parish's alkali grass	<input checked="" type="checkbox"/>
				Plants	<i>Ptilagrostis porteri</i>	Porter feathergrass	<input checked="" type="checkbox"/>
				Plants	<i>Cleome multicaulis</i>	Slender spiderflower	<input checked="" type="checkbox"/>
				Reptiles	<i>Thamnophis sirtalis</i>	Common gartersnake	<input checked="" type="checkbox"/>

Table 8 - Continued.

<div style="border: 1px solid black; padding: 2px; display: inline-block;"> Reptiles     <i>Kinosternon flavescens</i>     Yellow mud turtle     <input type="checkbox"/> </div>				
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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	<input checked="" type="checkbox"/>	Amphibians	<i>Hyla arenicolor</i>	Canyon tree frog	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Birds	<i>Grus canadensis tabida</i>	Greater sandhill crane	<input type="checkbox"/>	Birds	<i>Pelecanus erythrorhynchos</i>	American white pelican	<input type="checkbox"/>
Fish	<i>Catostomus discobolus</i>	Bluehead sucker	<input checked="" type="checkbox"/>	Birds	<i>Bucephala islandica</i>	Barrow's goldeneye	<input type="checkbox"/>
Fish	<i>Gila elegans</i>	Bonytail chub	<input checked="" type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input type="checkbox"/>
Fish	<i>Ptychocheilus lucius</i>	Colorado pikeminnow	<input checked="" type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Fish	<i>Catostomus latipinnis</i>	Flannelmouth sucker	<input checked="" type="checkbox"/>	Birds	<i>Progne subis</i>	Purple martin	<input type="checkbox"/>
Fish	<i>Gila cypha</i>	Humpback chub	<input checked="" type="checkbox"/>	Birds	<i>Plegadis chihi</i>	White-faced ibis	<input checked="" type="checkbox"/>
Fish	<i>Catostomus platyrhynchus</i>	Mountain sucker	<input checked="" type="checkbox"/>	Insects	<i>Stylurus intricatus</i>	Brimstone clubtail	<input checked="" type="checkbox"/>
Fish	<i>Xyrauchen texanus</i>	Razorback sucker	<input checked="" type="checkbox"/>	Insects	<i>Lachlania saskatchewanensis</i>	Bushlegged mayfly	<input type="checkbox"/>
Fish	<i>Gila robusta</i>	Roundtail chub	<input checked="" type="checkbox"/>	Insects	<i>Ametropus neavei</i>	Mayfly, spp.	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Mammals	<i>Idionycteris phyllotis</i>	Allen's big-eared bat	<input type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Mammals	<i>Lontra canadensis</i>	River otter	<input checked="" type="checkbox"/>
Mammals	<i>Euderma maculatum</i>	Spotted bat	<input type="checkbox"/>	Mollusks	<i>Ferrissia walkeri</i>	Cloche ancyloid	<input type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallascens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>	Mollusks	<i>Ferrissia fragilis</i>	Fragil ancyloid	<input type="checkbox"/>
				Mollusks	<i>Promenetus exacuouus</i>	Sharp sprite	<input type="checkbox"/>
				Reptiles	<i>Thamnophis cyrtopsis</i>	Blacknecked gartersnake	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	<input checked="" type="checkbox"/>	Amphibians	<i>Hyla arenicolor</i>	Canyon tree frog	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Birds	<i>Centrocercus urophasianus</i>	Greater sage-grouse	<input type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input checked="" type="checkbox"/>
Fish	<i>Catostomus discobolus</i>	Bluehead sucker	<input checked="" type="checkbox"/>	Birds	<i>Bucephala islandica</i>	Barrow's goldeneye	<input type="checkbox"/>
Fish	<i>Oncorhynchus clarkii pleuriticus</i>	Colorado River cutthroat trout	<input type="checkbox"/>	Birds	<i>Cypseloides niger</i>	Black swift	<input checked="" type="checkbox"/>
Fish	<i>Catostomus latipinnis</i>	Flannelmouth sucker	<input checked="" type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input type="checkbox"/>
Fish	<i>Catostomus platyrhynchus</i>	Mountain sucker	<input checked="" type="checkbox"/>	Birds	<i>Melanerpes lewis</i>	Lewis's woodpecker	<input checked="" type="checkbox"/>
Fish	<i>Gila robusta</i>	Roundtail chub	<input type="checkbox"/>	Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
Mammals	<i>Euderma maculatum</i>	Spotted bat	<input type="checkbox"/>	Insects	<i>Speyeria nokomis nokomis</i>	Great Basin silverspot butterfly	<input type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>	Insects	<i>Libellula nodisticta</i>	Hoary skimmer	<input checked="" type="checkbox"/>
				Mammals	<i>Idionycteris phyllotis</i>	Allen's big-eared bat	<input type="checkbox"/>
				Mammals	<i>Lontra canadensis</i>	River otter	<input type="checkbox"/>
				Reptiles	<i>Thamnophis cyrtopsis</i>	Blacknecked gartersnake	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	<input checked="" type="checkbox"/>	Amphibians	<i>Acris crepitans</i>	Blanchard's cricket frog	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Amphibians	<i>Lithobates blairi</i>	Plains leopard frog	<input checked="" type="checkbox"/>
Fish	<i>Etheostoma cragini</i>	Arkansas darter	<input type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Fish	<i>Hybognathus hankinsoni</i>	Brassy minnow	<input type="checkbox"/>	Birds	<i>Pelecanus erythrorhynchos</i>	American white pelican	<input type="checkbox"/>
Fish	<i>Platygobio gracilis</i>	Flathead chub	<input checked="" type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input checked="" type="checkbox"/>
Fish	<i>Lepomis humilis</i>	Orangespotted sunfish	<input checked="" type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input type="checkbox"/>
Fish	<i>Etheostoma spectabile</i>	Orangethroat darter	<input type="checkbox"/>	Birds	<i>Melanerpes lewis</i>	Lewis's woodpecker	<input checked="" type="checkbox"/>
Fish	<i>Hybognathus placitus</i>	Plains minnow	<input checked="" type="checkbox"/>	Birds	<i>Numenius americanus</i>	Long-billed curlew	<input type="checkbox"/>
Fish	<i>Fundulus sciadicus</i>	Plains topminnow	<input checked="" type="checkbox"/>	Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
Fish	<i>Noturus flavus</i>	Stonecat	<input type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Fish	<i>Phenacobius mirabilis</i>	Suckermouth minnow	<input checked="" type="checkbox"/>	Fish	<i>Etheostoma exile</i>	Iowa darter	<input checked="" type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Insects	<i>Lachlania saskatchewanensis</i>	Bushlegged mayfly	<input type="checkbox"/>
Mammals	<i>Zapus hudsonius luteus</i>	New Mexico jumping mouse	<input type="checkbox"/>	Insects	<i>Epithea petechialis</i>	Dot-winged baskettail	<input type="checkbox"/>
Mammals	<i>Zapus hudsonius preblei</i>	Prebles meadow jumping mouse	<input type="checkbox"/>	Insects	<i>Argia alberta</i>	Paiute dancer	<input checked="" type="checkbox"/>
				Insects	<i>Mesocapnia frisoni</i>	Plains snowfly	<input type="checkbox"/>
				Mammals	<i>Lontra canadensis</i>	River otter	<input type="checkbox"/>
				Mollusks	<i>Ferrissia fragilis</i>	Fragil ancyliid	<input checked="" type="checkbox"/>
				Reptiles	<i>Thamnophis cyrtopsis</i>	Blacknecked gartersnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Thamnophis sirtalis</i>	Common gartersnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Rhinocheilus lecontei</i>	Long-nosed snake	<input type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	<input checked="" type="checkbox"/>	Amphibians	<i>Acris crepitans</i>	Blanchard's cricket frog	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Amphibians	<i>Gastrophryne olivacea</i>	Great Plains narrowmouth toad	<input checked="" type="checkbox"/>
Fish	<i>Etheostoma cragini</i>	Arkansas darter	<input checked="" type="checkbox"/>	Amphibians	<i>Anaxyrus debilis</i>	Green toad	<input checked="" type="checkbox"/>
Fish	<i>Hybognathus hankinsoni</i>	Brassy minnow	<input checked="" type="checkbox"/>	Amphibians	<i>Lithobates blairi</i>	Plains leopard frog	<input checked="" type="checkbox"/>
Fish	<i>Platygobio gracilis</i>	Flathead chub	<input checked="" type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Fish	<i>Lepomis humilis</i>	Orangespotted sunfish	<input checked="" type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input checked="" type="checkbox"/>
Fish	<i>Etheostoma spectabile</i>	Orangethroat darter	<input checked="" type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input type="checkbox"/>
Fish	<i>Hybognathus placitus</i>	Plains minnow	<input type="checkbox"/>	Birds	<i>Melanerpes lewis</i>	Lewis's woodpecker	<input checked="" type="checkbox"/>
Fish	<i>Fundulus sciadicus</i>	Plains topminnow	<input checked="" type="checkbox"/>	Birds	<i>Numenius americanus</i>	Long-billed curlew	<input type="checkbox"/>
Fish	<i>Chrosomus erythrogaster</i>	Southern redbelly dace	<input type="checkbox"/>	Birds	<i>Colinus virginianus</i>	Northern bobwhite	<input type="checkbox"/>
Fish	<i>Noturus flavus</i>	Stonecat	<input checked="" type="checkbox"/>	Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
Fish	<i>Phenacobius mirabilis</i>	Suckermouth minnow	<input checked="" type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
Mammals	<i>Zapus hudsonius luteus</i>	New Mexico jumping mouse	<input checked="" type="checkbox"/>	Fish	<i>Etheostoma exile</i>	Iowa darter	<input checked="" type="checkbox"/>
Mammals	<i>Zapus hudsonius preblei</i>	Prebles meadow jumping mouse	<input checked="" type="checkbox"/>	Insects	<i>Epithea petechialis</i>	Dot-winged baskettail	<input type="checkbox"/>
				Insects	<i>Libellula nodisticta</i>	Hoary skimmer	<input checked="" type="checkbox"/>
				Insects	<i>Somatochlora ensigera</i>	Lemon-faced emerald	<input checked="" type="checkbox"/>
				Insects	<i>Argia alberta</i>	Paiute dancer	<input checked="" type="checkbox"/>
				Insects	<i>Mesocapnia frisoni</i>	Plains snowfly	<input type="checkbox"/>
				Insects	<i>Neochoroterpes oklahoma</i>	Prongbill mayfly	<input type="checkbox"/>
				Insects	<i>Euphyes bimacula</i>	Two-spotted skipper	<input checked="" type="checkbox"/>
				Mammals	<i>Lontra canadensis</i>	River otter	<input type="checkbox"/>
				Mollusks	<i>Anodontooides ferussacianus</i>	Cylindrical papershell	<input checked="" type="checkbox"/>
				Mollusks	<i>Ferrissia fragilis</i>	Fragil ancyloid	<input checked="" type="checkbox"/>
				Mollusks	<i>Unio merus tetralasmus</i>	Pondhorn	<input checked="" type="checkbox"/>
				Reptiles	<i>Thamnophis cyrtopsis</i>	Blacknecked gartersnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Thamnophis sirtalis</i>	Common gartersnake	<input checked="" type="checkbox"/>
				Reptiles	<i>Hypsiglena chlorophaea</i>	Desert nightsnake	<input type="checkbox"/>
				Reptiles	<i>Rena dissectus</i>	New Mexico threadsnake	<input type="checkbox"/>
				Reptiles	<i>Kinosternon flavescens</i>	Yellow mud turtle	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Anaxyrus boreas boreas</i>	Boreal toad (Southern Rocky Mountain Population)	<input checked="" type="checkbox"/>	Amphibians	<i>Lithobates sylvatica</i>	Wood frog	<input checked="" type="checkbox"/>
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	<input checked="" type="checkbox"/>	Birds	<i>Bucephala islandica</i>	Barrow's goldeneye	<input checked="" type="checkbox"/>
Fish	<i>Oncorhynchus clarkii pleuriticus</i>	Colorado River cutthroat trout	<input checked="" type="checkbox"/>	Birds	<i>Plegadis chihi</i>	White-faced ibis	<input checked="" type="checkbox"/>
Fish	<i>Catostomus latipinnis</i>	Flannelmouth sucker	<input type="checkbox"/>	Fish	<i>Couesius plumbeus</i>	Lake chub	<input checked="" type="checkbox"/>
Fish	<i>Oncorhynchus clarkii stomias</i>	Greenback cutthroat trout	<input checked="" type="checkbox"/>	Insects	<i>Libellula nodisticta</i>	Hoary skimmer	<input checked="" type="checkbox"/>
Fish	<i>Chrosomus eos</i>	Northern redbelly dace	<input type="checkbox"/>	Insects	<i>Sympetrum madidum</i>	Red-veined meadowfly	<input checked="" type="checkbox"/>
Fish	<i>Lepomis humilis</i>	Orangespotted sunfish	<input type="checkbox"/>	Mollusks	<i>Ferrissia walkeri</i>	Cloche ancyloid	<input checked="" type="checkbox"/>
Fish	<i>Gila pandora</i>	Rio Grande chub	<input type="checkbox"/>	Mollusks	<i>Promenetus umbilicatellus</i>	Cockerell	<input checked="" type="checkbox"/>
Fish	<i>Oncorhynchus clarkii virginalis</i>	Rio Grande cutthroat trout	<input checked="" type="checkbox"/>	Mollusks	<i>Anodontoides ferussacianus</i>	Cylindrical papershell	<input checked="" type="checkbox"/>
Fish	<i>Chrosomus erythrogaster</i>	Southern redbelly dace	<input type="checkbox"/>	Mollusks	<i>Ferrissia fragilis</i>	Fragil ancyloid	<input type="checkbox"/>
				Mollusks	<i>Uniomereus tetralasmus</i>	Pondhorn	<input checked="" type="checkbox"/>
				Mollusks	<i>Acroloxus coloradensis</i>	Rocky Mountain capshell	<input checked="" type="checkbox"/>
				Mollusks	<i>Promenetus exacuouus</i>	Sharp sprite	<input checked="" type="checkbox"/>
				Mollusks	<i>Physa gyrina utahensis</i>	Utah physa	<input checked="" type="checkbox"/>
				Reptiles	<i>Kinosternon flavescens</i>	Yellow mud turtle	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Anaxyrus boreas boreas</i>	Boreal toad (Southern Rocky Mountain Population)	<input checked="" type="checkbox"/>	Amphibians	<i>Lithobates sylvatica</i>	Wood frog	<input checked="" type="checkbox"/>
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	<input checked="" type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input type="checkbox"/>
Birds	<i>Grus canadensis tabida</i>	Greater sandhill crane	<input type="checkbox"/>	Birds	<i>Bucephala islandica</i>	Barrow's goldeneye	<input type="checkbox"/>
Fish	<i>Oncorhynchus clarkii pleuriticus</i>	Colorado River cutthroat trout	<input checked="" type="checkbox"/>	Birds	<i>Cypseloides niger</i>	Black swift	<input checked="" type="checkbox"/>
Fish	<i>Oncorhynchus clarkii stomias</i>	Greenback cutthroat trout	<input checked="" type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input type="checkbox"/>
Fish	<i>Catostomus platyrhynchus</i>	Mountain sucker	<input type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Fish	<i>Gila pandora</i>	Rio Grande chub	<input type="checkbox"/>	Birds	<i>Progne subis</i>	Purple martin	<input type="checkbox"/>
Fish	<i>Oncorhynchus clarkii virginalis</i>	Rio Grande cutthroat trout	<input checked="" type="checkbox"/>	Insects	<i>Arsapnia arapahoe</i>	Arapahoe snowfly	<input checked="" type="checkbox"/>
Fish	<i>Catostomus plebeius</i>	Rio Grande sucker	<input checked="" type="checkbox"/>	Insects	<i>Baetis brunneicolor</i>	Small minnow mayfly	<input type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Mammals	<i>Ursus arctos</i>	Grizzly bear	<input type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Mammals	<i>Lontra canadensis</i>	River otter	<input checked="" type="checkbox"/>
Mammals	<i>Zapus hudsonius luteus</i>	New Mexico jumping mouse	<input checked="" type="checkbox"/>	Mollusks	<i>Promenetus umbillicatellus</i>	Cockerell	<input type="checkbox"/>
Mammals	<i>Zapus hudsonius preblei</i>	Prebles meadow jumping mouse	<input checked="" type="checkbox"/>	Mollusks	<i>Acroloxus coloradensis</i>	Rocky Mountain capshell	<input type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat	<input type="checkbox"/>	Mollusks	<i>Promenetus exacuous</i>	Sharp sprite	<input type="checkbox"/>
Plants	<i>Draba weberi</i>	Weber's draba	<input checked="" type="checkbox"/>				

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	Group	Species	Common Name	Primary
Birds	<i>Pelecanus erythrorhynchos</i>	American white pelican	<input checked="" type="checkbox"/>	Birds	<i>Pelecanus erythrorhynchos</i>	American white pelican	<input checked="" type="checkbox"/>
Birds	<i>Sterna antillarum</i>	Least tern	<input checked="" type="checkbox"/>	Birds	<i>Sterna antillarum</i>	Least tern	<input checked="" type="checkbox"/>
Birds	<i>Charadrius melodus</i>	Piping plover	<input checked="" type="checkbox"/>	Birds	<i>Charadrius melodus</i>	Piping plover	<input checked="" type="checkbox"/>
Birds	<i>Charadrius alexandrinus nivosus</i>	Western snowy plover	<input checked="" type="checkbox"/>	Birds	<i>Charadrius alexandrinus nivosus</i>	Western snowy plover	<input checked="" type="checkbox"/>
Birds	<i>Plegadis chihi</i>	White-faced ibis	<input checked="" type="checkbox"/>	Birds	<i>Plegadis chihi</i>	White-faced ibis	<input checked="" type="checkbox"/>
Insects	<i>Bombus fraternus</i>	Southern plains bumblebee	<input checked="" type="checkbox"/>	Insects	<i>Bombus fraternus</i>	Southern plains bumblebee	<input checked="" type="checkbox"/>
Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>	Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>	Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
Mollusks	<i>Ferrissia walkeri</i>	Cloche ancyliid	<input type="checkbox"/>	Mollusks	<i>Ferrissia walkeri</i>	Cloche ancyliid	<input type="checkbox"/>
Mollusks	<i>Ferrissia fragilis</i>	Fragil ancyliid	<input type="checkbox"/>	Mollusks	<i>Ferrissia fragilis</i>	Fragil ancyliid	<input type="checkbox"/>

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				Tier 2 Species	
Group	Species	Common Name	Primary		
Fish	<i>Gila pandora</i>	Rio Grande chub	<input checked="" type="checkbox"/>		
Fish	<i>Catostomus plebeius</i>	Rio Grande sucker	<input checked="" type="checkbox"/>		
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				Tier 2 Species	
Group	Species	Common Name	Primary		
Fish	<i>Gila pandora</i>	Rio Grande chub	<input checked="" type="checkbox"/>		
Fish	<i>Catostomus plebeius</i>	Rio Grande sucker	<input checked="" type="checkbox"/>		
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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Amphibians	<i>Lithobates pipiens</i>	Northern leopard frog	<input checked="" type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input checked="" type="checkbox"/>
Fish	<i>Etheostoma cragini</i>	Arkansas darter	<input type="checkbox"/>	Birds	<i>Passerina amoena</i>	Lazuli bunting	<input type="checkbox"/>
Fish	<i>Hybognathus hankinsoni</i>	Brassy minnow	<input checked="" type="checkbox"/>	Birds	<i>Melanerpes lewis</i>	Lewis's woodpecker	<input checked="" type="checkbox"/>
Fish	<i>Luxilus cornutus</i>	Common shiner	<input checked="" type="checkbox"/>	Birds	<i>Strix occidentalis lucida</i>	Mexican spotted owl	<input checked="" type="checkbox"/>
Fish	<i>Platygobio gracilis</i>	Flathead chub	<input checked="" type="checkbox"/>	Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
Fish	<i>Chrosomus eos</i>	Northern redbelly dace	<input checked="" type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Fish	<i>Lepomis humilis</i>	Orangespotted sunfish	<input type="checkbox"/>	Birds	<i>Oreothlypis virginiae</i>	Virginia's warbler	<input type="checkbox"/>
Fish	<i>Etheostoma spectabile</i>	Orangethroat darter	<input type="checkbox"/>	Fish	<i>Etheostoma exile</i>	Iowa darter	<input checked="" type="checkbox"/>
Fish	<i>Fundulus sciadicus</i>	Plains topminnow	<input checked="" type="checkbox"/>	Insects	<i>Arsapnia arapahoe</i>	Arapahoe snowfly	<input type="checkbox"/>
Fish	<i>Chrosomus erythrogaster</i>	Southern redbelly dace	<input checked="" type="checkbox"/>	Insects	<i>Celastrina humulus</i>	Hops feeding azure	<input checked="" type="checkbox"/>
Fish	<i>Noturus flavus</i>	Stonecat	<input checked="" type="checkbox"/>	Insects	<i>Callophrys mossii schryveri</i>	Moss's elfin	<input type="checkbox"/>
Fish	<i>Phenacobius mirabilis</i>	Suckermouth minnow	<input type="checkbox"/>	Insects	<i>Mesocapnia frisoni</i>	Plains snowfly	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input type="checkbox"/>	Mammals	<i>Lontra canadensis</i>	River otter	<input type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Mollusks	<i>Physa gyrina utahensis</i>	Utah physa	<input checked="" type="checkbox"/>
Mammals	<i>Zapus hudsonius luteus</i>	New Mexico jumping mouse	<input type="checkbox"/>				
Mammals	<i>Zapus hudsonius preblei</i>	Prebles meadow jumping mouse	<input checked="" type="checkbox"/>				
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input type="checkbox"/>				

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	<input type="checkbox"/>	Birds	<i>Haliaeetus leucocephalus</i>	Bald eagle	<input type="checkbox"/>
Birds	<i>Centrocercus urophasianus</i>	Greater sage-grouse	<input type="checkbox"/>	Birds	<i>Patagioenas fasciata</i>	Band-tailed pigeon	<input type="checkbox"/>
Birds	<i>Grus canadensis tabida</i>	Greater sandhill crane	<input checked="" type="checkbox"/>	Birds	<i>Dolichonyx oryzivorus</i>	Bobolink	<input checked="" type="checkbox"/>
Birds	<i>Centrocercus minimus</i>	Gunnison sage-grouse	<input type="checkbox"/>	Birds	<i>Spizella breweri</i>	Brewer's sparrow	<input type="checkbox"/>
Birds	<i>Tympanuchus pallidicinctus</i>	Lesser prairie-chicken	<input type="checkbox"/>	Birds	<i>Aimophila cassinii</i>	Cassin's sparrow	<input type="checkbox"/>
Birds	<i>Charadrius montanus</i>	Mountain plover	<input type="checkbox"/>	Birds	<i>Calcarius ornatus</i>	Chestnut-collared longspur	<input type="checkbox"/>
				Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
				Birds	<i>Tympanuchus cupido</i>	Greater prairie-chicken	<input checked="" type="checkbox"/>
				Birds	<i>Calamospiza melanocorys</i>	Lark bunting	<input checked="" type="checkbox"/>
				Birds	<i>Melanerpes lewis</i>	Lewis's woodpecker	<input type="checkbox"/>
				Birds	<i>Lanius ludovicianus</i>	Loggerhead shrike	<input type="checkbox"/>
				Birds	<i>Numenius americanus</i>	Long-billed curlew	<input type="checkbox"/>
				Birds	<i>Rhynchophanes mccownii</i>	McCown's longspur	<input type="checkbox"/>
				Birds	<i>Colinus virginianus</i>	Northern bobwhite	<input checked="" type="checkbox"/>
				Birds	<i>Circus cyaneus</i>	Northern harrier	<input checked="" type="checkbox"/>
				Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
				Birds	<i>Asio flammeus</i>	Short-eared owl	<input type="checkbox"/>
				Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input checked="" type="checkbox"/>
				Birds	<i>Bartramia longicauda</i>	Upland sandpiper	<input type="checkbox"/>
				Birds	<i>Plegadis chihi</i>	White-faced ibis	<input checked="" type="checkbox"/>
				Birds	<i>Grus americana</i>	Whooping crane	<input checked="" type="checkbox"/>
				Insects	<i>Bombus pennsylvanicus</i>	American bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Danaus plexippus</i>	Monarch butterfly	<input checked="" type="checkbox"/>
				Insects	<i>Bombus fraternus</i>	Southern plains bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
				Insects	<i>Bombus fervidus</i>	Yellow bumblebee	<input checked="" type="checkbox"/>
				Mammals	<i>Vulpes velox</i>	Swift fox	<input type="checkbox"/>

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 dewatering	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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Leucosticte australis</i>	Brown-capped rosy-finch	<input checked="" type="checkbox"/>	Birds	<i>Leucosticte atrata</i>	Black rosy-finch	<input checked="" type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
Birds	<i>Lagopus leucura altipetens</i>	Southern white-tailed ptarmigan	<input checked="" type="checkbox"/>	Birds	<i>Selasphorus rufus</i>	Rufous hummingbird	<input checked="" type="checkbox"/>
Mammals	<i>Ochotona princeps</i>	American pika	<input checked="" type="checkbox"/>	Insects	<i>Bombus suckleyi</i>	Suckley cuckoo bumblebee	<input checked="" type="checkbox"/>
Mammals	<i>Gulo gulo</i>	Wolverine	<input checked="" type="checkbox"/>	Insects	<i>Boloria improba acrocnema</i>	Uncompahgre fritillary	<input checked="" type="checkbox"/>
Plants	<i>Descurainia kenheili</i>	Heil's tansy mustard	<input checked="" type="checkbox"/>	Insects	<i>Bombus occidentalis</i>	Western bumblebee	<input checked="" type="checkbox"/>
Plants	<i>Eutrema penlandii</i>	Penland alpine fen mustard	<input type="checkbox"/>	Mammals	<i>Martes americana</i>	American marten	<input type="checkbox"/>
Plants	<i>Oreoxis humilis</i>	Pikes Peak spring parsley	<input checked="" type="checkbox"/>	Mammals	<i>Ovis canadensis</i>	Bighorn sheep	<input type="checkbox"/>
Plants	<i>Aliciella sedifolia</i>	Stonecrop gilia	<input checked="" type="checkbox"/>	Mammals	<i>Ursus arctos</i>	Grizzly bear	<input checked="" type="checkbox"/>
Plants	<i>Draba weberi</i>	Weber's draba	<input checked="" type="checkbox"/>	Plants	<i>Physaria alpina</i>	Avery Peak twinpod	<input checked="" type="checkbox"/>
Plants	<i>Physaria scrotiformis</i>	West Silver bladderpod	<input checked="" type="checkbox"/>	Plants	<i>Draba exungiculata</i>	Clawless draba	<input checked="" type="checkbox"/>
Plants	<i>Draba malpighiacea</i>	Whitlow-grass	<input checked="" type="checkbox"/>	Plants	<i>Delphinium ramosum var. alpestre</i>	Colorado larkspur	<input checked="" type="checkbox"/>
				Plants	<i>Eriogonum coloradense</i>	Colorado wild buckwheat	<input checked="" type="checkbox"/>
				Plants	<i>Castilleja puberula</i>	Downy Indian paintbrush	<input checked="" type="checkbox"/>
				Plants	<i>Ipomopsis globularis</i>	Globe gilia	<input checked="" type="checkbox"/>
				Plants	<i>Draba grayana</i>	Gray's Peak whitlow-grass	<input checked="" type="checkbox"/>
				Plants	<i>Telesonix jamesii</i>	James telesonix	<input type="checkbox"/>
				Plants	<i>Townsendia rothrockii</i>	Rothrock townsend-daisy	<input checked="" type="checkbox"/>
				Plants	<i>Draba graminea</i>	San Juan whitlow-grass	<input checked="" type="checkbox"/>
				Plants	<i>Saussurea weberi</i>	Weber saussurea	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Plants	<i>Corispermum navicula</i>	Boat-shaped bugseed	<input type="checkbox"/>	Plants	<i>Physaria bellii</i>	Bell's twinpod	<input checked="" type="checkbox"/>
Plants	<i>Eriogonum brandegeei</i>	Brandegee wild buckwheat	<input checked="" type="checkbox"/>	Plants	<i>Lomatium concinnum</i>	Colorado desert-parsley	<input type="checkbox"/>
Plants	<i>Physaria pulvinata</i>	Cushion bladderpod	<input type="checkbox"/>	Plants	<i>Astragalus debequaeus</i>	DeBeque milkvetch	<input type="checkbox"/>
Plants	<i>Phacelia submutica</i>	DeBeque phacelia	<input checked="" type="checkbox"/>	Plants	<i>Townsendia fendleri</i>	Fendler's townsend-daisy	<input checked="" type="checkbox"/>
Plants	<i>Boechea glareosa</i>	Dorn's rockcress	<input checked="" type="checkbox"/>	Plants	<i>Nuttallia chrysantha</i>	Golden blazing star	<input checked="" type="checkbox"/>
Plants	<i>Physaria congesta</i>	Dudley Bluffs bladderpod	<input checked="" type="checkbox"/>	Plants	<i>Penstemon grahamii</i>	Graham beardtongue	<input checked="" type="checkbox"/>
Plants	<i>Penstemon gibbensii</i>	Gibben's beardtongue	<input checked="" type="checkbox"/>	Plants	<i>Townsendia glabella</i>	Gray's townsend-daisy	<input checked="" type="checkbox"/>
Plants	<i>Gutierrezia elegans</i>	Lone Mesa snakeweed	<input type="checkbox"/>	Plants	<i>Oreocarya revealii</i>	Gypsum Valley cat's-eye	<input type="checkbox"/>
Plants	<i>Packera mancosana</i>	Mancos shale packera	<input checked="" type="checkbox"/>	Plants	<i>Oreocarya osterhoutii</i>	Osterhout cat's-eye	<input checked="" type="checkbox"/>
Plants	<i>Sclerocactus mesae-verdae</i>	Mesa Verde hookless cactus	<input checked="" type="checkbox"/>	Plants	<i>Physaria pruinosa</i>	Pagosa bladderpod	<input checked="" type="checkbox"/>
Plants	<i>Phacelia formosula</i>	North Park phacelia	<input checked="" type="checkbox"/>	Plants	<i>Lupinus crassus</i>	Payson lupine	<input type="checkbox"/>
Plants	<i>Ipomopsis polyantha</i>	Pagosa skyrocket	<input type="checkbox"/>	Plants	<i>Physaria parviflora</i>	Piceance bladderpod	<input checked="" type="checkbox"/>
Plants	<i>Penstemon debilis</i>	Parachute penstemon	<input checked="" type="checkbox"/>	Plants	<i>Oonopsis puebloensis</i>	Pueblo goldenweed	<input type="checkbox"/>
Plants	<i>Physaria obcordata</i>	Piceance twinpod	<input checked="" type="checkbox"/>	Plants	<i>Mentzelia rhizomata</i>	Roan Cliffs blazing star	<input checked="" type="checkbox"/>
Plants	<i>Physaria rollinsii</i>	Rollins twinpod	<input type="checkbox"/>	Plants	<i>Oxybaphus rotundifolius</i>	Round-leaf four o'clock	<input checked="" type="checkbox"/>
Plants	<i>Physaria scrotiformis</i>	West Silver bladderpod	<input type="checkbox"/>	Plants	<i>Thalictrum heliophilum</i>	Sun-loving meadow rue	<input checked="" type="checkbox"/>
Plants	<i>Penstemon scariosus</i> var. <i>albifluvis</i>	White River penstemon	<input checked="" type="checkbox"/>				

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Leucosticte australis</i>	Brown-capped rosy-finch	<input type="checkbox"/>	Amphibians	<i>Hyla arenicolor</i>	Canyon tree frog	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input checked="" type="checkbox"/>	Arachnids	<i>Hypochilus bonneti</i>	A lampshade spider	<input checked="" type="checkbox"/>
Mammals	<i>Myotis thysanodes</i>	Fringed myotis	<input checked="" type="checkbox"/>	Birds	<i>Falco peregrinus anatum</i>	American peregrine falcon	<input checked="" type="checkbox"/>
Mammals	<i>Myotis lucifugus</i>	Little brown myotis	<input type="checkbox"/>	Birds	<i>Cypseloides niger</i>	Black swift	<input checked="" type="checkbox"/>
Mammals	<i>Euderma maculatum</i>	Spotted bat	<input checked="" type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
Mammals	<i>Corynorhinus townsendii pallescens</i>	Townsend's big-eared bat ssp.	<input checked="" type="checkbox"/>	Birds	<i>Strix occidentalis lucida</i>	Mexican spotted owl	<input checked="" type="checkbox"/>
Plants	<i>Mimulus gemmiparus</i>	Budding monkey flower	<input checked="" type="checkbox"/>	Birds	<i>Falco mexicanus</i>	Prairie falcon	<input checked="" type="checkbox"/>
Plants	<i>Aletes latilobus</i>	Canyonlands aletes	<input checked="" type="checkbox"/>	Insects	<i>Euphilotes rita coloradensis</i>	Colorado blue	<input checked="" type="checkbox"/>
Plants	<i>Astragalus deterior</i>	Cliff-palace milkvetch	<input checked="" type="checkbox"/>	Mammals	<i>Idionycteris phyllotis</i>	Allen's big-eared bat	<input type="checkbox"/>
Plants	<i>Astragalus humillimus</i>	Mancos milkvetch	<input checked="" type="checkbox"/>	Mammals	<i>Nyctinomops macrotis</i>	Big free-tailed bat	<input checked="" type="checkbox"/>
Plants	<i>Hackelia gracilentia</i>	Mesa Verde stickseed	<input type="checkbox"/>	Mammals	<i>Ovis canadensis</i>	Bighorn sheep	<input checked="" type="checkbox"/>
Plants	<i>Erigeron wilkenii</i>	Wilken fleabane	<input checked="" type="checkbox"/>	Plants	<i>Limnorchis zothecina</i>	Alcove bog orchid	<input checked="" type="checkbox"/>
Reptiles	<i>Aspidoscelis neotesselata</i>	Colorado checkered whiptail	<input checked="" type="checkbox"/>	Plants	<i>Anticlea vaginatus</i>	Alcove death camas	<input checked="" type="checkbox"/>
				Plants	<i>Telesonix jamesii</i>	James telesonix	<input checked="" type="checkbox"/>
				Plants	<i>Erigeron kachinensis</i>	Kachina daisy	<input checked="" type="checkbox"/>
				Plants	<i>Aletes humilis</i>	Larimer aletes	<input checked="" type="checkbox"/>
				Plants	<i>Aletes macdougallii ssp. breviradiatus</i>	Mesa Verde aletes	<input checked="" type="checkbox"/>
				Plants	<i>Astragalus naturitensis</i>	Naturita milkvetch	<input checked="" type="checkbox"/>
				Plants	<i>Potentilla rupincola</i>	Rocky Mountain cinquefoil	<input checked="" type="checkbox"/>
				Plants	<i>Draba smithii</i>	Smith whitlow-grass	<input checked="" type="checkbox"/>
				Reptiles	<i>Crotalus oreganus concolor</i>	Midget faded rattlesnake	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Birds	<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	<input checked="" type="checkbox"/>	Birds	<i>Dolichonyx oryzivorus</i>	Bobolink	<input type="checkbox"/>
Birds	<i>Aquila chrysaetos</i>	Golden eagle	<input type="checkbox"/>	Birds	<i>Spizella breweri</i>	Brewer's sparrow	<input type="checkbox"/>
Birds	<i>Centrocercus urophasianus</i>	Greater sage-grouse	<input type="checkbox"/>	Birds	<i>Aimophila cassinii</i>	Cassin's sparrow	<input type="checkbox"/>
Birds	<i>Centrocercus minimus</i>	Gunnison sage-grouse	<input checked="" type="checkbox"/>	Birds	<i>Calcarius ornatus</i>	Chestnut-collared longspur	<input type="checkbox"/>
Birds	<i>Tympanuchus pallidicinctus</i>	Lesser prairie-chicken	<input checked="" type="checkbox"/>	Birds	<i>Buteo regalis</i>	Ferruginous hawk	<input type="checkbox"/>
Birds	<i>Tympanuchus phasianellus jamesi</i>	Plains sharp-tailed grouse	<input checked="" type="checkbox"/>	Birds	<i>Ammodramus savannarum</i>	Grasshopper sparrow	<input checked="" type="checkbox"/>
Reptiles	<i>Aspidoscelis neotessellata</i>	Colorado checkered whiptail	<input type="checkbox"/>	Birds	<i>Tympanuchus cupido</i>	Greater prairie-chicken	<input type="checkbox"/>
Reptiles	<i>Sistrurus catenatus</i>	Massasauga	<input type="checkbox"/>	Birds	<i>Calamospiza melanocorys</i>	Lark bunting	<input type="checkbox"/>
				Birds	<i>Rhynchophanes mccownii</i>	McCown's longspur	<input type="checkbox"/>
				Birds	<i>Colinus virginianus</i>	Northern bobwhite	<input type="checkbox"/>
				Birds	<i>Circus cyaneus</i>	Northern harrier	<input type="checkbox"/>
				Birds	<i>Falco mexicanus</i>	Prairie falcon	<input type="checkbox"/>
				Birds	<i>Amphispiza belli</i>	Sage sparrow	<input type="checkbox"/>
				Birds	<i>Buteo swainsoni</i>	Swainson's hawk	<input type="checkbox"/>
				Mammals	<i>Vulpes velox</i>	Swift fox	<input type="checkbox"/>
				Reptiles	<i>Rhinocheilus lecontei</i>	Long-nosed snake	<input type="checkbox"/>
				Reptiles	<i>Tantilla horbartsmithi</i>	Smith's black-headed snake	<input type="checkbox"/>
				Reptiles	<i>Phrynosoma cornutum</i>	Texas horned lizard	<input type="checkbox"/>

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	<i>Physa cupreonitens</i>	Hot Springs physa	<input checked="" type="checkbox"/>

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				Tier 2 Species			
Group	Species	Common Name	Primary	Group	Species	Common Name	Primary
Plants	<i>Corispermum navicula</i>	Boat-shaped bugseed	<input checked="" type="checkbox"/>	Insects	<i>Amblyderus weneri</i>	Great Sand Dunes anthicid beetle	<input checked="" type="checkbox"/>
				Insects	<i>Cicindela theatina</i>	San Luis Dunes tiger beetle	<input checked="" type="checkbox"/>
				Insects	<i>Euproserpinus wiesti</i>	Wiest's sphinx moth	<input checked="" type="checkbox"/>
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			