United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Colorado Field Office
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IN REPLY REFER TO:
ES/LK-6-CO-03-F-041
Mail Stop 65412

William C. Jones, Division Administrator
Colorado Federal Aid Division
U.S. Department of Transportation
Federal Highway Administration
555 Zang Street, Room 250
Lakewood, Colorado 80228

Dear Mr. Jones:

In accordance with section 7 of the Endangered Species Act (Act) as amended (16 U.S.C. 1531 et seq.) and the Interagency Cooperative Regulations (50 CFR 402), this is the U.S. Fish and Wildlife Service's (Service) programmatic biological opinion on impacts to federally-listed endangered and threatened species associated with Federal Highway Administration (FHWA) funding of the Colorado Department of Transportation's (CDOT) routine maintenance and upgrade activities on existing transportation corridors of eastern Colorado over the next 20 years. The project focuses on the Colorado portion of the central shortgrass prairie ecoregion as defined by Bailey et al. (1994), and modified by The Nature Conservancy (TNC) to include all segments of Interstate 25 (I-25) within Colorado.

This biological opinion is based on the project proposal as described in the May 2003, report prepared principally by the Colorado Natural Heritage Program (CNHP) entitled "Programmatic Biological Assessment, Conference Report, and Conservation Strategy for Impacts from Transportation Improvement Projects on Select Sensitive Species on Colorado's Central Short Grass Prairie" (Biological Assessment). The Service received the Biological Assessment on June 25, 2003. The Service concurs with the FHWA's determination that the proposed program may affect the threatened bald eagle (*Haliaeetus leucocephalus*), the threatened piping plover (*Charadrius melodus*), the endangered interior least tern (*Sterna antillarum athalassos*), and the threatened Colorado butterfly plant (*Gaura neomexicana coloradensis*). Further, the Service finds that the proposed action is likely to adversely affect the bald eagle, but is not likely to adversely affect the piping plover, the interior least tern, and the Colorado butterfly plant for the following reasons:

- the proposed CDOT activities will not occur near the playa lakes and reservoirs of Prowers, Bent, Kiowa, or Baca counties that are used by nesting piping plovers
- the proposed CDOT activities will not affect water flows or sandbar deposition which could affect interior least tern nesting habitat
- the only known Colorado butterfly plant population is at least ½ mile away from I-25 and the proposed maintenance and improvement projects are not expected to result in adverse impacts to this occurrence
- CDOT will implement on-site Best Management Practices (BMP) to avoid and minimize impacts to all the species addressed in this biological opinion or in the appended Conservation Strategy for Non-Listed Species (Appendix A).

In addition, three candidate species (lesser prairie-chicken [*Tympanuchus pallidicinctus*], the black-tailed prairie dog [*Cynomys ludovicianus*], and the Arkansas darter [*Etheostoma cragini*]),

as well as twenty-nine species of concern (mountain plover [*Charadrius montanus*], burrowing owl [*Athene cunicularia*], Cassin's sparrow [*Aimophila cassinii*], ferruginous hawk [*Buteo regalis*], lark bunting [*Calamospiza melanocorys*], loggerhead shrike [*Lanius ludovicianus*], McCown's longspur [*Calcarius mccownii*], massasauga rattlesnake [*Sisturus catenatus*], northern cricket frog [*Acris crepitans*], northern leopard frog [*Rana pipiens*], Texas horned lizard [*Phrynosoma cornutum*], western box turtle [*Terrapene ornata*], brassy minnow [*Hybognathus hankinsoni*], common shiner [*Notropis cornutus*], flathead chub [*Hybopsis gracilis*], plains minnow [*Hybognathus placitus*], plains topminnow [*Fundulus sciadicus*], southern redbelly dace [*Phoxinus erythrogaster*], suckermouth minnow [*Phenacobius mirabilis*], cylindrical papershell [*Anodontoids ferussacianus*], giant floater [*Pyganodon = [Anodonta] grandis*], arogos skipper [*Atrytone arogos*], hops feeding azure [*Celastrina humulus*], ottoe skipper [*Hesperia ottoe*], regal fritillary [*Speyeria idalia*], Arkansas River feverfew [*Bolophyta tetraneuris*], Arkansas Valley evening primrose [*Oenothera harringtonii*], golden blazing star [*Nuttallia chrysantha*], Pueblo goldenweed [*Oonopsis puebloensis*], and round-leaf four-o'clock [*Oxybaphus rotundifolia*]) are addressed in the appended Conservation Strategy for Non-listed Species (Appendix A). By addressing these species in the Biological Assessment, FHWA/CDOT hope to satisfy any obligations under the Act in advance through implementation of best practices in design and maintenance and through purchase and management of priority habitat for conservation. Only the bald eagle is addressed in this programmatic biological opinion, but should any of the species in the Conservation Strategy for Non-listed Species (Appendix A) become listed under the Act, they will be incorporated into this opinion, as appropriate.

CONSULTATION HISTORY

Early in 2000, FHWA/CDOT approached the Service with the idea of conserving and managing large areas of habitat on Colorado's central shortgrass prairie to compensate for the effects of routine upgrade and maintenance activities on the existing highway network on listed and sensitive prairie species. Numerous meetings were held between February 2000 and October 2002, to discuss the most appropriate regulatory mechanism, process, and availability of suitable lands. Most of these meetings were attended by the core project team which was composed of representatives of the Service, FHWA, CDOT, the Colorado Division of Wildlife (CDOW), CNHP, and TNC. In addition, several meetings were held with local taxonomic experts to identify sensitive species and to define and refine their ranges within Colorado's central shortgrass prairie. These experts also provided much insight into the effects of the existing highway system as well as the potential effects of routine upgrade and maintenance activities on the species over the next 20 years. A complete chronology of consultation may be found in Appendix A of the Biological Assessment. The final Biological Assessment was received by the Service on June 25, 2003.

Because federal funding will be used for the activities addressed in this consultation, and because several listed species that could be affected are known to occupy appropriate habitats within Colorado's central shortgrass prairie, formal section 7 consultation is necessary. The first priority of this consultation is to address impacts of the proposed program to listed species. The second priority is to treat the sensitive species as if they were listed, thereby minimizing effects to these species, as well as streamlining future consultations.

All of the species addressed in the Biological Assessment, listed and sensitive, are known to occupy portions of suitable habitats within Colorado's central shortgrass prairie ecoregion where highway and maintenance and upgrade activities will occur.

BIOLOGICAL OPINION

Description of the Proposed Action

This programmatic consultation addresses the effects of CDOT's routine upgrade and maintenance activities on existing transportation corridors of eastern Colorado over the next 20 years on the threatened and endangered species listed above. Proposed, candidate or sensitive species are addressed in the appended Conservation Strategy for Non-listed Species and will be reassessed and incorporated into this biological opinion as appropriate. The action area of the proposed project consists of the highway rights-of-way (ROW) within the eastern plains of Colorado, which is shown in Figure 1. Secondary or indirect impacts could extend beyond the ROW, and would be difficult to quantify. The action area is dominated by shortgrass, mixed-grass, and sandsage prairie spread across rolling plains, tablelands, canyons, badlands, and buttes. It is not possible at this time to specify which of the existing eastern plains transportation corridors and off-system bridges will undergo the proposed actions (described below) over the 20-year timeframe of the project. Therefore, the extent of potential direct and indirect impacts are assessed for all ROWs.

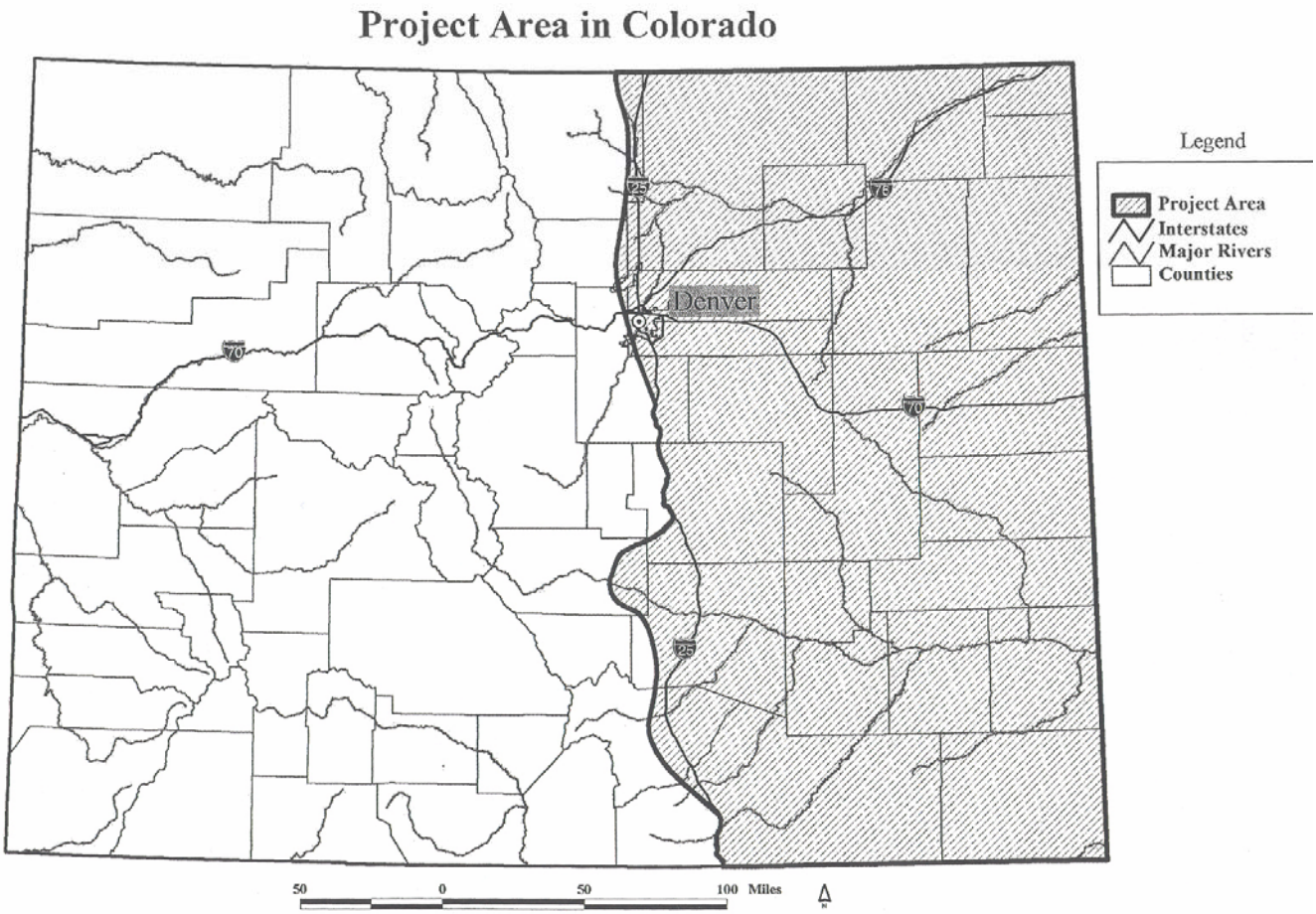
The core project team, in consultation with taxonomic experts, defined the project area as the ROW of existing transportation corridors, including bridges. ROW width varies with the highway capacity, and is defined further in the Environmental Baseline section of this document. Experts suggested that, because the "disturbance mechanism" - the road - is already present, most potential impacts from the proposed actions would be temporary. The primary source of concern was the potential for additional permanent habitat loss. The experts concurred that permanent habitat loss from any of the proposed actions would be limited to the ROW. Therefore, for the purposes of the impact analysis and conservation/mitigation strategies presented in this document, the project area is the ROW.

The process for selecting the species to be targeted in this analysis was primarily driven by the ultimate goal of the project which is large scale, off-site mitigation for those prairie species most likely to be 1) adversely impacted by CDOT activities, and 2) federally-listed in the next 20 years. The project team began with the species list compiled in 1998 by TNC for their Central Shortgrass Prairie conservation plan (TNC 1998). TNC's list included all imperiled, declining, and endemic species for the central shortgrass prairie (portions of Colorado, Nebraska, Kansas, Oklahoma, Texas, Wyoming, and New Mexico). Scientists from CDOT, the Service, CDOW and CNHP updated and refined the TNC list, and added professional insight into the vulnerability of the species in question. Species that do not occur in Colorado were deleted, and some species of state concern were added. The resulting list of 96 species (which may be found in Appendix A of the document entitled "Estimating Impacts of Highway Projects on Select Rare, Sensitive, or Declining Species on Colorado's Central Shortgrass Prairie" prepared by CNHP and submitted to the Service with the Biological Assessment) was then ranked according to two criteria: 1) likelihood of impact from CDOT activities within 20 years, and 2) likelihood of federal listing under the Act within 20 years.

Likelihood of impact was scored "yes" or "no" for each species, based on proximity to any state or federal highway within Colorado's central shortgrass prairie. Proximity was defined as any known occurrence within a 0.5 mile distance from any state or federal highway. Identification of "known occurrence" was based on existing information in CNHP and CDOW databases, and then refined through expert review.

Likelihood of federal listing within 20 years was scored "high," "medium," or "low" for each species. These scores reflect existing information on species status, trends and threats. Chris Pague, Director of Conservation Science for The Nature Conservancy of Colorado, performed the preliminary evaluation, which was further refined by other biologists on the core project team and species experts that were consulted during the impact analysis process.

Figure 1. Colorado's Central Shortgrass Prairie. Proposed actions that are subject to consultation occur along the highway right-of-ways within the shaded area shown below.



Species that met the "likelihood of impact" and "likelihood of listing" criteria were further evaluated for extent of their range and distribution within the central shortgrass prairie. Some declining prairie species are very restricted in their range and distribution in Colorado, and a multi-species habitat protection effort is not likely to be an effective alternative for offsetting impacts to such range-restricted species. Also, for some species, expert opinion suggested that potential threats may be better ameliorated on-site. Therefore, the core project team developed two species lists: a primary list of species that would be targeted for off-site habitat protection (Table 1), and an "on-site mitigation" list for species that would be targeted for *in situ* conservation measures and Best Management Practices (BMPs) (Table 2). The target species lists were finalized by the core project team after consultation with the experts on species distribution and potential impacts.

Six species occurring on Colorado's central shortgrass prairie, two of them listed as threatened under the Act, are not being considered in this document. Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is not addressed here because CDOT is engaging in a separate consultation and programmatic agreement where it occurs along I-25 in Douglas and El Paso County. The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) has only historical records in the project area. The Greater Prairie-chicken (*Tympanuchus cupido pinnatus*) was once considered threatened by the CDOW but has been reclassified as a game bird and does not meet the "likelihood of federal listing under the Act within 20 years" criterion for inclusion in this initiative. The Plains Sharp-tailed Grouse (*Tympanuchus phasianellus jamesi*) is also unlikely to be listed in the next 20 years because even though it has a very limited range in Colorado, it is hunted in some parts of its range. The Northern Redbelly Dace (*Phoxinus erythrogaster*) has historically occurred in the project area but is currently found only west of I-25, and drainages with the fish's habitat requirements all are west of I-25. The Round-tailed Horned Lizard (*Phrynosoma modestum*) has only been found on three private properties near dirt roads and is unlikely to be affected by CDOT actions.

For most of the proposed actions, the actual impacts will likely be limited to the project footprint - an area that is usually smaller than the ROW. However, CDOT and FHWA have defined the project area as the larger ROW, rather than the actual project footprint, and have calculated mitigation obligations accordingly.

During the project's 20-year timeframe, the maximum number of road miles within the central shortgrass prairie that can feasibly undergo construction leading to permanent habitat loss is estimated by CDOT to be 22 percent. This estimate is based on typical funding levels and the amount of time required to complete construction projects.

If an emergency occurs within the action area, CDOT will notify the Service immediately and determine and implement actions that will correct the situation and minimize any necessary additional impacts. CDOT will submit a report to the Service describing any actions taken, additional impacts (if any), and an updated project database report, if applicable.

<u>Scope and Scale of Proposed Actions and Timeframe for Implementation</u>

1. Bridge repairs for all bridges on the 20-year needs list.
2. Approximately 4,307 miles of resurfacing/overlays and accompanying shoulder improvements.
3. Maintenance along existing transportation corridors and bridges.
4. Safety, reconstruction, capacity, and other transportation improvements (in addition to the overlay projects) for 22 percent of the transportation corridor network in Colorado's central shortgrass prairie.

This project proposes to provide up-front compensation for routine maintenance on approximately 4,307 miles of existing transportation corridors in the central shortgrass prairie; resurfacing of these same 4,307 miles; replacement of off-system bridges (approximately five

Table 1. Primary (Target) Species List

Bald Eagle	*Haliaeetus leucocephalus*
Burrowing Owl	*Athene cunicularia*
Cassin's Sparrow	*Aimophila cassinii*
Ferruginous Hawk	*Buteo regalis*
Lark Bunting	*Calamospiza melanocorys*
Lesser Prairie-chicken	*Tympanuchus pallidicinctus*
Loggerhead Shrike	*Lanius ludovicianus*
Long-billed Curlew	*Numenius americanus*
McCown's Longspur	*Calcarius mccownii*
Mountain Plover	*Charadrius montanus*
Black-tailed Prairie Dog	*Cynomys ludovicianus*
Massasauga Rattlesnake	*Sistrurus catenatus*
Texas Horned Lizard	*Phrynosoma cornutum*
Western Box Turtle	*Terrapene ornata*
Arkansas River Feverfew	*Bolophyta tetraneuris*
Pueblo Goldenweed	*Oonopsis puebloensis*
Round-leaf Four-O'clock	*Oxybaphus rotundifolius*

Table 2. On-site Mitigation (BMPs) Species List

Interior Least Tern	*Sterna antillarum athalassos*
Piping Plover	*Charadrius melodus*
Northern Cricket Frog	*Acris crepitans*
Northern Leopard Frog	*Rana pipiens*
Arkansas Darter	*Etheostoma cragini*
Brassy Minnow	*Hybognathus hankinsoni*
Common Shiner	*Notropis cornutus*
Flathead Chub	*Hybopsis gracilis*
Plains Minnow	*Hybognathus placitus*
Plains Topminnow	*Fundulus sciadicus*
Southern Redbelly Dace	*Phoxinus erythrogaster*
Suckermouth Minnow	*Phenacobius mirabilis*
Cylindrical Papershell	*Anodontoides ferussacianus*
Giant Floater	*Pyganodon = [Anodonta] grandis*
Arogos Skipper	*Atrytone arogos*
Hops Feeding Azure	*Celastrina humulus*
Ottoe Skipper	*Hesperia ottoe*
Regal Fritillary	*Speyeria idalia*
Arkansas Valley Evening Primrose	*Oenothera harringtonii*
Colorado Butterfly Plant	*Gaura neomexicana* ssp. *coloradensis*
Golden Blazing Star	*Nuttallia chrysantha*

bridges occur in the project area, and four of these are in urban areas); and safety and capacity improvements on approximately 22 percent of the existing transportation corridor network on the central shortgrass prairie. The majority of permanent impacts and a large percentage of temporary impacts will occur as a result of these safety and capacity improvements. All areas that are temporarily impacted will be restored and revegetated on-site using native species.

Descriptions of Types, Purpose, and Intent of Proposed Actions

Routine maintenance involves preserving and keeping all roads, roadsides, structures and miscellaneous facilities in as close to their original or improved condition as possible. Maintenance personnel responsibilities are to maintain roadway surfaces true to type, cross-section, alignment, and grade as originally constructed or reconstructed; to preserve the original

roadway in the safest and best condition possible; and to provide the services necessary to keep traffic moving in the safest possible manner every day of the year.

Several activities are necessary to achieve these goals including overlays, chip-sealing, patching, roadway reconstruction, bridge maintenance, rest area maintenance, noise barrier maintenance, drainage and erosion control structure maintenance, system quality enhancements, bicycle trail construction/maintenance, pedestrian facility additions or improvements, landscaping or reseeding, curb and gutter work, and wildlife crossing maintenance. Each of these activities is described in more detail below.

Overlays

Overlays are placed on existing sections of highway that will not be reconstructed for a long period of time and are in need of extensive repair. When surfaces, either concrete or asphalt, of older projects show signs of distress due to deficient base course or other causes, it is often more economical or expedient to place an additional depth of bituminous surfacing over the section of road rather than reconstruct the entire base and surface courses. Asphalt overlays are generally one-half inch to two inches in thickness, but may be as thick as four inches. Overlay equipment can cover approximately one to four miles per day, and stays on the pavement. Any staging will occur within the existing ROW.

Asphalt chip seal (Seal coats)

Seal coats with cover are applied to existing asphalt surfaces that are dry, cracked, and oxidized. These coats prevent penetration of surface moisture, provide a skid-resistant wearing surface, improve the night-driving characteristics of the road, and reduce the need for patching on surfaces that show raveling or cracking.

Seal coats are applied in four stages. Bituminous material (emulsified asphalt) is first applied uniformly and continuously to a clean, dry surface. Air and surface temperature must be above 70^{0}F at the time of application. A cover coat (crushed stone or crushed or natural gravel) material is immediately applied to the bituminous material, before it has the time to chill, set up, dry or otherwise impair retention of the cover coat. Water may be applied to the cover material to control dust. Rolling starts immediately behind the cover coat application and is continued until three complete coverages are obtained. Rolling is completed the same day that the bituminous material and cover coat are applied. The completed surface is lightly broomed the next day to remove excess material without dislodging any embedded material. A fog seal may or may not be applied. Approximately 10 - 12 lane miles, or five to six linear miles, can be chip sealed in a single day. Any staging of equipment will occur within the existing ROW.

Asphalt and concrete crack-seal

Cracks and joints in pavement surfaces are sealed by filling them with liquid asphalt and then covering them with sand, hand-raking in a rich mixture of sand and asphalt, or filling them with a specific crack-sealing material. A distributor is hauled behind a truck and the cracks are sealed by hand. The truck and distributor generally stay on the pavement or shoulder during this procedure.

Patching

Patching may be done by hand or machine, and may be temporary or permanent. For temporary hand-patching, asphalt surfaces, holes or depressions are first cleared of loose material, then liquid asphalt is applied to the sides of the hole, and the hole is filled with premix. The edges of the patch are then feathered to match the existing asphalt roadway, and the site is rolled or compacted to a smooth finish. Permanent hand patching requires exposing the road subgrade or base, determining the cause of the hole or depression, and removing and replacing any unsatisfactory material. Patch areas are made to be rectangular, cleaned, primed with a coat of light grade asphaltic material, and filled with a premixed material tamped into place in layers of no more than two inches in thickness. The patch is then rolled so that it smoothly fits the road

surface. Machine patching follows the same procedure as asphalt overlays, uses similar equipment, and can generally be completed within a couple of hours.

The typical Portland Cement roadway surface in Colorado is a single course pavement of unreinforced concrete varying in thickness and width. These surfaces may fail for a variety of reasons, including cracking due to base failure, sunken or raised slabs from base failure or earth movements, raised joints resulting from faulting at a joint with an unstable base, joint spalling (chipping at joint edges), or surface scaling (separation and flaking) caused by freeze-thaw, chemical ice control, or extensive use of tire chains or studded tires on bare pavement. Patching concrete follows much the same procedure as patching asphalt. Small areas of broken-up concrete may be patched with premixed bituminous material or with a Portland Cement concrete or epoxy. Edges of the broken area are squared and a tack coat material is applied. If necessary, the subgrade is strengthened by compacting a stable material into the hole. As with asphalt patching, concrete patching can generally be completed within a couple of hours.

Concrete slab replacement

Concrete roadway slabs are removed, and the area leveled with aggregate base course. The concrete is replaced by casting-in-place a new slab or a pre-cast slab and sealing the concrete joints. When portions of concrete pavement are removed and replaced, the portion removed is at least 10 feet in length and the full width of the lane. Any remaining portion adjacent to the transverse joint that is less than 10 feet in length is also removed. The subgrade may also be replaced. Generally, one to two feet of the subgrade is dug up and compacted with moisture and density control. A crane placed on a paved surface is used to remove and replace the concrete slabs. Replacement can usually be completed in one to three days.

Asphalt reconstruction

Existing asphalt is removed or recycled. It is hauled to a central asphalt plant for hot recycling, or stockpiled for in-place cold or hot recycling, replaced, then topped with a high quality hot bituminous pavement. All work is done from the road surface, and approximately one mile of asphalt per day can be reconstructed using this procedure.

Concrete reconstruction

Concrete reconstruction involves a full depth overlay of concrete or asphalt with stabilization. Widening could also take place if warranted by traffic volume increases. Reconstructed pavements need to be placed on a hard subgrade. If concrete or asphalt is already in place, then that surface acts as the subgrade. If the old road is removed before placing the new pavement, then the subgrade needs to be re-worked to a depth of six inches to four feet to ensure that compaction requirements are met. Because of the complexity of this type of work, a week or more may be required for its completion.

Bridge maintenance/replacement/restoration/rehabilitation

All bridges and approaches on the highway system within the ROW are maintained by CDOT. Most repairs are handled by maintenance crews, but some are placed on contract. Bridges are routinely inspected for waterway, guardrail, fence, approach, and deck maintenance needs. Inspections also occur every two years by CDOT Staff Bridge, as well as during and after floods. Waterway maintenance could consist of keeping the waterway clear of fences, debris, silt, logs, or live vegetation that could reduce the carrying capacity of the structure. Additional maintenance activities include protecting the approach side slopes against erosion by using riprap, lined ditches, flumes, or pipes. Deck drains may also cause erosion and these sites may require riprap or drain extensions. Guardrail posts are kept clear of weeds and in proper repair. Bridge approaches are kept flush with the bridge deck surface, and kept drained, especially at the ends of wingwalls. Steel structures are systematically repainted to prevent deterioration by corrosion. Dirt, scale, and blisters are removed from the steel with a wire brush or a scraper, or by sand or water blasting, prior to painting. Patching bridge decks is carried out in the same manner as patching asphalt or concrete, except that patching material is kept out of expansion devices and joints.

Bridge maintenance activities are highly variable, and the associated disturbance also varies. These activities could require a few hours to a few days to complete.

Bridge replacement

Consists of the removal of the old bridge and replacing with a new structure that may be wider if traffic volumes are projected to be higher. Details of bridge construction depend upon site-specific traffic and environmental characteristics, and could require weeks or months to complete.

Bridge restoration

Deficient portions of a bridge are restored so the intended design life may be achieved. Bridge restoration usually involves removing portions of deteriorated concrete and pouring new concrete in its place. Restoration methods are usually very specific to the type of bridge structure and are temporary.

Bridge rehabilitation

Deficient areas of the bridge are removed, which usually includes the bridge deck, bridge girders, bridge abutments and pier caps, and replacing or supporting the deficient areas with new concrete, epoxy reinforcing steel, water proof membrane and a thin layer of hot bituminous pavement. Bridge rehabilitation is more comprehensive and permanent than bridge restoration. A significant increase in service life (up to 50 years or more) and a "like new" structure can result from a rehabilitation.

Rest area construction/maintenance

Rest area maintenance includes weed control, litter control, and other activities required to keep these areas neat and orderly and their equipment functional. Weed control could occur as mowing, herbicide application, or other methods described below (Roadside Vegetation Management).

Noise barrier construction/maintenance/replacement

Activities associated with the construction and maintenance of noise barriers include clearing and grubbing, excavation and backfill. All these activities occur within the CDOT right-of-way unless a temporary easement is necessary. All disturbed areas and temporary construction easements are revegetated with native plant species or returned to original condition as soon as practical after project completion. Environmental clearances, such as wetlands and sensitive species, are obtained prior to construction or maintenance activities. Where sensitive habitats occur, plastic fencing is erected to define the work area.

Noise barriers are typically constructed of pre-cast concrete panels held together with steel posts. They may also be composed of earthen berms. Berm construction consists of excavation, hauling, disposal, placement, and compaction of all material encountered within the limits of the work. Barrier height depends upon topography as well as the location and distance of the highway from the area to be protected. Noise barriers are rarely constructed in rural areas. Virtually all noise barriers occur adjacent to major highways in urban, suburban, or industrial areas.

Drainage or erosion-control structure construction/maintenance

Drainage structures include cattle passes and cattle guards, collection ditches, shoulder drains, side ditches, under drains, outlet ditches, contour ditches, culverts, dips and overflow sections, and natural watercourses and streams. Additional drainage or erosion-control maintenance activities include sump pump maintenance, ice prevention and removal, cleaning and mowing paved and unpaved roadsides and ditches, and maintenance of slopes, streambanks, wetlands, paths and trails, fences, as well as litter control and sweeping. All drainage structures are cleaned

in the fall and spring to ensure that they can accommodate spring runoff and summer rain. Excavated material is never placed in wetlands or adjacent to waterways. Equipment access is limited to one or two points of entry. Materials used in streambank repair are free of fine-grained erodible soils, asphalt materials, and hazardous materials. Larger culverts are treated as bridges. Calcium chloride or salt is used to keep spring-fed culverts ice-free, or to open them up if they are already frozen.

System quality enhancements

Bicycle trail construction/maintenance - Maintain trails as originally constructed or subsequently reconstructed. Keep free of all brush and debris. Maintain same as bituminous roadway surface. If gravel, fill in ruts and holes. Construction consists of clearing the construction area, drainage, building sub-grade and surfacing with aggregate base, asphalt or concrete. Width usually varies from four feet to 12 feet.

Bicycle rack installation - Purchase and install prefabricated steel bicycle rack(s). These are usually attached to asphalt or concrete surfacing.

Pedestrian facility additions or improvements - Installation of miscellaneous amenities to improve or maintain pedestrian facilities, such as overpasses, ramps, etc.

Betterments and emergency repairs

Betterments are small permanent improvements to the highway that are of urgent necessity. Emergency repairs are necessary when roadway use is impaired or substantially obstructed. Emergencies include landslides, fires, floods, and national emergencies. Maintenance actions include erecting barricades or providing flaggers, removing and repairing the obstruction, and providing a detour. There is no set procedure for these activities. They are highly variable and the rectifying actions are event-specific.

Snow and ice control

Snow removal and ice control activities involve plowing, deicer or abrasive application, emergency assistance, rockslide removal, and snow fence maintenance and construction. Snow fences are erected at a set back from the highway of 35 times the height of the snow fence. They are repaired prior to the snow season and kept free of windblown sand and weeds. Where topography permits, snow fences may be constructed by plowing windrows of snow.

Traffic services

Traffic Services include activities related to installation, repair, and maintenance of traffic control devices (signs, signals, delineators, mile markers, guardrails, pavement markings, energy attenuators [crash cushions], portable variable message signs, barricades, lighting, rumble strips). Signs are visually inspected twice every year during daylight hours and once every year during darkness for general position, visibility, legibility, damage to sign or post, breakaway devises, and reflectivity. Delineators and mile markers are also regularly inspected and cleaned and repaired as needed. Guardrails, end sections, and guardrail posts are regularly inspected and are repaired, readjusted or replaced when their proper function is compromised. If more than 25 percent of a sub-standard guardrail is damaged, the entire length of the guardrail is replaced to current design standard.

Roadside vegetation management

Roadside vegetation management includes mowing, brush control, noxious weed control, bare ground treatment, tree pruning, planting, thinning, seeding, and other actions. The area covered by these actions extends from the roadway shoulder to the right-of-way limits and includes medians. Roadside vegetation management occurs on an as-needed basis and is coordinated through CDOT's Regional Planning and Environmental Managers in order to obtain any necessary permits. Roadsides are maintained to be as much like their natural habitat or the condition to which they were constructed or developed as possible. Four methods of vegetation

management are used by CDOT: mechanical control, chemical control, cultural control and biological control. Burning is not used by CDOT to control vegetation.

Mechanical mowers, saws, axes or other cutting implements are the tools used in mechanical control. Mechanical mowers are used only in areas that are level enough for the machinery. Mowing in rural areas (i.e., non-landscaped areas) is kept to one mower width (not to exceed 22 feet), except in areas with safety or noxious weed concerns. Mowing width is also restricted to one mower width in habitats where sensitive species are known to occur. Grasses are generally mowed to a height of eight to ten inches, but no less than six inches. In order to protect nesting bird habitat, mowing in areas beyond the slope area that allows surface drainage (Zones 2 and 3) is avoided between April 15 and August 1. CDOT's maintenance Zones 1-3 are shown in Figure 2. Handsaws, axes or other cutting implements are used to remove select trees, shrubs, or other vegetation. Tree and shrub pruning is generally conducted when the plants are dormant.

Chemical control is accomplished by herbicide application through either hand spraying (pulling hose or back pack) or broadcast by truck, depending upon the situation and as directed by CDOT's Weed Coordinator. Herbicides are not applied within 15 feet of a riparian area, except by personnel licensed to apply herbicide within a wetland or riparian area. In habitats where sensitive species are known to occur, herbicide application is coordinated through CDOT's Office of Environmental Programs. Best Management Practices and a weed-spraying plan are being developed by CDOT's Weed Coordinator. Plant growth regulators are used on roadsides, around delineators, and along guardrails.

Cultural control methods enhance the competitive capabilities of desirable plants by meeting their nutrient, moisture, and light requirements. Methods include reseeding, fertilizing, and irrigating.

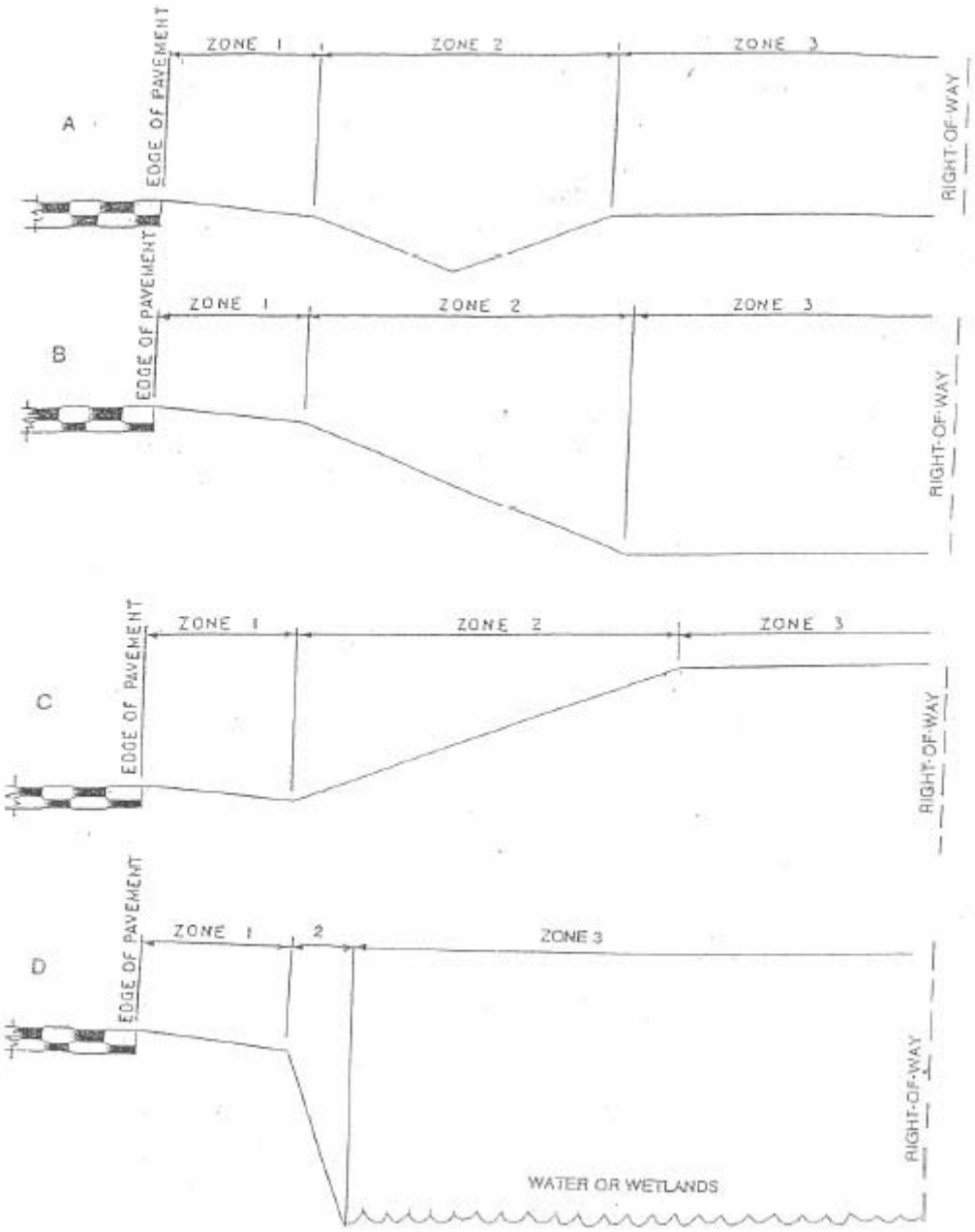
Biological control involves releasing organisms that prey upon a specific host plant. CDOT does not frequently employ this method of weed control.

Curb and gutter

Construction of curb, gutter, or combination of curb and gutter. CDOT constructs three types of curbs: cast-in-place concrete, dowelled concrete, or bituminous.

Wood or metal forms are used for cast-in-place concrete. Curbs are generally constructed in 10-foot sections separated by 1/8-inch open joints, except at expansion joints, unless otherwise specified. Expansion joints are placed according to each project's plan or to match existing pavement. The curb is then cured and back-filled according to plan. Alternatively, a curb-forming machine, such as that used for a bituminous curb, may be used.

Figure 2. Cross Sections of CDOT's Maintenance Zones



Wildlife crossings

Wildlife crossings are typically either a concrete box culvert or a large corrugated steel pipe with inlets to allow for lighting. Bridges spanning drainages may also serve as wildlife crossings. Crossings are maintained by removing debris and/or snow from existing culverts that could impede wildlife crossing.

Roadway geometrics improvements

These improvements include upgrading sub-standard roadways to meet current federal and state requirements. Examples would be improving the super-elevation of a curve, improving deficient sight distances, and changing the cross slope of the roadway for public driving safety. Construction could involve removing sub-standard road, earth work, shoulder addition, resurfacing, adding guardrails, and jersey barriers, or blasting out rock faces.

Interchange construction/reconstruction

Interchange construction or reconstruction generally consists of adding an overpass or underpass as a means of crossing existing roadways. Newly constructed or reconstructed overpasses or underpasses usually have four ramps as well as necessary lighting, signing and signalization in order to meet increased traffic volumes on the intersecting roadways. These activities are more likely to occur in urban areas.

Intersection improvements

Intersection improvements consist of adding or improving the signalization, signing, lighting, pavement marking, and/or sight distances. They may also entail separating traffic with medians, and/or constructing through traffic or turn lanes.

Rail crossing upgrades

Rail crossing upgrades involve overpass or underpass construction, and the installation of railroad signals.

Grooved pavement, centerline, or shoulders

Placing grooves or rumble strips in either the centerline or shoulder pavement is a safety measure to alert drivers to a dangerous condition or to maintain their alertness. It involves removing parallel strips of pavement approximately five inches wide, 12 inches long, 3/8 inch deep, and seven inches apart and perpendicular to the flow of traffic, with a small asphalt planing device. Rumble strips are placed for 48 feet, and then not placed the next 12 feet, with this pattern repeated.

Lane addition (i.e., added capacity, acceleration/deceleration lanes, truck climbing lanes)

Lane addition involves earthwork, drainage work, base course addition, surfacing with either asphalt or concrete, pavement marking, signing and oftentimes guardrail placement.

Transit line addition

The addition of lines to an existing transit facility.

Transit station addition and other amenities

The addition, reconstruction, or maintenance of transit stations and amenities, such as pullouts, benches, restrooms, bicycle racks, shelters, bicycle lockers, etc.

Shoulder addition/widening

Current standards call for shoulders in each direction of travel varying from 4 - 12 feet, depending on the facility type, location, and traffic. Shoulders are 4 - 6 feet adjacent to auxiliary lanes, 8 - 10 feet along rural highways, and 10 - 12 feet along interstates. Widening consists of earthwork, drainage, base course addition, surfacing with asphalt or concrete, landscaping, pavement marking, and, if necessary, guardrail addition.

Bike trails and/or crossings

Bike trail construction includes scraping, grubbing, excavation, fill, compaction, and paving. Bike crossings are most commonly at-grade with pedestrian signalization and pavement marking, but are occasionally overpasses or underpasses.

Conservation Measures

Habitat loss, fragmentation, and degradation are considered by many to be the primary threats to the persistence of most species dependent on the shortgrass prairie (Lauenroth 1979; Hammerson 1986; Clausen et al. 1989; Wake 1991; Dobkin 1994; Jennings and Hayes 1994; McDiarmid 1995; Opler 1995; Williams and Neves 1995; Knopf 1996b; Nesler et al. 1997; Sidle and Faanes 1997). CDOT and FHWA are taking a habitat-based approach to mitigation by committing to conserve several large tracts of high quality habitat in Colorado's central shortgrass prairie, meeting or exceeding mitigation requirements, for select rare, sensitive and declining species that may be impacted by CDOT's projects. In addition, temporary effects of maintenance activities will be avoided, minimized, and mitigated through use of BMPs.

The proposed conservation strategy is to offset permanent habitat loss through large-scale off-site habitat protection. During a 20-year time period (i.e., the amount of time covered by this project), the maximum percent of existing transportation corridors within Colorado's central shortgrass prairie anticipated to undergo construction of safety, re-construction, or capacity improvements, and thus potentially lead to permanent habitat loss, is estimated by CDOT at 22 percent. This estimate is based on estimated funding levels as of 2000 and 2001, and the amount of time required to complete construction projects. Therefore, "maximum potential impact" was determined to be 22 percent of the number of acres of presumed presence (described below) within the impact zone for each species. Once the maximum potential impact was calculated for each species, impact zones for each species were overlaid to subtract overlap among species (i.e., to account for areas providing potential habitat for multiple species). When redundancy in reporting is eliminated, the maximum amount of central shortgrass prairie habitat for targeted species that is subject to potential habitat loss is 15,160 acres.

If larger than expected future budgets allow CDOT to undertake reconstruction and capacity improvements on more than 22 percent of the existing network, consultation may need to be reinitiated.

The plant species targeted for off-site habitat protection are extremely rare, and are limited in range and distribution to a very discrete area that has been fairly well surveyed. Therefore, potential impacts were calculated based on known locations, and mitigation lands were identified using the same criterion. None of these plants is listed, and they are further addressed in the appended Conservation Strategy for Non-listed Species.

For the terrestrial animal species targeted for off-site habitat protection, acres of potential impact were calculated using CDOW's GAP (Gap Analysis Project vegetation types were developed by the CDOW to map habitat types across Colorado and to help model animal distributions. Vegetation types were photointerpreted from Landsat imagery with a 100-hectare minimum mapping unit.) vegetation types to represent suitable habitat and potential presence. Estimates of impact and the approach to mitigation were as conservative as possible.

Once the maximum acres of potential impact were calculated, all vegetation types representing suitable habitat for targeted species were grouped into habitat types for mitigation. Each GAP vegetation type within the impact zone and its corresponding mitigation habitat type are presented in Table 7 of the Biological Assessment, and potential impacts for each vegetation type are presented in Table 8 of the Biological Assessment.

No distinction was made between occupied habitat and unoccupied habitat. The impact analysis was based on "presumed presence," in other words, the analysis assumed that all suitable habitat was occupied. The same weight of importance was given to unoccupied habitat as to occupied habitat, and therefore, the real potential impact to species has likely been overestimated. Likewise, the quality of habitat within the CDOT ROW was not evaluated, though experts agreed that, in general, such habitats are relatively degraded by current CDOT maintenance practices. Most experts agreed that the ROW should not be maintained in ways that attract or support wildlife, due to the possibility of increased mortality from fast-moving vehicles. The impact analysis and the conservation strategy are conservative in approach, in that potential impacts to presumably degraded habitat are being compensated by protection in perpetuity of high quality habitat, that is within a good landscape context, and that is currently being used (or can be used) by target species. Therefore, the conservation strategy is to overestimate impacts and conserve higher quality habitats than those potentially being impacted, and to adaptively manage for species protection in perpetuity.

A preliminary list of potential high-quality conservation areas in high priority areas was identified based upon previous planning efforts by TNC (via their Central Shortgrass Prairie Ecoregional Plan) and CDOW (via their real estate plan). CDOW reported overlap with the results of their real estate plan, and ultimately endorsed use of The Nature Conservancy's ecoregional conservation plan (TNC 1998) for this project as a framework for selection of conservation areas, which were reviewed and discussed extensively by the Conservation Site Identification Panel, which was established to assist CDOT in identifying potential conservation areas. The Panel included experts from CDOW, CNHP, the Service, TNC, and the Rocky Mountain Bird Observatory (RMBO).

TNC's plan was developed over a one and a half-year period by a multi-disciplinary team of biologists and conservation practitioners. The stated goal of the plan is "the long-term survival of all viable native species and natural plant community types occurring within the ecoregion." It included extensive consultation with experts, as well as thorough evaluations of the status of all native species within the ecoregion, threats, and landscapes where conservation success might be achieved. The effort resulted in a number of conservation sites that identified the highest priority conservation sites within the central shortgrass prairie. In this case, "highest priority" includes areas with the greatest likelihood of conservation success due to size, quality, and landscape context.

Because the conservation strategy is based on impacts to presumed habitat within a species' range, whether or not habitat is occupied at any given time, it is not necessary to observe each targeted species during the site evaluation process, or to document status of populations (although sites were originally identified based on documented occurrences of targeted species). However, each conservation parcel needs to offer a reasonable expectation that the species would be present. Criteria for demonstrating likelihood of occurrence includes presence of high quality suitable habitat of appropriate size, occurrence within the range of the targeted species, and previously documented occurrence on the site, or observations of targeted species on nearby parcels.

FHWA, CDOT, and the Service based the strategy on a 1:1 ratio of acres of potential impact to acres of mitigation lands. Therefore, the minimum total acreage of mitigation lands must equal no less than 15,160 acres, if all mitigation could be found in the appropriate amount and where it would occur in the most efficiently overlapping situation for target species.

The total acreage of lands presented by FHWA/CDOT as potential conservation scenarios presented below, is 55,811 acres, of which 46,640 acres would count towards mitigation credit. The acreage of mitigation credit was calculated by buffering all state and county roads within the proposed parcels by one-quarter mile for all species except the McCown's longspur and the lesser prairie-chicken. The road buffer used in calculating mitigation acres on the proposed McCown's longspur site was defined as 287 feet, which is the radius of this species' average home range. Home range estimates for lesser prairie-chicken are quite large; enough to suggest that no reasonable distance from roads will prevent mortality. However, for females with broods,

home range size has a radius of ½ mile, which suggests that, optimally, the protected 78 acres (see Table 10 in the Biological Assessment) would be at least ½ mile from active roads.

Potential Conservation Scenarios

In their Biological Assessment, FHWA and CDOT present descriptions of four sample properties that demonstrate how successful mitigation could occur. Each site description discusses how the site will contribute to the conservation strategy, target species observed, target species that potentially occur at the site, other species that will benefit from conserving the site, current site management, species targeted for conservation, management goals, as well as other topics. As conservation sites are found and secured, their descriptions as shown in the Biological Assessment will be appended to this biological opinion.

Best Management Practices

CDOT will integrate the following "Best Management Practices" (BMPs) techniques into its transportation improvement projects. These BMPs are designed to offset potential impacts identified by agency and core project team biologists, and by species experts. Minor changes to these BMPs may be made in the project specifications to ensure consistency with the existing MOU between CDOT and CDOW, which is being updated to include the Service and FHWA, on management of sensitive areas within ROWs. These BMPs are designed to ensure that actions avoid and minimize impacts to the extent possible.

These BMPs will be employed within presumed presence for relevant species. A map depicting presumed presence for the bald eagle may be found in Figure 2 of CNHP's document entitled "Estimating Impacts of Highway Projects on Select Rare, Sensitive, or Declining Species on Colorado's Central Shortgrass Prairie" which was submitted with the Biological Assessment.

Listed here are those BMPs that apply to the bald eagle. BMPs for the interior least tern, the piping plover, the Colorado butterfly plant, and the non-listed species may be found in the appended Conservation Strategy for Non-listed Species (Appendix A). Should any of those species become listed, the appropriate BMPs will be incorporated into this biological opinion.

Erosion Control and Storm Water Quality

(1) Best Management Practices (BMPs) as described in the latest edition of CDOT's Erosion Control and Stormwater Quality Guide and the Erosion Control Pocket Book shall be used by CDOT during all projects to protect aquatic resources and riparian areas including wetlands. These BMPs include, but are not limited to, standard soil/sediment erosion control practices that are correctly located, installed, and maintained to prevent sedimentation of Colorado's waterways. Most streams on the eastern plains where small native fish species are found flow at less than five cubic feet per second. Thus, it is important to control sedimentation that may occur without precluding fish passage. CDOT will ensure continuity of the natural flow regime of any stream documented in a CDOT action area. Programmatic BMPs and performance standards include the following:

- Where practicable, habitat in and around disturbed sites will be restored to its original condition or better at the end of the project.
- Habitat enhancement may include the creation of riffle habitat using boulders or other bio-engineering techniques, as well as replacing or enhancing the riparian and wetland vegetation, and restoring or improving habitat connectivity at the disturbed site.

(2) All specifications set forth in CDOT's Standard Specifications for Road and Bridge Construction, section 107.25 Water Quality Control, shall be included in all projects. This section outlines practices that minimize water pollution during construction to any state waters, including wetlands. Additionally, section 208, Erosion Control, shall be included on all projects. Section 208 directs contractors on the construction, installation, maintenance, and removal of erosion control measures during the life of the contract to prevent or minimize erosion, sedimentation, and pollution of any state waters, including wetlands. Erosion Control devices will be installed according to CDOT Miscellaneous and Safety (M & S) Standards.

Examples of methods used for erosion control are:
- Seeding/Mulching
- Blankets
- Check Dams
- Earthen berms

Examples of methods used for sediment control are:
- Inlet protection
- Erosion bales/logs
- Silt fence
- Sediment trap/basin

Inspections of all erosion control features shall occur every 14 calendar days and after each storm event that causes surface run-off. Corrective action measures must occur within 7 calendar days of inspection. Once earthwork has begun on a section it shall be pursued to completion. Within seven days, completed areas should be stabilized. Stabilization may include permanent stabilization such as seed/mulch, or temporary stabilization such as mulch with mulch tackifier, as appropriate.

Bald Eagles

(3) Bald Eagles are protected under the Act, the Migratory Bird Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act. For projects occurring near documented nesting/roosting areas, CDOT will check with CDOW to determine whether or not active nests/roosts are known to be present, and what actions, if any, are desirable to protect these features. If there are active nesting or roosting bald eagles within one mile of an active project area, CDOT activities will be curtailed from February 1 through July 31 during the nesting period, and from November 1 through March 31 during the roosting period, as determined by the CDOT staff biologist based on input from CDOW and the Service.

Status of the Species

Grasslands have been identified as the most imperiled ecosystem type in North America (Samson and Knopf 1996), as they have been converted to agriculture, pastureland, and development. Following directly from habitat conversion and degradation is the decline of many species that co-evolved with the grasslands. In the central shortgrass prairie, during the late 1990s, 58 species were endemic, declining or disjunct in their distribution, another 54 species were considered globally imperiled and, of these, 10 were listed under the Act, and six were candidates for listing (TNC 1998). Currently, in Colorado's portion of the central shortgrass prairie, there are six listed species and three candidates. This program will not address all these species, as explained earlier in the **Description of the Proposed Action** section on page 6 of this document.

This biological opinion and the Conservation Strategy for Non-listed Species use the GAP vegetation types as described earlier in the Conservation Measures section on page 13 of this document to determine impacts of the proposed activities on listed species, or on non-listed, at risk species. Species occupation of a particular area is dynamic, they will occupy certain areas one year, and perhaps occupy similar, but spatially separate areas another year. Occupation can depend on a variety of biological conditions, which are usually responding to climatological fluxes. Habitat is generally a more stable measure than occupation of a particular species.

Thirty-six listed and declining species are addressed in this biological opinion and the attached Conservation Strategy for Non-listed Species (Appendix A).

Bald Eagle (*Haliaeetus leucocephalus*)

Species Description

Bald eagles are large, relatively long-lived raptors. Nests are usually built in the tops of large trees near a body of water and are reused annually. Pair bonds persist for many years. The

reproductive rate is low: age of first reproduction is probably four to five years, clutches are small, and incubation and rearing periods are long (Austin 1971; Green 1985). Proximity to water, the presence of large trees with a clear flight path to one side of the tree, and excellent visibility are key features of nesting habitat (Green 1985). Eagles are opportunistic feeders, though fish are the primary diet (Green 1985). In winter, eagles congregate in areas characterized by abundant food and perches (Lingle and Krapu 1986) where they will spend four to five months. The majority of wintering areas are found near open water where the eagles feed primarily on fish and waterfowl, usually taking those which are dead, crippled, or otherwise vulnerable (USFWS 1983; Lingle and Krapu 1986). Additionally, eagles are known to feed on carrion, small mammals, and waterfowl (Green 1985; Lingle and Krapu 1986). In Colorado, wintering habitat is often coincident with black-tailed prairie dog colonies (pers. obs., C. Pague 2002).

Distribution and Status

Bald eagles occur throughout North America. During the nesting season they tend to be sparsely distributed (Fuller et al. 1995), but congregate in large numbers at winter roosts (Winternitz 1998). Little is known about historical nesting in Colorado, but today they nest throughout the state, primarily on the Western Slope (Winternitz 1998). From 1987-1995, Colorado Bird Atlas researchers documented 33 nesting pairs of bald eagles in Colorado (Winternitz 1998). Colorado's bald eagle population increases in winter when they are usually found along western river systems, in mountain parks, and on the eastern plains where they subsist largely on black-tailed prairie dogs (Winternitz 1998).

Many local bald eagle populations experienced sharp declines from 1950 to the 1970s due to shooting, habitat conversions, and impaired reproduction due to the accumulation of pesticides ingested from prey contaminated with organochlorine pesticides (chiefly DDT) (USFWS 1983; Fuller et al. 1995). The primary causes of mortality over the last 30 years include accidental trauma, poisoning (primarily lead), gunshot, and electrocution (Green 1985; Franson et al. 1995). The factor most consistently associated with population declines is loss or degradation of nesting and wintering habitat (Green 1985). With protection under the Act and subsequent protection of nesting habitat and reintroduction of captive eagles to the wild, the continent-wide population has rebounded (USFWS 1983).

The eagle was listed as an endangered species on March 11, 1967 (32 Federal Register 4001). Since listing, populations and the number of occupied nesting territories have increased throughout much of the United States. As a result, in 1995 the bald eagle was downlisted to threatened, and in 1999 it was proposed for delisting (to date, delisting has not occurred). The Colorado Natural Heritage Program ranks the bald eagle G4/S1B-S3N (apparently secure rangewide; breeding birds in Colorado are very rare; Colorado's winter population is vulnerable) (CNHP 2002b). The bald eagle is listed as Threatened by CDOW.

Habitat

In Colorado, most nesting occurs on the Western Slope (Winternitz 1998). The majority of the documented bald eagle occurrences on the eastern plains of Colorado are winter roost sites.

There are two elements that are critical for bald eagle winter habitat: roosts and food. Wintering concentrations of eagles in the midcontinent region are associated primarily with river systems. Nocturnal roosts consist predominantly of large cottonwoods (*Populus* spp.) that offer protection from the elements and are apparently used year after year (Green 1985; Lingle and Krapu 1986). Roosts may be occupied for long periods of the day during inclement weather. As with nesting habitat, the structural and site characteristics are more important than species of tree. Trees used for roosting are usually the largest and oldest in a stand, and have robust horizontal limbs and open branching which facilitate landing and taking off by large birds.

Winter diets of bald eagles track prey availability. When fish are difficult to obtain, as when rivers are covered with ice or during high winter flows, eagles are more dependent on waterfowl as a food source (Green 1985; Lingle and Krapu 1986). Wintering eagles are frequently observed

feeding on carrion along roadsides and in areas where waterfowl congregate. In eastern Colorado they commonly hunt in prairie dog colonies (Winternitz 1998).

Survival of individual eagles, particularly young of the year, probably depends on conditions encountered during the winter (USFWS 1983; Green 1985). Additionally, the physiological condition of adults at the beginning of each breeding season (an important factor influencing reproductive success) is also affected by how well energy demands are met in wintering areas (USFWS 1983; Green 1985). Thus, the survival and recovery of nesting populations of eagles depends on the presence of suitable wintering areas (USFWS 1983; Green 1985).

Bald eagles are protected at the national level by several federal laws and treaties in addition to the Act. The Eagle Protection Act (16 USC 668 et. seq.) and its associated regulations govern the taking, possession, and transportation of eagles. The Migratory Bird Treaty Acts and associated regulations (16 USC 703-711) with Great Britain (for Canada), Russia, and Mexico provide for migratory bird conservation through the enhancement of habitat. As amended in the 1972 treaty with Mexico, all of the treaties apply to raptors including bald eagles.

Each January the CDOW, in cooperation with the USGS Snake River Field Station in Boise, Idaho, conducts wintering bald eagle surveys. The surveys are part of a nationwide effort to index the total wintering bald eagle population in the lower 48 states, and to identify previously unrecognized areas of winter habitat. Colorado has been conducting bald eagle mid-winter surveys since 1987, providing critical information on eagle population trends, distribution, and habitat in Colorado. In 2001, the total number of bald eagles counted was 545 (CDOW 2002).

There is no federally-designated critical habitat within the action area.

Environmental Baseline

The Environmental Baseline describes the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process. [50 CFR §402.02]

The central shortgrass prairie occupies approximately 90,700 square miles of North American grasslands. North American grasslands are dominated by grasses and grass-like plants, shrubs, and a general absence of trees (Weaver 1968; Weaver et al. 1996; Licht 1997). In Colorado, the central shortgrass prairie is characterized by shortgrass, mixed-grass and sandsage prairie on rolling plains, tablelands, canyons, badlands, and buttes (TNC 1998). Shortgrass prairie uplands are dominated by blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloë dactyloides*). Both are warm-season grasses that flourish with intensive grazing, retain their protein content, and remain digestible when dormant (Weaver et al. 1996). Grasslands are among the most biologically productive of all communities (Williams and Diebel 1996). Their high productivity derives from high retention of nutrients, efficient biological recycling, and a structure that provides for a wide variety of life (Estes et al. 1982).

Climate, grazing, and fire are the primary ecological processes driving natural systems in the central shortgrass prairie (Ostlie et al. 1997). In addition, soil type is a primary determinant of the types of vegetation that can occur in an area. Historically, this combination of processes and soil type probably created a heterogeneous landscape that included a patchwork of intensively grazed lands and disturbed soils (Knopf and Sampson 1997).

Soils vary in texture, moisture, and structure. All of these attributes contribute to the potential vegetation types as well as macrobiotic soil fauna. For example, impermeable clay soils support either greasewood or four-winged saltbush communities, but not shortgrass prairie, regardless of local climate and grazing variables. Soils of this ecoregion that are loamy (clayey or sandy loams) support either mixed-grass or shortgrass, while sandy soils support sandhills grasslands or sandsage shrublands.

The total amount of precipitation is low, and evaporation generally exceeds precipitation (Bailey 1995). The central North American grasslands experience an east to west declining precipitation gradient and a north to south increasing temperature gradient that, combined, help drive a corresponding gradient in plant community type, net biomass productivity, soil carbon storage, and available nitrogen (Lauenroth et al. 1999).

Historically (i.e., before widespread conversion to agriculture), the landscape probably consisted of a shifting mosaic of intensely and lightly grazed patches of vegetation. The patchiness of the landscape resulted from the actions of large herds of ungulates, including bison (*Bison bison*), pronghorn (*Antilocapra americana*), elk (*Cervus elaphus*), and feral horses (*Equus caballus*), as well as prairie dogs (*Cynomys ludovicianus*), grasshoppers, and wildfire (Hart 2001). Of these, the most profound grazing impacts were from bison, pronghorn, prairie dogs, and (periodically) grasshoppers. Today, domestic livestock have replaced bison and pronghorn as the primary herbivores on the central shortgrass prairie, and poisoning, shooting and plague have greatly reduced the extent of prairie dog colonies (Fitzgerald 1996; Knopf 1996a; EDAW 2000).

Prairie fires, either intentionally set by Native Americans or naturally ignited by lightning, occurred periodically (at undocumented frequencies). These fires returned nutrients to the soil, stimulated the growth of grasses and forbs, and retarded succession to woody vegetation. Most grasses of the central shortgrass prairie are adapted to survive and even flourish in the presence of fire (Wright and Bailey 1980; Brown 1989), though its value as a management tool is not well understood (Ostlie et al. 1997).

The streams and rivers of the eastern plains of Colorado are characterized by highly variable and turbid warm water flows, and support native fishes, many of which are species of special concern. Rivers are fed by intermittent tributaries, runoff and surfacing groundwater (Woodling 1985). The surfacing groundwater sometimes forms permanent stream and wetland reaches of tributary streams. Water levels become shallow (only a few inches) in summer, water temperatures become high in summer, total dissolved salt can become quite high, and in spring, flows can be high and turbulent (Woodling 1985). Fish species living in such habitats must be able to tolerate drought, flooding (both high flows from snowmelt, and flashfloods from summer thunderstorms), high turbidity, and fluctuating habitat conditions.

River floodplains were originally a complex of wet bottomlands in which the scouring flows of spring runoff precluded the development of permanent stands of wooded vegetation in the riparian corridor (Currier et al. 1985; Fitzgerald et al. 1994; Hart and Hart 1997). Spring flows moved large quantities of sediment, removed shallowly rooted seedlings, and created sandbars among the braided channels. Before settlement, the large river valleys were largely a mixture of poorly drained sedge meadows and marshes and relatively well-drained, slightly elevated lowland prairies (Currier et al. 1985; Hart and Hart 1997). Short- and mid-grass prairies of little bluestem (*Schizachyrium scoparium*) and buffalo grass were found on the tablelands surrounding the valleys (Currier et al. 1985; Hart and Hart 1997). Further east in the central shortgrass prairie, river valleys were often dominated by cottonwood (*Populus* spp.) and peachleaf willow (*Salix amygdaloides*) woodlands, and/or tallgrass prairie communities, including big bluestem (*Andropogon gerardii*) and Indian grass (*Sorghastrum nutans*) (TNC 1998). With the advent of water development, the dynamic nature of the rivers has been greatly reduced. As a result, diminished hydrologic connectivity between meadows and rivers, reduced sediment supply, river bed degradation, intensive grazing, and fire restriction, have led to significant expansion of native and exotic woody vegetation onto grasslands, and into wet meadows and inactive river channels (Currier et al. 1985; Fitzgerald et al. 1994; Hart and Hart 1997; Sidle and Faanes 1997). The consequent establishment of permanent wooded vegetation has created corridors that facilitate the dispersal of fauna west of their historic ranges, including raccoons (*Procyon lotor*), eastern cottontail rabbits (*Sylvilagus floridanus*), fox squirrels (*Sciurus niger*), Virginia opossums (*Didelphis virginiana*), bullfrogs, and a large number of avian species (Knopf 1986; Schwalbe and Rosen 1989; Fitzgerald et al. 1994; Knopf 1994). While some of these species may have occurred sporadically in the central shortgrass prairie, they are now permanent and often dominant residents.

Ninety-one percent of the ecoregion is privately-owned (TNC 1998), with the remainder under federal (Department of Defense, National Grassland) or state management. The majority of the

central shortgrass prairie in Colorado east of I-25 is rural, with most people dependent on agriculture. Approximately 29 percent of the central shortgrass prairie has been converted to crop or pastureland (Knopf and Samson 1997), and approximately 40 percent remains in relatively large, intact parcels (TNC 1998).

Loamy soils are the most likely to support agriculture, while clay soils (because they protect organic matter from decomposition, and thus, tend to be the highest in organic matter and the lowest in nutrients) are the least likely to support agriculture (Burke et al. 1989). Where soil texture tends toward the loamy, precipitation is highest and mean annual temperature most moderate, grassland is most likely to be converted to crops (Burke et al. 1994). These are the areas with the highest turnover of organic matter to soil nutrients, thus the highest carbon and nitrogen concentrations. Because the shortgrass prairie tends to be the hottest, driest portion of the North American grasslands, more of the shortgrass prairie remains in native vegetation (approximately 60 percent [Weaver et al. 1996]) than either the tallgrass or mixed-grass prairie (Lauenroth et al. 1999).

Agriculture has been the dominant land use in the project area for most of the last 100 years, and much of the area outside the major metropolitan areas remains in agricultural use today. While population loss on the eastern plains has been a reality for decades (Lang et al. 1995), commercial and residential development is occurring in the I-25 corridor, particularly between Colorado Springs and Fort Collins. However, Colorado is a "home rule" state, meaning that planning and decisions regarding land use are made at the local level. Metropolitan Planning Organizations and Regional Planning Organizations prioritize and funnel transportation needs, developed in response to current and locally planned development, to CDOT. In the Denver metro area, cooperating local governments have joined together in an effort to limit land consumption as a core principle of MetroVision 2020, and its update MetroVision 2025. Proposed transportation improvements will be consistent with local plans for the region of influence and will promote goals set forth in related comprehensive land use plans. The proposed transportation project and its component parts are expected to prove beneficial in the long-run, improve safety and enhance the function of surrounding transportation infrastructure features (including local and county roads) and provide greater access to surrounding developed and developing areas.

Grassland Birds

Using data from the Breeding Bird Survey (1966 - 1991), Knopf (1995) found that over the last 25 years, grassland bird species have shown steeper, more widespread and more consistent population declines than any other guild of North American birds. There are nine species of birds endemic to the North American shortgrass prairie (Knopf 1996b); these birds have declined more rapidly than have other North American birds, probably due to extensive loss of habitat through conversion of grasslands to cropland and pasture, and loss of grassland herbivore populations.

Bald Eagle

Bald eagles occur throughout North America. During the nesting season they tend to be sparsely distributed (Fuller et al. 1995), but congregate in large numbers at winter roosts (Winternitz 1998). Little is known about historical nesting in Colorado, but today they nest throughout the state, primarily on the Western Slope (Winternitz 1998). In Colorado, there were six occupied nests in 1982 (Green 1985). From 1987-1995, Colorado Breeding Bird Atlas researchers and CDOW workers documented 33 nesting pairs of bald eagles in Colorado (Winternitz 1998). Roughly a quarter of these sites occur on Colorado's central shortgrass prairie, but the Breeding Bird Atlas map masks their exact locations in an effort to protect the birds from human predation (Winternitz 1998).

Colorado's bald eagle population increases in winter when they are usually found along western river systems, in mountain parks, and on the eastern plains where they subsist largely on black-tailed prairie dogs (Winternitz 1998).

Reduction in the threats to bald eagles across their range, especially suspension of the use of DDT, has reversed the population declines that triggered their listing (Ostlie et al. 1997). This is reflected in their downlisting from endangered to threatened.

Effects of Action

Effects of the action include the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species for purposes of preparing a biological opinion on the proposed action. [50 CFR §402.02]

Impacts to the species addressed in this consultation (as well as those addressed in the attached Conservation Strategy for Non-listed Species) were estimated using a geographic information system (GIS) and the best available scientific data, in conjunction with expert review. Experts in each taxonomic group (amphibians and reptiles, birds, fish, mammals, invertebrates, and plants) helped select target species, refine existing range/distribution spatial data, and guide development of impact zones. Maximum acreage of permanent habitat loss by vegetation type (Table 3) and for each species that could potentially result from the proposed activities was calculated. Impact zones were used to spatially represent areas of potential habitat loss for each species. Results were edited to represent only suitable habitat for each species. Results for each species were then combined to eliminate redundancy. The only listed species for which maximum impact was calculated is the bald eagle because the other three species will be addressed through on-site BMPs and minimization measures.

All impacts will occur in roadside habitat which is already degraded by fragmentation, pollutants, weeds, and traffic. Impacts from most routine maintenance activities are probably temporary and can be minimized through BMPs. Disturbances from these activities are not expected to last more than a few days, and most, such as overlays and resurfacing, are expected to cause a disturbance for only a few hours.

On both the individual project (local) and landscape scales, permanent habitat loss was identified by most of the experts consulted as the most likely impact of the activities addressed in this consultation, and should be mitigated.

Many of the activities addressed in this opinion may not only result in a loss of habitat, but may also result in an increase in habitat fragmentation, primarily on the scale of the individual project. Any activity that widens the current road footprint could result in increased fragmentation and includes rest area construction, noise barrier construction, roadway geometrics improvements, interchange construction/reconstruction, intersection improvements, and lane additions. As mentioned previously, the landscape is already fragmented by roads, and increased habitat fragmentation is not likely to be a major impact on a landscape scale because not all impacts will occur simultaneously, and one site will have time to recover before another site is impacted. On a local scale, fragmentation is not likely to have an impact on the bald eagle. The bald eagle could be indirectly affected by fragmentation by its effects to the black-tailed prairie dog, a primary prey for bald eagles.

CDOT has estimated that the maximum number of road miles within the central shortgrass prairie that can feasibly undergo construction leading to permanent habitat loss is 22 percent. This estimate is based on typical funding levels and the amount of time required to complete construction projects. In addition, according to the best estimates and the professional opinions of the experts, direct habitat loss from construction projects is expected to be limited to the ROW. The average ROW width for the different highway types was used as the “impact zone” and has been estimated as 150 feet total for state and federal highways (i.e., 75 feet on either side of the road), 300 feet total for I-25 and I-70, and 400 feet total for I-76. The botany experts agreed that 50 meters (164 feet) on either side of the roadways was an appropriate estimate of impact zone for plants. In the analyses of impacts to targeted plant species, all highways were buffered by 50 meters on each side. There fore, “maximum potential impact” has been defined as 22 percent of the number of acres of presumed presence within the impact zone for each species. Maximum potential impact zones for all species, except those being protected by on-site

BMPs, were then overlaid to subtract overlap among species in order to account for the same areas of potentially impacted habitat being reported for multiple species. When this redundancy in reporting is eliminated, the total amount of central shortgrass prairie habitat for targeted species that is potentially impacted by CDOT improvement projects within existing transportation corridors in 15,160 acres.

The assumptions made for the purposes of this programmatic consultation are that permanent impacts are restricted to the ROW, that a maximum of 22 percent of the ROW will be affected by routine maintenance and upgrade activities over the next 20 years, that the species addressed are present in areas of suitable habitat, and that the total amount of prairie habitat that could be affected is 15,160 acres.

Direct impacts to species can be expected from habitat loss due to conversion to asphalt or concrete (i.e., road widening, rest area construction, sidewalks, etc.), fill slopes, crane pads, mowing along the ROW, application of herbicides or plant growth inhibitors, and areas covered by new bridges, new buildings (such as at rest areas) and culvert extensions. Temporary impacts include the temporary loss of habitat during construction and recovery, and an increase in machinery and human presence.

Indirect impacts include a temporary increase in sedimentation in creeks and airborne dust during construction as well as the potential of an increased amount of road traction substances such as sand and de-icers, into the surface water and air, due to a wider road surface, and an increase in noise, traffic, and pollutants. A wider road surface could also increase the risk of an animal being struck by traffic, which is especially true for the slow-moving species such as many of the amphibians and reptiles. A wider road surface could also potentially increase growth, although capacity improvements are usually in response to growth that has already occurred. This effect however, is very difficult to quantify.

Table 3. Maximum Estimated Impact by Vegetation Type

Vegetation Types within Presumed Presence	Acres of Vegetation Type within Presumed Presence	Acres of Maximum Potential Impact	Percent of Presumed Presence Subject to Potential Impact
Dryland Agriculture	8,479,627	5,221	0.06%
Shortgrass Prairie	9,912,523	4,901	0.04%
Sand Dune Shrub Complex	2,634,015	1,888	0.07%
Irrigated Agriculture	804,586	1,396	0.17%
Midgrass Prairie	953,633	438	0.04%
Forest Dominated Wetland/Riparian	170,044	263	0.15%
Tallgrass Prairie	492,327	257	0.05%
Pinyon-Juniper	427,610	252	0.05%
Foothills/Mountain Grassland	205,710	223	0.10%
Desert Shrub	165,823	128	0.07%
Graminoid/Forb Dominated Wetland/Riparian	77,256	68	0.08%
Juniper Woodland	576,739	34	0.01%
Barren Land	37,502	29	0.07%
Shrub Dominated Wetland/Riparian	27,235	17	0.06%
Open Water	68,290	13	0.01%
Bare Soil	3,386	2	0.05%
Sand Dune Grassland Complex	132,762	0	0
Exposed Rock	11,133	0	0
Sandy Areas	5,250	0	0
Greasewood Fans/Flats	2,191	0	0
Big Sagebrush	855	0	0

Animal behavior may be affected during project construction. Disturbances to habitat may affect breeding behavior, dispersal ability, and susceptibility to predation. Many species are also likely

to avoid construction areas because of noise, human activity, and lack of habitat. Such effects are difficult to quantify, but were considered during consultation.

In sum, potential impacts to degraded roadside habitat are being minimized by implementation of on-site BMPs and are being compensated by protection in perpetuity of high quality habitat, that is within a good landscape context, and that is currently being used (or can be used) by target species. The conservation strategy is to overestimate impacts and conserve higher quality habitats than those potentially being impacted, and to adaptively manage for species protection in perpetuity.

For those species that cannot be addressed through the proposed off-site mitigation plan, on-site BMPs and avoidance measures will effectively mitigate impacts.

Temporarily impacted areas will be restored and revegetated on-site using native species.

Following is an account of expected impacts to the bald eagle. Impacts to the remaining species are described in the appended Conservation Strategy for Non-listed Species.

Bald Eagle

Because impacts to bald eagles in the project area are expected to be largely restricted to roosting bald eagles, this document only considers the effects of CDOT actions on wintering habitat. Activities that adversely alter historical and traditional roost sites will adversely affect wintering distributions and survival of bald eagles. Because bald eagles commonly hunt in prairie dog colonies on the eastern plains (Winternitz 1998), declines in the extent of prairie dog colonies in eastern Colorado may have an adverse impact on the continued success of bald eagle recovery.

CDOT projects would not be expected to cause direct disturbance to bald eagles. Roosting and future potential nest sites in deciduous forests along streams and rivers could be impacted if CDOT activities prevent tree regeneration and/or accelerate tree declines already occurring. However, implementation of BMPs near streams and rivers will avoid or minimize this condition, so impacts of this nature are not expected to occur.

CDOT maintenance activities within a mile of winter roosts could disturb eagles, potentially resulting in abandonment of the roost site. However, maintenance activities are infrequent and will not occur in concentration, but will be spatially distributed throughout eastern Colorado, as well as temporally distributed over a period of many years. Expert opinion indicates that, although eagles tend not to frequent areas where traffic volume is high, birds using habitat near existing roads in Colorado have habituated to activity on the roads (pers. comm., J. Craig 2002). Therefore, CDOT activities are not be expected to cause direct disturbance to bald eagles.

In Colorado, bald eagles rely heavily upon black-tailed prairie dogs in winter. Therefore, any loss of prairie dog colonies would translate into lost habitat (i.e., feeding areas) and resources (i.e., prey) for eagles (pers. comm., J. Craig 2002).

Bald eagle presumed presence was calculated by establishing a 15-mile radius buffer around known communal roost sites and intersecting these areas with appropriate vegetation affinities for the bald eagle as well as its primary prey species, the black-tailed prairie dog. The zone of impact was considered to be the highway ROW, which was intersected with areas of presumed presence to determine the number of acres of potential impact.

The maximum potential loss of bald eagle habitat from transportation improvement projects was calculated to be 3,688 acres. This represents approximately 0.064 percent of the identified habitat within the project area (Grunau and Lavender 2002).

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future

Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Construction of new power lines across eastern Colorado, especially if they are sited near winter roosts or prairie dog colonies, can result in increased mortality risks to bald eagles due to electrocution. Construction and development activities near active bald eagle nests, or winter roosts, have lead to abandonment (pers. obs., C. Pague), suggesting that prolonged human activity near a roost may have negative consequences.

Livestock grazing practices or alteration of hydrologic flows due to irrigation and dams (Ostlie et al. 1997) can both result in reduction in the establishment of cottonwood seedlings, thus resulting in the long term degradation of riparian forests, which are important to bald eagles for nesting and winter roosting. Historically, poisoning efforts to control prairie dogs may have had the largest effect on bald eagle persistence in eastern Colorado, by reducing winter food sources. Now, plague in prairie dog colonies, accentuated by private landowners eliminating (or nearly eliminating) remaining prairie dogs in the aftermath of a plague event, have a combined impact on the availability of food for wintering bald eagles. An increase in any of these activities or their occurrence in previously unaffected areas, could negatively impact bald eagles.

Flooding of prairie dog towns or roosting habitat by reservoirs, channelization, and unpredictable water discharge patterns below dams could also negatively impact bald eagles.

Urbanization will result in the loss of some land that had formerly been used for agricultural purposes and habitat. Road improvement may facilitate such development, but generally is a response to development that has already occurred. Development can also lead to changes in land use that could have potential secondary impacts on habitat for all species. Secondary effects include an increase in impervious surfaces and subsequent changes in the hydrology potentially leading to downcutting and loss of hydrology to support adjacent wetlands; and increases in noise, traffic, pollution, human activity, weeds, domestic animals, and native predators habituated to humans. Cumulative impacts from land use include continued urbanization, particularly adjacent to metro areas.

Conclusion

After reviewing the current status of the bald eagle, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that neither the direct nor indirect effects of the proposed action (which includes the implementation of conservation measures agreed to during informal consultation and outlined in this biological opinion) nor the cumulative effects will jeopardize the continued existence of the species. Potential impacts to degraded roadside habitat are being minimized and are being compensated by protection in perpetuity of high quality habitat, that is within a good landscape context, and that is currently being used (or can be used) by target species. The conservation strategy is to overestimate impacts and conserve higher quality habitats than those potentially being impacted, and to adaptively manage for species protection in perpetuity.

Impacts due to the proposed activities are small. FHWA and CDOT have over-estimated impacts by assuming that all impacted habitat is occupied by one or more of the species. It is unlikely in any mitigation scenario, that the exact number of mitigation acres needed will be obtained, instead there will likely be much more, thus exceeding the proposed 1:1 mitigation ratio. For example, the potential conservation scenario presented in this document would protect 55,811 acres, of which 46,640 acres would count toward mitigation credit after buffering the site for roads as described previously.

Although routine maintenance and upgrade activities on the existing road network will likely adversely affect the bald eagle and its habitat on Colorado's central shortgrass prairie, the proposed action and conservation measures will avoid the likelihood of jeopardy to the species. No critical habitat has been designated in the project area, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

This incidental take statement is based on full implementation of the proposed action as described in the Description of the Proposed Action section of this biological opinion, including conservation measures and BMPs incorporated into the project design.

The measures described below are non-discretionary, and must be undertaken by the FHWA so that they become binding conditions of any project approval issued to CDOT for the exemption in section 7(o)(2) to apply. The FHWA has the continuing duty to regulate the activity covered by this incidental take statement. If the FHWA fails (1) to assume and implement the terms and conditions or (2) fails to require CDOT to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the project approval, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, CDOT must report the progress of the action or its impact on the species to the Service as specified in the incidental take statement.

This biological opinion allows for take of the bald eagle. This biological opinion will be amended should any of the unlisted species identified in the appended Conservation Strategy for Non-listed Species (Appendix A) become listed under the Act. The Conservation Strategy will be considered in future section 7 consultations.

If the Service proposes to list a species, the Service will notify FHWA, and FHWA will prepare a Biological Assessment, incorporating by reference the information already contained in Appendix A, along with any new information. The Service can complete consultation either formally or informally, as appropriate.

Amount or Extent of Incidental Take

The Service anticipates incidental take of the bald eagle will occur through permanent or temporary loss of food and cover habitat. CDOT activities could result in abandonment of winter roost sites or destruction of prairie dogs, the bald eagle's primary wintertime food source, therefore, a portion of the spatial measurements of potential impact to prairie dogs were also counted as potential impact to the bald eagle. Effects of the action to the black-tailed prairie dog are addressed in the appended Conservation Strategy for Non-listed Species. The maximum potential loss of bald eagle habitat from transportation improvement projects was calculated to be 3,688 acres which represents approximately 0.064 percent of the identified habitat within the project area. Habitat is likely occupied only during winter. Incidental take through the direct killing of bald eagles is not authorized.
Incidental take may also occur through secondary impacts to the bald eagle, its habitat, or its prey. Because the roads in the project area have existed for many years, only insignificant additional secondary threats to the bald eagle and its primary prey will be introduced through completion of the projects. Such threats include increased impervious surfaces, increase in road traction substances, weeds, predators, and competitors. Site-specific conservation measures will minimize take.

Effect of the Take

In this biological opinion, the Service determined that the level of anticipated take is not likely to result in jeopardy to the bald eagle. No critical habitat has been designated in the action area, therefore none will be affected.

Reasonable and Prudent Measures

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the effects of incidental take that might otherwise result from the proposed action.

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the bald eagle:

1. The FHWA will ensure that conservation sites are selected and secured via easement or fee purchase prior to debiting this program for any of the approved activities.

2. The FHWA will monitor the extent of permanent habitat impacts to assure that they do not extend beyond the road ROW.

3. The FHWA will monitor the extent of habitat impacted to assure that it does not exceed the total amount allowed (i.e., 15,160 acres or 22 percent of the existing highway network in the next 20 years).

4. The FHWA will ensure that all off-site acreage conserved to offset impacts are maintained and managed into perpetuity as habitat for the covered species.

5. The FHWA will ensure that on-site BMPs designed to minimize take are implemented and successful, including revegetation.

6. The FHWA will ensure that off-site fill material will not be obtained from nor disposed of in an area containing a listed species or its habitat without Service approval.

7. The FHWA will ensure that if any of the species addressed in the attached Conservation Strategy for Non-listed Species becomes listed, that the appropriate protective measures are incorporated into this opinion.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the FHWA must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring. These terms and conditions are non-discretionary.

1. The following terms and conditions implement reasonable and prudent measure number 1. As conservation sites are found and secured, they will be approved by the Service, and their descriptions as shown in the Biological Assessment will be provided to the Service. FHWA and CDOT, or their designee, will enter into agreements with private property holders to maintain and manage their properties for the benefit of the species addressed in this opinion and in the attached Conservation Strategy for Non-listed Species (Appendix A) into perpetuity.

2. The following terms and conditions implement reasonable and prudent measure number 2. CDOT Regional environmental personnel will be trained on the requirements of this program and will ensure that training will be held with the selected contractor(s) prior to the commencement of any activity. The applicable requirements of this program will be added to the specifications for all projects covered under this opinion.

Work will be supervised, inspected, and monitored by an on-site individual from CDOT or by an authorized representative.

3. The following terms and conditions implement reasonable and prudent measure number 3. FHWA/CDOT will develop a spreadsheet or other mechanism to track the impacts created by the activities covered under this opinion and annually report this information to the Service. Should the total amount of impact allowed, i.e., 15,160 acres, be approached, then the FHWA and the Service will meet to determine whether reinitiation of consultation will be necessary.

If larger than expected future budgets allow CDOT to undertake reconstruction and capacity improvements on more than 22 percent of the existing network, the Service will be notified in writing so that the FHWA and the Service can meet to determine whether reinitiation of consultation will be necessary.

4. The following terms and conditions implement reasonable and prudent measure number 4. Management plans for each of the properties selected to preserve the covered species will be approved by the Service. Monitoring and management reports for the conservation sites will be submitted to the Service on an annual or semi-annual basis.

5. The following terms and conditions implement reasonable and prudent measure number 5. CDOT Regional environmental personnel will be trained on the BMPs of this program and will ensure that training will be held with the selected contractor prior to the commencement of any activity. The applicable requirements of this program will be added to the specifications for all projects covered under this opinion.

6. The following terms and conditions implement reasonable and prudent measure number 6. CDOT will include in the project specifications that the contractor shall obtain prior written approval from the Service and/or CDOT's Threatened and Endangered Species staff specialist for all borrow or off-site material sources or for material disposal sites. The contractor and workers will be informed during training that they will be required to submit proof of compliance to CDOT. This condition will assure that off-site indirect impacts of the activities to listed species are minimized.

7. The following term and condition implements reasonable and prudent measure number 7. The FHWA will inform the Service in writing when they wish to incorporate a species that is currently addressed in the Conservation Strategy for Non-listed Species (Appendix A) into this biological opinion. The written request will describe how the added species fits into this biological opinion, and any changes in management of the conservation sites that will occur, if any, because of the addition, and the impacts of those changes on all other species, whether listed or not. The request will also contain all other information pertinent to the species and that is needed for consultation.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Reporting Requirements

CDOT will maintain a database that will include project information for activities that are covered in the Biological Assessment. In addition, FHWA/CDOT or their designee will deliver an annual report to the Service that documents the status of all activities covered in the Biological Assessment.

CDOT/FHWA or their designee will deliver monitoring reports for the conservation sites that will describe the type of plant communities/habitats present; land use on-site and in surrounding areas; success of recommendations from previous year and suggested modifications to the management plan; general observations on wildlife diversity, activity, and general trends, noting presence or absence of targeted species, and photos at established permanent locations.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse affects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service has no conservation recommendations at this time relating to the proposed project.

REINITIATION NOTICE

This concludes formal consultation and conference on proposed Federal actions related to the proposed highway improvements. As required by 50 CFR 402.16, reinitiation of formal consultation is required if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an adverse effect to the listed species or critical habitat that was not considered in this opinion, (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where incidental take exceeds the authorized, any operations causing such take must cease pending reinitiation. In addition, if any of the Terms and Conditions are not met, reinitiation of formal consultation will become necessary.

If the Service can be of further assistance, please contact Alison Deans Michael of my staff at (303) 275-2370.

Sincerely,

Susan C. Linner
Colorado Field Supervisor

pc: FWS/ES - GJ
FWS, RO (section 7 Coordinator)
CDOT, Denver, CO (R. Wostl)
Michael

Ref:Alison/CDOT2000/Shortgrass Prairie

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Appendix A: Conservation Strategy for Non-listed Species

Conservation Strategy for Non-listed Species

INTRODUCTION

The purpose of this Conservation Strategy for Non-listed Species is to accompany the Central Shortgrass Prairie Programmatic biological opinion and provide information regarding the three candidate and the thirty-one non-listed species addressed in FHWA/CDOT's programmatic strategy to minimize and compensate for impacts from transportation improvement projects on Colorado's central shortgrass prairie. Supplemental information on the three listed species for which we concurred with a "may affect, not likely to adversely affect" determination, is also given here in the event reinitiation is required. The information in this appendix will be presented using the same general outline as the biological opinion, but will present only additional information. Nothing in this document *replaces* anything in the biological opinion.

One purpose of FHWA/CDOT's programmatic strategy is to treat non-listed species as if they were listed by protecting them into perpetuity with upfront habitat protection and management with the intention that, should any of those species become listed, they can be incorporated into the biological opinion without the need to change the proposed activities because those activities have already been modified to minimize the impact of take. In addition, compensation has already been provided that is commensurate with the anticipated impact. If the Service proposes to list a species, the Service will notify FHWA, and FHWA will prepare a Biological Assessment, incorporating by reference the information already contained in this document, along with any new information. The Service can complete consultation either formally, or informally, as appropriate.

CONSERVATION STRATEGY

Conservation Measures

This strategy will directly benefit the black-tailed prairie dog and species dependent on prairie dogs, their burrows, or prairie dog-modified habitat. Black-tailed prairie dogs are of particular concern in this strategy because this species, more than any other target species, faces limited opportunities for conservation in Colorado due to persistent and sustained eradication efforts. This conservation strategy will also benefit bald eagles, burrowing owls, ferruginous hawks, lark buntings, loggerhead shrikes, long-billed curlews, McCown's longspurs, mountain plovers, massasauga rattlesnakes, Texas horned lizards, and western box turtles. Other targeted species benefitting from this strategy are Cassin's sparrow, lark bunting, lesser prairie-chicken, Arkansas River feverfew, Pueblo goldenweed and the round-leaf four-o'clock. Some species that were not target species (i.e., were not deciding factors in locating conservation areas) will also benefit from this conservation strategy, including: Swainson's hawk (*Buteo swainsoni*), prairie falcon (*Falco mexicanus*), grasshopper sparrow (*Ammodramus savannarum*), chestnut-collared longspur (*Calcarius ornatus*), swift fox (*Vulpes velox*), eastern spotted skunk (*Spilogale putorius*), longnose snake (*Rhinocheilus lecontei*), ground snake (*Sonora semiannulata*), triploid Colorado checkered whiptail (*Cnemidophorus neotesselatus*), mottled dusky wing butterfly (*Erynnis martialis*), simius roadside skipper butterfly (*Amblyscirtes simius*), two-spotted skipper butterfly (*Euphyes bimacula*), Colorado blue butterfly (*Euphilotes rita coloradensis*), and the Colorado green gentian (*Frasera coloradensis*).

Best Management Practices

These BMPs will be employed within areas of presumed presence (as described previously in this biological opinion) for relevant target species. Maps depicting presumed presence for species on the primary species list are included in the report "Estimating Impacts of Highway Projects on Select Rare, Sensitive, or Declining Species on Colorado's Central Shortgrass Prairie" (Grunau and Lavender 2002), which was submitted to the Service with the Biological Assessment. Maps depicting where presence of species was presumed and for which BMPs are the primary conservation strategy are also included in that document. Maps for fish species represent current known distribution and planned recovery areas, as identified by CDOW (pers. comm. Nesler,

2002). These maps are for graphical display purposes only. CDOT will use digital data layers to map presumed presence at more appropriate scales for specific projects.

Interior Least Tern and Piping Plover

(1) If CDOT widens any roads in the vicinity of feeding habitat, roads will be designed so existing surface waters or ground water movement shall be maintained. Where practicable, historic flows will be restored.

Black-tailed Prairie Dogs

(2) CDOT will avoid and minimize impacts from projects to known black-tailed prairie dog colonies within the project footprint.

Burrowing Owls

(3) Although burrowing owls may occur throughout a prairie dog colony, they are most often found near the colony's margins (Craig 2001). Causing abandonment of a nest is a violation of the Migratory Bird Treaty Act and is not covered by this strategy. As such, CDOT will limit work on projects that impact prairie dog colonies within the ROW to the non-nesting season, from August 15 to April 1 (Craig 2001).
(4) Burrowing owls may be present at a burrow up to one month prior to egg-laying and several months after young have fledged. Thus, in areas where burrowing owls are known by the CDOT staff biologist to occur, earthwork should be avoided where possible between March 1 through March 31 and August 15 through October 31 (Craig 2001).
(5) If CDOT engages in spraying for insects on any of its ROWs, this should be reevaluated and eliminated in areas within 225 feet of known nesting locations (Dechant et al. 2001b).
(6) If a project that will impact prairie dog colonies within the ROW cannot be scheduled for construction during any other time except the nesting season (from April 1 to August 15), the project area will be surveyed by the CDOT staff biologist for the presence of burrowing owls. If burrowing owls are found at the site, CDOT will coordinate with USFWS under the Migratory Bird Treaty Act to ensure compliance.

Ground-nesting Birds (Cassin's sparrow, lark bunting, long-billed curlew, McCown's longspur, and mountain plover)

(7) Mowing in CDOT Maintenance Zone 1 (see Figure 2 in biological opinion) shall not exceed one mower width (22 feet maximum) and can be done at any time of the year. Mowing in Zones 2 and 3 in rural areas (those areas with native plants or those areas that are not in cities) shall not occur unless mowing restrictions compromise highway safety or noxious weeds are present. Prior to mowing or other actions necessary for the removal/control of noxious weeds or mowing for highway safety, the Regional Planning and Environmental Manager must be contacted for approval.
(8) Harvesting in the Right-of-Way is only permitted outside the nesting period for migratory birds. Harvesting in the right-of-way rules limit harvesting to a 6-inch height.

Lesser Prairie-chicken

(9) There are currently no known lesser prairie-chicken leks near any CDOT roadways (pers. comm., Kindler 2002). If any CDOT projects are undertaken in known lesser prairie-chicken habitat, CDOT will consult with CDOW and the Service to determine whether or not any new lek sites have been identified in the project area, and if so, what measures should be taken to avoid or minimize potential impacts.

Native Fish and Mussels (Arkansas darter, brassy minnow, common shiner, flathead chub, plains minnow, plains topminnow, southern redbelly dace, suckermouth minnow, cylindrical papershell, and giant floater)

(10) Temporary and permanent erosion and sediment control measures shall be installed at the earliest practicable time consistent with good construction practices to prevent siltation into state waters.
(11) CDOT activities will be planned to avoid alteration of the natural flow regime of any stream and to implement natural flow restoration improvements, where such can be incorporated into the larger transportation improvement project.
(12) All disturbed areas above the ordinary high water mark shall be revegetated with appropriate native plant species to provide bank stabilization, erosion control, and habitat replacement. This may include the creation of riffle habitat using boulders or other bio-engineering techniques, as well as replacing or enhancing the riparian vegetation, wetland and aquatic vegetation. Restoration will be planned and carried out in consultation with CDOW and CDOT's wetlands and/or threatened and endangered species coordinator(s) and CDOT's landscape architect.
(13) Each project requiring an NPDES permit will have a Stormwater Management Plan (SWMP), which will include site-specific BMPs for each project developed or reviewed by CDOT landscape architects in consultation with CDOT's biologists.
(14) To limit possible siltation and other pollution problems of streams, stormwater will be directed away from streams and associated wetlands. Such run-off shall be treated with the most appropriate temporary and permanent best management practices.
(15) No vegetation clearing, grubbing or grading will be done until just before other soil disturbance work is to begin in a specific area. The exposed areas will be stabilized as soon as work in the area is completed.
(16) Actions that result in disturbance of water or sediment underlying state waters will be avoided. Debris from bridge repair will not be allowed to enter the stream or surrounding habitat.
(17) Where possible, deck drains over streams will be eliminated and run-downs will be located on the bridge approach. Energy dissipaters will be placed at the outlet of the rundown as directed by the hydraulic engineer; a vegetated swale shall be installed where practicable for erosion control and as a means of filtering contaminants.
(18) During a project, motor fuels, lubricants, and other toxic substances will be kept at least 50 feet from the stream. The most current edition of CDOT's Standard Specifications for Road and Bridge Construction will govern the use, storage, and stockpiling of chemicals in the vicinity of state waters.

Prairie Butterflies (arogos skipper, hops feeding azure, ottoe skipper, and regal fritillary)

(19) CDOT will complete a sensitive habitat delineation using GPS and GIS technology that will include sensitive habitat for Prairie Butterflies and other species. This information will be provided to maintenance patrols so that inadvertent spraying of habitat does not occur. Where sensitive habitat has been delineated, the following conservation measures will be used where determined to be necessary by CDOT's staff biologist.
(20) Within presumed presence for the regal fritillary as demonstrated by the sensitive habitat delineation, mowing in all Maintenance Zones (see Figure 2 in the biological opinion) or herbicide application will be avoided until late in the season (mid September). The timing of these efforts is important because 1) adults are generally present and feeding during most of the summer; and 2) the larvae feed upon their host plants when the plants themselves are most visible during the spring. If mowing must occur while larvae are feeding, the blade will be adjusted to a height of at least six inches, and mowing will be preceded by surveys by the CDOT staff biologist for violets (Wisconsin DNR 2000).
(21) Reseeding of disturbed areas will use a mix of native graminoids and forbs. When adequate moisture is available and seed is available, species that may be included in the mix are big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), switchgrass (*Panicum virgatum*), milkweeds (*Asclepias speciosa* and *A. incarnata*), dogbane (*Apocynum cannabinum*), coneflower (*Ratibida columnifera* and *Rudbeckia hirta*), wavy-leaf thistle (*Cirsium undulatum*), and horsemint (*Monarda fistulosa*). Mixes shall be as specified and/or approved by the CDOT landscape architect.
(22) Herbicide applications, if necessary, will occur in early spring or after mid-July, in order to correlate with the timing of the butterflies in their adult stages.
(23) Should mowing be necessary for safety requirements, CDOT will seek to maintain at least one-half the width of the roadside in an unmowed state. Mowing will occur in the spring to

reduce the incidence of and competition from exotic cool season graminoids with warm season native grasses.
(24) If wild hops (*Humulus lupulus*), the larval host for hops feeding azures, is present in riparian or gulch areas, CDOT will avoid removing the hops to the maximum extent practicable, and will attempt to maintain a rocky and sunny exposure if that is the original condition of the habitat.
(25) CDOT is following a plan to reduce the spread, and eliminate where possible, noxious weeds in the ROW, through a program of mapping and treatment of larger patches of noxious weeds. Noxious weeds and Russian olive trees in areas of mitigation will be removed, to the extent practicable, to maintain a non-competitive, open, and sunny habitat for the butterflies, the hostplant(s), and the nectar sources.
(26) If road widening has potential to alter hydrologic regimes (and thus adjacent grasslands), culverts will be installed to ensure that water flow is not disrupted.

Northern Cricket Frog and Northern Leopard Frog

(27) If construction activities are to occur between March 1 and July 31 at sites that contain habitat for the northern cricket frog or the northern leopard frog, the CDOT staff biologist and the Service will be consulted prior to construction to determine actions necessary to avoid and minimize impacts.
(28) Pesticide application near permanent bodies of water will be restricted during the period of frog metamorphosis (June - August).

Texas Horned Lizard, Massasauga Rattlesnake, and Western Box Turtle

(29) In areas with high population densities of the target species, underpasses and drift fences will be installed where practicable, as part of reconstruction projects. Because Hammerson (1999) counsels caution in placing such devices, and additionally recommends education of the public via roadside signs placed at known turtle crossings, the CDOT staff biologist and the Service will be consulted before construction activities begin in known Texas horned lizard, Massasauga or Western Box Turtle habitat to determine that crossings are properly placed and determine if road signs should be used.

Rare Plants (Arkansas Valley evening primrose, Colorado butterfly plant, and golden blazing star)

(30) If target plant(s) are present, mowing will be avoided until late in the season (mid-September) if possible. The timing of these efforts is important because flowering does not occur until mid-summer, and therefore, seeds are not fully developed until fall. If mowing cannot wait until autumn (e.g., for safety reasons), spring mowing (prior to June 15) will still allow plants to complete their reproductive life cycle.
(31) Re-seeding of disturbed areas will be with a mix of native graminoids and forbs wherever possible. Native mixes shall be specified and/or approved by the CDOT landscape architect.
(32) Herbicide applications will be used only if the herbicide targets monocots but not dicots. If monocot targeted herbicides are used, timing of application is not an issue.
(33) Where road widening results in alteration of the hydrologic regime, efforts will be made to ensure that water flow is not interrupted.
(34) While the majority of known occurrences for golden blazing star (*Nuttallia chrysantha*) are in the ROW of existing roads, road widening is not expected to occur within 165 feet of existing populations of this plant. This species does not transplant well. Re-seeding disturbed areas may be a viable alternative, but it is very important not to decimate the original seed source population. This species is not abundant, and seed availability is limited. Seed harvest is restrained so as not to deplete the soil seed bank in remaining populations. Therefore, habitat destruction for this species will be avoided to the maximum extent practicable.

Status of the Species

Interior Least Tern (*Sterna antillarum*)

Species Description

The least tern is the smallest member of the tern family. It is a colony nesting shorebird found near shallow water bodies in the interior of North America during the summer. It feeds on small fish taken from rivers or sand pit ponds (Wilson 1991), and breeds on barren ground that is surrounded by water. Nest cups tend to be unlined (Ehrlich et al. 1988). Following the breeding season, least terns gather in small flocks along rivers to feed in preparation for migration. They are thought to winter on beaches along the Central American coast and along the northern coast of South America from Venezuela to northeastern Brazil (Ehrlich et al. 1988).

In Colorado, interior least terns usually arrive on their breeding grounds in mid- to late May, when water levels are receding and thus revealing bare ground (Nelson 1998c). In years with high runoff, nesting may be deferred until water levels have receded, or the colony may move (Nelson 1998c). Feeding is largely on small fish and crustaceans captured in the shallow water of rivers and lakes. Interior least terns probably do not nest on alkali playas in Colorado because such playas cannot support fish (Nelson 1998c).

Distribution and Status

The interior least tern historically nested along the Colorado (in Texas), Red, Rio Grande, Arkansas, Missouri, Ohio, and Mississippi River systems. It currently nests in the Mississippi and Rio Grande River basins from Montana south to Texas, and from eastern New Mexico and Colorado to Indiana and Louisiana (Nelson 1998c). This species is thought to overwinter in Central and South America (National Geographic Society 1999).

There are three distinct subspecies of least tern. The coastal least tern breeds along the U.S. Atlantic coast from the southern tip of Texas north to southern Maine; the California least tern breeds from southern Baja California and Mexico, north to San Francisco Bay; the interior least tern breeds locally along the major tributaries of the Mississippi River drainage basin from eastern Montana south to Texas and east to western Illinois, Missouri, Arkansas and Louisiana (National Geographic Society 1999).

Population counts of interior least terns, made at the time this bird was listed under the Act (1985), found 1,400-1,800 birds (Whitman 1988). Counts of the interior least tern made in 1988 found 4,932 individuals. Counts made in the 1990s found approximately 7,000 birds (Sidle and Faanes 1997).

In Colorado, least terns were confirmed to be nesting at Horse Creek Reservoir on the border of Bent and Otero counties, and Adobe Creek Reservoir on the border of Bent and Kiowa counties, during 1978 (Chase 1979). In 1990, they were confirmed to be nesting again at Adobe Creek Reservoir and also at Neenoshe Reservoir in Kiowa County (Nelson 1998c). In 1991, 23 nests were located, while in 1995 only 12 nests were located, and 1996, 19 nests were located (Nelson 1998c). In 2001, 20 pairs produced 26 nests, 67 eggs, and 31 fledglings from Tern Island at Adobe Creek Reservoir, John Martin Reservoir in Bent County, and Neenoshe Reservoir (Nelson 2001).

The interior population of the least tern was federally-listed as endangered in 1985 (50 FR 21792). There are now approximately 7,000 terns widely distributed across the interior of the United States (Sidle and Faanes 1997). The interior least tern is listed as state endangered in Colorado, and has a CNHP rank of G4/T2QS1B (the species is apparently secure globally; the subspecies, as currently described, is considered imperiled across its range; there is uncertainty about taxonomic status; breeding birds are extremely rare in Colorado) (CNHP 2002b).

Habitat

Historically, interior least terns nested on river sandbars scoured by spring runoff (Nelson 1998c). In Colorado, nesting habitat included sandbars in the South Platte River (Lamb 1950). Now that such habitat along rivers is largely nonexistent, they are found on the shores and especially the islands of irrigation reservoirs (Nelson 1998c). The occurrence of breeding least terns is localized and is highly dependent on the presence of dry, exposed sandbars and favorable river flows that support small fish, and that isolate the sandbars from the riverbanks, providing

protection from terrestrial predators. Characteristic riverine nesting sites are dry, flat, sparsely vegetated sand and gravel bars within a wide, unobstructed, water-filled river channel.

Nest sites are devoid of vegetation. Plant cover at nest sites is usually less than 20 percent at nest initiation (Sidle and Faanes 1997). In a comparison of sandbar area, channel width, mean elevation, and maximum elevation of nest sites versus random sites along the lower and central Platte River, piping plovers and least terns selected for wide channels having large areas of dry, sparsely vegetated sand (Ziewitz et al. 1992).

Like the piping plover, least terns seem to prefer nesting habitat that provides wide, horizontal visibility, protection from terrestrial predators, rises in water level, and disturbance (Sidle and Fannes 1997). Dry, mid-stream, mostly barren sandbars in wide, open channel beds of rivers historically provided these conditions (Schwalbach 1988; Ziewitz et al. 1992).

Conservation Planning

The Interior Least Tern Recovery Plan calls for the maintenance of the distribution and range of the tern through protection of essential habitat and restoration of nesting habitat (i.e., suitable sandbars in the river channel with adequate stream flows).

There is a Colorado recovery plan for the interior least tern that focuses on recovery and creation of nesting habitat, primarily at Tern Island on the Adobe Creek Reservoir. This includes removal of saplings around the Tern Island shore and the creation of nesting habitat on an island in John Martin Reservoir (Nelson 1998c).

Piping Plover (*Charadrius melodus*)

Species Description

The piping plover is a small, migratory, beach-nesting shorebird. Adults return from wintering grounds in late April and initiate nesting in early May. Nests are scrapes placed in open sand and lined with small pebbles (Nelson 1998b). Piping plovers are often found nesting near snowy plovers (*C. alexandrinus*), killdeer (*C. vociferous*), spotted sandpipers (*Actitis macularia*), American avocets (*Recurvirostra americana*), and least terns (*Sterna antillarum*), all of which require similar nesting habitat (Nelson 1998b). Food consists of native minnows. Both adults incubate the eggs and feed the young. Piping plovers feed by gleaning invertebrates from the substrate on exposed wet sand (Corn and Armbruster 1993).

Distribution and Status

Piping plovers nest in three disjunct regions of temperate North America. One population (endangered) consists of a few breeding pairs, and only nests on the shores of northern Lake Michigan (Nelson 1998b). A second population (threatened) breeds along the Atlantic shore from the maritime provinces of Canada to South Carolina. The third population (threatened) nests on the prairies from southern Canada to Kansas and Colorado. Piping plovers winter on the coasts of the Atlantic and Gulf of Mexico from North Carolina to Mexico, and in the Bahamas, Cuba and the West Indies (Commission for Environmental Cooperation 2000).

The breeding range of the northern Great Plains population extends from southern Alberta, northern Saskatchewan and southern Manitoba, south to eastern Montana, North Dakota, South Dakota, southeastern Colorado, Iowa, Nebraska, and east to Lake of the Woods, Minnesota (USFWS 2001).

In 1991, all known piping plover breeding sites were censused (Haig and Plissner 1995) and the continent-wide population was found to be 5,486 adults at 728 sites (Haig and Plissner 1995). The northern Great Plains and prairie population consisted of 2,030 adults at 314 sites, and the Colorado population had 13 adults at four sites (Haig and Plissner 1995). The 1996 International Piping Plover Census found 5,800 breeding individuals in 20 states, nine Canadian Provinces and a few French-owned islands off the coast of Newfoundland (Commission for Environmental Cooperation 2000). The northern Great Plains plover population was found to be declining by

seven percent annually (Ryan et al. 1993). The 1999 count found only 2,668 pairs of piping plover in North America (Kuzminski 1999). The continental interior population in 1999 consisted of 975 pairs (Kuzminski 1999), a decline from the 1991 count. In the United States, the interior piping plover population decreased from 682 pairs in 1988 to 296 pairs in 1999 (Kuzminski 1999).

The Colorado breeding sites are in Prowers, Bent, Kiowa, and Baca Counties in the southeast corner of the state (Nelson 1998b). During the 1991 census, nesting piping plovers were only found at the four Great Plains Reservoirs in Kiowa County (Nelson 1998b). In 1992, they were also found on the Adobe Creek and John Martin reservoirs (Nelson 1998b), where they remained in 1995 (Nelson 1998b). From 1990 to 1995, only three to eight pairs nested in Colorado annually (Nelson 1998b). In 2001, three unmated males and five nesting pairs of piping plovers were documented (Nelson 2001). Twenty-four eggs were produced and seven young fledged (Nelson 2001). Successful nests were at John Martin Reservoir and Neenoshe Reservoir (Nelson 2001). It has been hypothesized that the Colorado population developed from birds displaced by droughts elsewhere (Sidle and Kirsch 1993), or from flooded out habitat in Oklahoma (Nelson 1993).

There are three distinct population segments of the piping plover, all listed under the Act. The Great Lakes population (the Great Lakes watershed states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin and Ontario) is listed as endangered, and the Atlantic coast and northern Great Plains populations are both listed as threatened (50 FR 50733). All piping plovers winter along the coasts of the southeast Atlantic and Gulf of Mexico, and are listed as threatened in their wintering habitat (50 FR 50733). Critical habitat has been proposed for the northern Great Plains population - there is none in Colorado - (66 FR 31759-31815), and for wintering habitat (65 FR 41782). The comment period for the designation of critical habitat for the northern Great Plains population was reopened and closed May 20, 2002 (67 FR 13123). The Piping Plover Recovery Team has recommended that the northern Great Plains population of the piping plover be reclassified as endangered (Sidle and Faanes 1997).

On December 11, 1985, the piping plover was listed as endangered under the Act in the Great Lakes portion of its range, and was listed as threatened in the other portions of its range including Colorado. Final critical habitat was designated on September 11, 2002, but was not designated within Colorado. On August 5, 2002, the Notice of Availability for review and comment of the draft recovery plan for the Great Lakes population was published in the Federal Register. The piping plover occurs along shorelines of lakes, peninsulas, and islands, as well as river channels and their sandbars and islands. Piping plover breeding sites have been found in Prowers, Bent, Kiowa and Baca Counties in southeastern Colorado.

The northern Great Plains population is listed as threatened in Canada and in Mexico (Commission for Environmental Cooperation 2000). The piping plover is listed as state threatened in Colorado, and has a CNHP rank of G3/S1B-SZN (very rare or local throughout its range or found locally in a restricted range; breeding birds in Colorado are very rare; no consistent location can be discerned for migrants or non-breeding populations) (CNHP 2002b).

Habitat

Nesting habitat for the northern Great Plains and prairie populations of piping plovers includes prairie alkali wetlands and surrounding shoreline; inland and reservoir lakes, along with their sparsely vegetated shorelines, peninsulas and islands; and river channels and their associated sandbars and islands (66 FR 31759-31815). Like the interior least tern, the piping plover seems to prefer nesting habitat that provides wide, horizontal visibility, protection from terrestrial predators, protection from rises in water level, and protection from disturbance (Sidle and Faanes 1997). Dry, mid-stream, mostly barren sandbars in wide, open channel beds of rivers historically provided these conditions (Schwalbach 1988; Ziewitz et al. 1992).

Piping plovers initiate nest building only after spring and early summer flows recede and dry areas on sandbars are exposed, usually on higher elevations away from the water's edge. Artificially created nesting sites, such as sand and gravel pits, dredge islands, and reservoir shorelines are also used.

In a comparison of sandbar area, channel width, mean elevation, and maximum elevation of nest sites versus random sites along the lower and central Platte River, plovers and terns selected for wide channels having large areas of dry, sparsely vegetated sand (Ziewitz et al. 1992).

In Colorado, piping plovers nest on broad, sandy beaches that are, ideally, located on islands (Nelson 1998b). They have successfully adapted to nesting on the shores of off-stream reservoirs and initiate nesting as the water level drops due to irrigation withdrawals (Nelson 1998b).

Conservation Planning

The piping plover recovery plan (USFWS 1988) calls for the maintenance of the distribution and range of the piping plover by protecting essential habitat and restoring nesting habitat (i.e., suitable sandbars in river channels with adequate stream flows).

CDOW has implemented a recovery plan for piping plovers that emphasizes habitat improvement and vegetation control. The plan uses agreements with ditch companies, closure of nesting beaches, manual removal of cottonwood saplings encroaching on nesting beaches, and predator exclosures (Nelson 1998b).

In 1994, the Department of the Interior entered into a Memorandum of Agreement with Colorado, Nebraska, and Wyoming to establish the Platte River Basin Program. Its primary focus is to address the needs of federally-listed species, including the piping plover, along the central Platte River by improving and conserving habitat (Sidle and Faanes 1997).

Colorado Butterfly Plant (*Gaura neomexicana* ssp. *coloradensis*)

Species Description

The Colorado butterfly plant is an early successional, perennial herb of the evening primrose family (Onagraceae) that lives vegetatively for several years before bearing fruit once and then dying. Flowering stems are 50-80 centimeters tall, and non-flowering plants consist simply of a stemless, basal rosette of leaves (Marriott 1987; Fertig 1994). This species was first collected near Fort Collins, Colorado, in 1895 (Munz 1938). The butterfly plant is endemic to moist soils in wet meadows associated with floodplains (USFWS 2000a), and is adapted to use periodically-disturbed stream channel sites. The vegetative rosettes seem to be fairly resistant to disturbance events, but are sensitive to low soil moisture. Generally it is a plant with a restricted geographic range and high habitat specificity (USFWS 2000a).

Distribution and Status

Little is known about the historical distribution of the butterfly plant (Fertig 1994). Intensive range-wide surveys between 1984-1986 identified more than 20 populations in Wyoming, Colorado and Nebraska with approximately 20,000 flowering individuals (Marriott 1987). Subsequent surveys have confirmed populations in Wyoming and Colorado (Fertig 1994; Floyd 1995). Today this species is confined to an area of approximately 17,000 acres (6,880 hectares) in northcentral Colorado, extreme western Nebraska, and southeastern Wyoming (USFWS 2000a). Most are on private land (USFWS 2000a). The only known extant location in Colorado is near Fort Collins, adjacent to Interstate 25, on land owned by the City of Fort Collins (CNHP 2002a).

The Colorado butterfly plant was listed as threatened throughout its range under the Act (50 CFR 62302) on October 18, 2000. The Colorado butterfly plant has a CNHP rank of G3T2/S1 (the species is vulnerable globally; the subspecies is imperiled globally; critically imperiled in Colorado due to extreme rarity) (Spackman et al. 1997; CNHP 2002b). It is a U.S. Forest Service sensitive species, though its presence on U.S. Forest Service land is unknown (Spackman et al. 1997).

Habitat

The butterfly plant occurs on sub-irrigated, alluvial soils on level to slightly sloping floodplains and in drainage bottoms between 5,000 to 6,400 feet (1,524 and 1,951 meters) (USFWS 2000a). It occurs in depressions or along bends in wide, active meandering stream channels just upslope of the channel, and requires early to mid-succession riparian habitat. Typical habitat is open, periodically disturbed (flooded), and without dense vegetation. Establishment and survival of seedlings decrease with a decrease in disturbance and the consequent increase in plant density (Floyd 1995; Fertig 1996).

Conservation Planning

There are no federal or state laws or regulations other than the Act that provide protection for the plant or its habitat. Designation of critical habitat has been deferred (USFWS 2000a). The City of Fort Collins has land use planning regulations that provide protection for riparian habitats. The largest known site of this plant is on F. E. Warren Air Force base in Wyoming, which has been designated the Colorado Butterfly Plant Research Natural Area, and a management plan has been developed for this population (Marriott and Jones 1988).

Arkansas Darter (*Etheostoma cragini*)

Species Description

The Arkansas darter is a three-inch member of the perch family (Percidae). It prefers small, shallow, usually spring-fed streams with a sandy substrate, slow current, cool water, and abundant aquatic vegetation. These characteristics provide both reproductive and non-reproductive habitat. Darters are apparently able to withstand short duration changes from the preferred conditions during droughts or heavy runoff following rainstorms (Miller 1984). Breeding occurs in spring, with eggs being deposited in open areas on organic ooze covering a sandy substrate (Woodling 1985). Juveniles remain in the open areas while adults prefer areas with aquatic vegetation (Woodling 1985). The darters feed on aquatic insects (especially mayflies) and some plant material, including seeds (Moss 1981).

Distribution and Status

The Arkansas darter is a native of the Arkansas River in Colorado. There is little historical information for this species (CDOW 2001) from which to estimate either historical range or abundance. However, it is likely that distribution was continuous prior to Euro-American settlement (Eberle and Stark 2000).

In Colorado, there are reports of darters as far north as Limon and as far west as CaZon City (CDOW 2001). Scientists generally assume that the darter's distribution and abundance have declined in concert with loss of riparian habitat and decreases in groundwater aquifers supporting spring-fed environments in the Arkansas River drainage (CDOW 2001). In recent years, the Arkansas darter has been found in tributaries of the Arkansas River in southeastern Colorado, southern Kansas, northeastern and northwestern Oklahoma, southwest Missouri and northwest Arkansas (Lee et al. 1980).

From 1979-1982, CDOW surveyed intensively in southeast Colorado and found the Arkansas darter in the Fountain Creek, Rush Creek and Big Sandy Creek drainages (Loeffler et al. 1982). From 1993-1996, CDOW carried out another intensive survey and found distribution changed little from the earlier survey (Nesler et al. 1999). Currently there are 11 populations in five tributaries to the Arkansas River - Fountain Creek, Rush Creek, Big Sandy Creek, Horse Creek and Chico Creek (CDOW 2001).

The Arkansas darter was included as a federal candidate species (61 FR 40) February 28, 1996. It is listed as threatened under State law in Colorado and Kansas, endangered in Oklahoma, rare in Arkansas, and is a U.S. Forest Service sensitive species (CDOW 2001). It has a CNHP rank of G3/S2 (vulnerable throughout its range; imperiled in Colorado) (CNHP 2002b).

Habitat

Darters prefer clear, shallow streams with a sandy substrate that is partially overgrown with rooted aquatic vegetation, slow current, and cool water (Miller and Robinson 1973; Cross and Collins 1975). It is primarily a tributary species, but needs a connection to the mainstem for colonization and dispersal.

Conservation Planning

The State's Arkansas Darter (*Etheostoma cragini*) Recovery Plan (CDOW 2001) is a plan designed to preserve the Arkansas darter and its habitat, to restore the species to a viable condition, and to remove it from Colorado's threatened species list (CDOW 2001).

Black-tailed Prairie Dog (*Cynomys ludovicianus*)

Species Description

Black-tailed prairie dogs are diurnal, mid-sized burrowing rodents that live in colonies composed of harem-polygynous family groups (Hoogland 1995) on short- and mixed- grass prairies of the North American grasslands. They are monestrus, with a litter size (when young first emerge) from one to six, with an average of three (Hoogland 1995). Most subadult males and some subadult females will disperse from their natal colonies before they reach sexual maturity at two years (Hoogland 1995). On average, over her lifetime (about five years) a female will produce 2.14 yearlings (Hoogland 1995).

Black-tailed prairie dogs are selectively herbivorous, with the preferred food species varying through the year and dependent on local plant community composition (Fagerstone 1981). Graminoids seem to be selected over forbs, but preferred species include wheatgrass, blue grama, buffalo grass, globemallow (*Sphaeralcea coccinea*) and rabbitbrush (*Chrysothamnus* spp.) (Kelso 1939; King 1955; Koford 1958; Bonham and Hannan 1978; Garret and Franklin 1988). Winter foods add prickly pear cactus (*Opuntia* spp.) and underground roots (King 1955; Summers and Linder 1978) to the diet.

Vegetation is also clipped to maintain visibility in the vicinity of the burrows. Long-term colonization of an area can result in a change in plant species composition from a grass-dominated community to a forb-dominated community with bare ground (Severe 1977; Coppock et al. 1983; Archer et al. 1987).

Black-tailed prairie dogs are active year round, but during extremely cold weather will remain underground for several consecutive days. Colonies can expand to occupy suitable adjoining habitat. Dispersal of up to ten kilometers has been documented (Knowles 1985), though most dispersal occurs within two kilometers.

Distribution and Status

Between 1900 and the present, the area of the western United States occupied by black-tailed prairie dog colonies has been reduced from an estimated 4 x 107 hectares to less than 600,000 hectares (9,880,000 to 1,480,000 acres) (Biggins and Godby 1995; Knowles 1998; Nowak 1999). Governmental and private pest control, conversion of habitat from grassland to crops, and sylvatic plague (*Yersinia pestis*), have been identified as the primary mechanisms of this decline (Cully and Williams 2001). Over the last two decades, poisoning and plague epizootics have continued to result in range wide declines of black-tailed prairie dog populations (USFWS 2000b). This represents an overall reduction in colony acreage since European settlement of North America of more than 90 percent (Biggins and Godbey 1995; Mulhern and Knowles 1997; Ostlie et al. 1997).

In the 1800s, black-tailed prairie dog colonies covered large portions of the eastern third of Colorado (Cary 1911). Historical estimates suggest that 20 percent of the shortgrass and midgrass prairies may once have been inhabited by prairie dogs (Lauenroth 1979). The largest recent concern for black-tailed prairie dog habitat in Colorado has been habitat conversion. In the Front Range corridor, urban development has resulted in highly fragmented habitat. On the eastern plains, the conversion of grassland to agriculture from the late 1800s on has resulted in the conversion of large sections of prairie. The result is a patchwork of prairie and cropland leading to mostly small remnant prairie dog colonies scattered across the eastern plains (EDAW 2000).

In a study completed for the Colorado Department of Natural Resources, EDAW (2000) developed a GIS database of known black-tailed prairie dog occurrences in eastern Colorado. EDAW (2000) documented 314,114 acres of active, inactive, no longer present and unknown status colonies. Data were assembled from federal, state, and local agencies. Some of the colony status data had been verified within the last five years (1,348 colonies), while 1,087 colonies had not been verified in over ten years, and another 507 had not been verified within the last five years. EDAW field checked 38 percent of the acreage in the baseline they compiled. They concluded that of the 314,114 acres of black-tailed prairie dog habitat, 190,423 acres was active and the remainder was inactive (21,599 acres), no longer present (45,037 acres), or of unknown status (57, 056 acres). Relying on information from 1995-2000, EDAW summarized active colonies by size and found that the average current colony size is 75 acres, with a range of 0.04 acres to 4,129 acres. Of 2,578 colonies, they found that only one percent, or 17 active colonies, were greater than 1,000 acres, two percent (45 colonies) were greater than 500 acres and less than 1000 acres, and the remainder less than 500 acres.

The black-tailed prairie dog is a candidate species for listing under the ESA. The USFWS (2000b) found that the species warrants listing but that higher priority species are in need of more immediate action, thus precluding the listing of the black-tailed prairie dog. In its 12-month finding of February 3, 2000, the USFWS again found that listing was warranted but precluded by other listing priorities. The 2001 review found no need to alter this status. It is a U.S. Forest Service sensitive species, and it is a species of special concern in Colorado. The black-tailed prairie dog has a CNHP rank of G4/S4 (apparently secure rangewide and in Colorado) (CNHP 2002b).

The American Society of Mammalogists (1998) adopted a “Resolution on the decline of prairie dogs and the grassland ecosystem in North America,” and the Society for Conservation Biology adopted a resolution on “Conservation of Prairie-dog Ecosystems (in Litt.).” Both express

concern not only for prairie dog population declines, but also for loss and degradation of the system of which prairie dogs are a part.

Habitat

Black-tailed prairie dogs occur primarily on shortgrass and mixed-grass prairies on the Great Plains. Colonies are usually found on sites with slopes of less than ten percent (Koford 1958; Dalstad et al. 1981; Clippinger 1989; Reading and Matchett 1997). Prairie dogs avoid wetlands and areas with high water tables. The most suitable habitats are those with low plant cover, and thus increased visibility that likely enhances their ability to detect predators (King 1955; Hoogland 1981). The selection of new territories by dispersing individuals seems to be influenced by visibility at the new site (Cincotta 1985; Knowles 1985). In a study of black-tailed prairie dog colonies surrounded by tall grass, Osborn and Allen (1949) found that they abandoned sites or were gradually eliminated if they could not keep vegetation clipped. Total canopy cover ranged from 58 percent to 70 percent in work done in northern Colorado (Klatt and Hein 1978).

Black-tailed prairie dogs change the landscape that they colonize in several ways. They maintain the plant community in an early seral stage, maintain grasses in an early growth stage, keep vegetation height low, increase the proportion of bare ground at a site, and create a plant community pattern with forbs at the center of a colony with an increasing proportion of grasses toward the periphery (Koford 1958; Garrett and Franklin 1988).

Black-tailed prairie dogs facilitate complex species interactions by increasing landscape heterogeneity and creating conditions attractive to other species, including black-footed ferrets (endangered species), mountain plovers, ferruginous hawk (sensitive species), swift fox (sensitive species), burrowing owls (sensitive species), rabbits, voles, mice, and a variety of insects and snakes (Knowles and Knowles 1994; Hoogland 1995). Their digging contributes to enhancing soil structure, water filtration, and forb growth (Koford 1958). Ungulates seem to prefer grazing on prairie dog colonies due to the greater nutritional value (high nitrogen and low stem content) per unit biomass of vegetation found in colonies (King 1955; Coppock et al. 1983; Holland and Detling 1990). In turn the ungulates reduce vegetation height, which is advantageous to prairie dogs (Foster and Hygnstrom 1990; Sharps and Ursek 1990). Generally, species richness appears to be significantly higher in prairie dog colonies than in surrounding areas (Reading 1993).

Conservation Planning

The conservation of prairie dogs, and thus of their large-scale functional role on short and mixed-grass prairies, is necessary to maintain viable numbers of species found in association with them. The state of Colorado is engaged in developing a management strategy for black-tailed prairie dogs that includes prohibiting hunting east of Interstate 25 and in Adams, Arapaho, Boulder, Broomfield, Custer, Douglas, El Paso, Fremont, Huerfano, Jefferson, Las Animas, Larimer, Pueblo, and Weld counties (CDOW 2002a). However, private landowners have the authority to control prairie dogs on their land. The CDOW has initiated a private landowner incentive program to help landowners conserve habitat required by prairie dogs and other species that interact with or depend on them, including the mountain plover and the burrowing owl (CDOW 2002a). In the program, CDOW will make $600,000 available to landowners in the Baca, West Greeley, South Pueblo, and Turkey Creek soil conservation districts. Landowners will be allowed to offer a per-acre bid for the amount of compensation they think is reasonable for protecting prairie dogs on their property (CDOW 2002a). The Division and the soil conservation districts will then evaluate potential parcels based on quality of habitat, size of prairie dog colonies, acres of shortgrass, proximity to protected habitat, and distance from adjacent landowners (CDOW 2002a). Lands that provide the best benefit at the least cost will be accepted into the program. Landowners will be able to enter five or ten year agreements. The smallest parcels acceptable will be 160 acres, with prairie dogs present on at least 25 percent of the land. Compensation will be based on total acreage enrolled (CDOW 2002a).

The Colorado Department of Agriculture classifies the prairie dog as an “agricultural pest” and helps landowners reduce or eliminate prairie dog populations on their land (EDAW 2000).

In response to the proposal to list black-tailed prairie dogs as threatened under the Act, the 13 states having black-tailed prairie dog populations have undertaken a regional planning process as the Interstate Black-tailed Prairie Dog Conservation Team. The purpose is to manage, maintain, and enhance habitat and populations of black-tailed prairie dogs across their historic range. Chief among the strategies are eliminating mandatory control, regulating seasons and possession limits, and maintaining, conserving, and establishing core populations on public lands.

The Pawnee National Grassland and Comanche National Grasslands together comprise 528,767 acres (approximately two percent) of Colorado's central shortgrass prairie. The U.S. Forest Service has selected the black-tailed prairie dog as the management indicator species for low structure grasslands and the biological community associated with prairie dog colonies on the national grasslands of the Northern Great Plains. Their management goal is to encourage the growth of large complexes, maintain small colonies, and limit control of prairie dogs to the maximum extent possible. The Comanche National Grassland contains 1,375 acres of prairie dog colonies, and the Pawnee National Grassland contains 1,008 acres of prairie dog colonies (EDAW 2000). To date, management recommendations have not resulted in increased acreage of prairie dogs on the Pawnee National Grasslands, for as yet undetermined reasons (pers. comm., Currey 2002).

Lesser Prairie-chicken (*Tympanuchus pallidicinctus*)

Species Description

The lesser prairie-chicken is a member of the subfamily Tetraoninae, a diverse group of ground dwelling birds with stocky bodies, short, thick legs with toes adapted for walking and scratching, and in which flight is brief but strong (Johnsgard 1975, 1983). This species is a non-migratory resident of arid shortgrass prairies with shinnery oak *(Quercus havardii*) or sand sagebrush (*Oligosporus filifolius*) (Jones 1963; Sutton 1967; Oberholser 1974; Andrews and Righter 1992).

Lesser prairie-chickens are primarily insectivorous during the summer months, with large grasshoppers the prey of choice (Kingery 1998; Mote et al. 1998). During the remainder of the year, birds consume plant materials including leaves, buds, catkins, seeds, and galls (Copelin 1963; Hoffman 1963). Juveniles depend almost entirely on insects (CDOW 1993).

Lesser prairie-chickens are polygynous. Males perform elaborate courting displays on leks to which the birds demonstrate a great deal of fidelity (National Geographic Society 1999). Females build ground nests, incubate the eggs, and care for the young alone (Johnsgard 1975, 1983). Nests consist of a scrape made on well-drained sites in ungrazed meadows or natural prairie within 0.8 kilometers of leks (Mote et al. 1998), and are concealed by small shrubs, or grass clumps from the previous years' growth of tall, dense, perennial grasses (Mote et al. 1998; Winn 1998).

Distribution and Status

The lesser prairie-chicken ranges from western Kansas and southeastern Colorado, south to the Texas panhandle, the Oklahoma panhandle, and eastern New Mexico (AOU 1983; Winn 1998). Prior to the 1930s, this species was common and was thought to number more than one million birds in Texas alone (USFWS 1998), but these numbers have since declined dramatically. The continent-wide population estimate today is approximately 50,000 breeding birds (CDOW 1993). It is considered to have the smallest population and most restricted distribution of all North American prairie grouse (Johnsgard 1983; Giesen 1998).

Lesser prairie-chicken distribution and population size have been significantly impacted by human activities. Excessive livestock grazing of rangelands and conversion of native rangelands to cropland or introduced pastures have significantly reduced populations and distributions. Since the 1800s, lesser prairie-chickens have experienced rangewide reductions of 92 percent, including a 78 percent reduction in occupied range since 1963 (Taylor and Guthery 1980).

The first confirmed report of lesser prairie-chickens in Colorado comes from Baca County in 1914 (Bailey and Niedrach 1965). Before the grasslands were converted to agricultural uses, lesser prairie-chickens were probably "fairly common" in southeastern Colorado (Bailey and Niedrach 1965). Today, Colorado's population is estimated at 2,000-4,000 birds found largely in the Comanche National Grasslands and on private lands south of the Cimarron River (CDOW). Colorado's population, which has increased since 1977 largely due to habitat protection on the Comanche National grassland, is the only population exhibiting consistently positive trends (Andrews and Righter 1992). Between 1986 and 1990, CDOW identified 58 active leks, 40 of them in Baca County and most on the Comanche National Grasslands (Giesen 1994a).

The lesser prairie-chicken is a federal candidate species. It was proposed for federal listing under the ESA in 1995, but in a 12-month finding (9 June 1998) the USFWS found that listing was warranted but precluded (USFWS 1998). It is a U.S. Forest Service sensitive species on the National Grasslands, and the Bureau of Land Management considers it an emphasis species. The lesser prairie-chicken has a CNHP rank of G3/S2 (vulnerable throughout its range; imperiled in Colorado) (CNHP 2002b).

Habitat

Ideal lesser prairie-chicken habitat exhibits structural diversity, including short to mid-height grasses that provide both forage and cover. Forbs and small shrubs interspersed among the grasses provide cover for nesting as well as food and winter cover. Leks are devoid of cover and are characterized by short grasses or other low-growing vegetation (Giesen 1994b). All of these components (i.e., leks, nest and brood-rearing cover, winter cover, and food) must occur within an area of two to four square miles. In southeast Colorado, lesser prairie-chicken habitat consists of sand sagebrush communities dominated by sand dropseed (*Sporobolus cryptandrus*), sideoats grama (*Bouteloua curtipendula*), threeawn (*Aristida* spp.), and blue grama (*Bouteloua gracilis*) (Mote et al. 1998; Winn 1998; USDA-NRCS 1999). Research from Kansas found that optimum habitat consisted of 75 percent grassland and 25 percent cropland (Horak 1984). Generally, areas composed of less than 63 percent native rangeland have been found to have little ability to support viable populations of lesser prairie-chickens (Mote et al. 1998).

Conservation Planning

An interstate working group, including Colorado, Kansas, New Mexico, Oklahoma, and Texas, has developed a strategy for conservation and recovery of the lesser prairie-chicken (Mote et al. 1998). This conservation plan is the start of a cooperative effort among state and federal agencies and private landowners to conserve the lesser prairie-chicken and the habitat on which it depends.

On the Comanche National Grassland, the U.S. Forest Service provides special management for the species. Their goal is to maintain sandy rangeland in good to excellent condition (Taylor and Guthery 1980). CDOW has undertaken transplantation of flocks into high quality non-federal habitat in southeastern Colorado, but success so far is unknown (Braun et al. 1994).

The Conservation Reserve Program may provide habitat for lesser prairie-chickens if lands remain in the program long enough to develop a shrub community and also supply all of the other habitat components within two to four square miles.

Mountain Plover (*Charadrius montanus*)

Species Description

The mountain plover is an endemic grassland species that exists on grasslands and shrub-steppe and is associated with prairie dogs and other grazers (Knowles et al. 1982; Knopf 1996a). This species evolved in a landscape shaped by the effects of large numbers of grazing mammals (Knopf 1996b), where there was a mosaic of short vegetation, bare ground and flat topography (Graul 1975; Knopf and Miller 1994; Knopf and Rupert 1995). Historically, mountain plovers nested in shallow depressions on the ground in prairie dog colonies (Knowles et al. 1982; Knowles and Knowles 1993), or on sites intensively grazed by other prairie herbivores. Recent

work has identified short vegetation, at least 30 percent bare ground, the presence of a nearby conspicuous object such as a manure pile, and less than five percent slope as typical of nesting habitat (Graul 1975; Olson and Edge 1985; Knowles and Knowles 1993; Knopf and Miller 1994). Nesting also occurs on fallow and recently plowed ground where prairie habitat is fragmented (Shackford 1991). Nest site fidelity may be high, with males, females, and chicks returning to within several hundred meters of the previous years' nest (Graul 1973, 1975; Knopf 1996c). Hatchlings are led away from the nest to an area affording some shade. In Colorado, areas with shade include those areas along roadsides (Kuenning and Kingery 1998), where plant cover may be taller and denser due to increased moisture from runoff.

Almost 99 percent of the mountain plover's diet consists of invertebrates (grasshoppers, beetles and crickets), and the rest consists of seeds (Gillihan and Hutchings 2000). Outside the breeding season, mountain plovers are gregarious and forage in loose flocks (Knopf and Rupert 1995). Generally, mountain plovers in the central and northern shortgrass prairie spend about four months on the breeding grounds, five months on the wintering grounds, and the remaining time in migration (Knopf and Rupert 1995).

Distribution and Status

Three of the eight species of plover (snowy, piping and mountain) that occur east of the 105th meridian are species of concern and are in decline (Harrington 1995). All three species are found principally in temperate latitudes and breed in specialized habitats. Mountain plover populations and distributions are declining faster than any of the other endemic shortgrass prairie birds (Gillihan and Hutchings 2000). Between 1966 and 1999, the continent-wide mountain plover population declined at a rate of 2.7 percent annually with a cumulative decline of 63 percent (USFWS 1999). Today this species exists in geographically isolated breeding and wintering populations. The current population is estimated at 5,000 to 11,000 birds (USFWS 2003).

Mountain plovers range from southeastern Alberta and southwestern Saskatchewan through central Montana, south to southcentral Wyoming, eastern Colorado, northeastern New Mexico, and east to northern Texas and western Kansas and into northcentral Mexico and western California (National Geographic Society 1999). They breed almost exclusively in the United States (Commission for Environmental Cooperation 2000), with most breeding occurring in Colorado (Knopf 1996a; Kuenning and Kingery 1998) and Montana (USFWS 1999). Most birds winter in the Central and Imperial Valleys of California, with others wintering in and near Mexico (Knopf 1996a).

Kuenning and Kingery (1998) estimated that Colorado has 3,600 breeding pairs, which is a large percentage of the USFWS (2003) global estimate of 5,000 to 11,000 birds. More recently, RMBO estimated 4,850 individuals in eastern Colorado (USFWS 2003). In Colorado, mountain plovers breed on the eastern plains, and also in South Park. Wunder et al. (in prep.) estimates that approximately 15-20 percent of the global mountain plover population breeds in South Park, which currently appears to be the most productive breeding area in Colorado. However, reports in the literature that name Colorado as one of the two most important breeding sites for this species were written prior to completion of much of the South Park inventory. In other words, Colorado was already considered highly significant before researchers documented the extent of breeding in South Park. Carter et al. (1996) determined that mountain plovers occur at very low densities in ten eastern Colorado counties, being most numerous in Kiowa and Park counties. At one time, they were believed to be most numerous in Weld County, but later inventories found them to be more widely distributed, with 75 percent occurring south of Weld County (USFWS 2003). Clearly, therefore, the eastern plains of Colorado represent a significant component of the remaining habitat for this species.

The mountain plover was proposed threatened on February 16, 1999, throughout its entire range. The comment period on the proposal was reopened on December 5, 2002, due to new information regarding the species' biology and listing factors. A 4(d) rule was simultaneously proposed. The comment period reopened again on February 21, 2003. On September 9, 2003, the Service published a final rule, which determined that the action of listing the mountain plover as threatened is not warranted, and consequently withdrew the proposed rule and the proposed special rule. We made this determination because threats to the species as identified in the

proposed rule are not as significant as earlier believed, and current available data do not indicate that the threats to the species and its habitat, as analyzed under the five listing factors described in section 4(a)(1) of the Act, are likely to endanger the species in the foreseeable future throughout all or a significant portion of its range. It is listed as threatened in Canada and in Mexico (Commission for Environmental Cooperation 2000). It has a CNHP rank of G2/S2B-SZN (imperiled globally because of extreme rarity; breeding season imperiled in Colorado) (CNHP 2002b). The Committee on Environmental Cooperation (2000), established under the North American Free Trade Act, considers the mountain plover and the black-tailed prairie dog priority grassland species for conservation action. The mountain plover is listed as threatened in Nebraska, a "species of special interest or concern" in Montana, Oklahoma and California, "a species in need of conservation" in Kansas, and a "species of management concern" under the Partners in Flight Program for Colorado, Kansas, Montana, Nebraska, New Mexico and Oklahoma. It is a species of concern in Colorado, and is a U.S. Forest Service sensitive species.

Habitat

Mountain plovers nest in shortgrass prairie or its ecological equivalent, preferring short, sparse vegetation with at least 30 percent bare ground (Graul 1973; Knowles et al. 1982; Leachman and Osmundson 1990; Parrish et al. 1993; Knopf and Miller 1994; Knowles 1996). Areas that have been disturbed by prairie dogs, intensive grazing, or fire, all provide suitable habitat for mountain plovers (Knowles and Knowles 1984; Olson 1984; Wershler and Wallis 1987; Shackford 1991). Foraging habitat is similar to nesting habitat. Wintering habitat is also characterized by low sparse vegetation and includes alkali flats, plowed or burned fields, heavily grazed grasslands, and prairie dog colonies. Mountain plovers are often associated with blue grama (Bouteloua gracilis) or buffalo grass (Buchloe dactyloides) (Graul 1973, 1975; Graul and Webster 1976; Wallis and Wershler 1981; Parrish 1988; Parrish et al. 1993), but are also known from montane grasslands, sparse shrublands, and other heavily grazed grasslands in Colorado's mountain parks (e.g., South Park, San Luis Valley, Cochetopa Park).

Conservation Planning

The BLM and U.S. Forest Service restrict oil and gas exploration during the mountain plover nesting season from April through June in Colorado, Wyoming, and Utah (Gillihan and Hutchings 2000). Both agencies also use fire to maintain shortgrass habitat, and protect prairie dog colonies. The CDOW is working on a Memorandum of Agreement to enhance conservation of mountain plovers in Colorado. The Natural Resources Conservation Service in Colorado has designated the mountain plover as a species eligible for credit in Conservation Reserve Programs (CRP). The U.S. Forest Service (1994) and the BLM (1994) have adopted an interim mountain plover management strategy for oil and gas activities on the Pawnee National grasslands because of the potential impact these activities would have on the birds.

Burrowing Owl (*Athene cunicularia*)

Species Description

The western burrowing owl is a grassland specialist that is distributed throughout North America, and is dependent on the presence of fossorial mammals. It is a largely nocturnal bird, often seen perching in the daytime on posts or on the ground, in or near prairie dog (*Cynomys* spp.) colonies (National Geographic Society 1999). They nest in underground burrows in grasslands, shrublands, deserts, and grassy urban areas (such as golf courses and airports), and forage nearby. Burrowing owls are capable of excavating their own burrows if the soils are sandy, but most often use holes excavated by other animals (especially rodents).

Burrowing owls are opportunistic feeders, subsisting largely on insects, small rodents, amphibians, reptiles, and on occasion, small birds (Haug et al. 1993). Most foraging occurs in areas with vegetation less than one meter tall (Haug and Oliphant 1990; Wellicome 1994). During the nesting season they are active throughout the day and night, hunting insects when it is light and rodents at night (Bent 1938; Plumpton and Lutz 1993a).

Fledging rates for burrowing owls are high relative to rates for other small owls, and may reflect the advantage of nesting underground as much as a need to compensate for high post-fledging mortality (Johnsgard 1988). Pezzolesi (1994) found that, of 326 birds banded at the Rocky Mountain Arsenal in Colorado in 1991 and 1992, only 28 returned to nest in 1992 or 1993.

Colonial nesting has been reported for this species (Ehrlich et al. 1988), and may reduce depredation risks as owls may alert one another to threats (Desmond 1991; Desmond et al. 1995). Jones (1998), however, suggests that this may be a recently developed behavior reflecting a scarcity of nest sites as much as a lack of territoriality. In northeastern Colorado, Hughes (1993) found that pairs breeding in large prairie dog colonies nested further apart than did pairs nesting in small colonies.

Distribution and Status

The burrowing owl is distributed discontinuously throughout the grasslands of North America. Historically it ranged from Alberta, Saskatchewan, Manitoba, and southeastern British Columbia south to Mexico and into South America as far south as northern Chile. Populations in the northern and southern portions of this range are migratory. There is a second, non-migratory population in Florida.

Surveys in the United States and Canada indicate that the burrowing owl is declining through much of its range. It is not listed under the Act, but is listed by many states. It is listed as endangered in Minnesota and Iowa, is considered a species of special concern in Washington, Oregon, California, Montana, Wyoming, Idaho, North Dakota, South Dakota, Utah and Oklahoma, and is listed as threatened in Colorado.

The burrowing owl has been declining nationally at an average of 0.7 percent (Peterjohn et al. 1995). Breeding Bird Survey (BBS) data show a significant decline in the Central BBS Region, a stable trend in the Western BBS Region, and non-significant declines in Colorado, New Mexico, South Dakota and Texas (Sauer et al. 1997).

Along the Front Range of Colorado, burrowing owls have largely disappeared from much of their historic range (Jones 1998). Workers for the Colorado Breeding Bird Atlas (Jones 1998) found breeding burrowing owls almost exclusively in eastern Colorado, despite their once having been more widespread throughout the state. RMBO documented 468 burrowing owl colonies and 2,675 individuals in eastern Colorado in 1999 (Hutchings et al. 1999).
Burrowing owls were listed as a Category 2 species to be considered for federal listing by USFWS from 1994-1996, but in 1996 Category 2 designation was discontinued. This species is a USFWS "Nongame Avian Species of Management Concern" (USFWS 1995), a sensitive species in Regions 1 and 2 of the U.S. Forest Service, and is listed as an Appendix II species by CITES (Ehrlich et al. 1992). Mexico lists the burrowing owl as threatened, and Canada changed its rank from threatened to endangered in 1995 (Commission for Environmental Cooperation 2000). The Committee on Environmental Cooperation, established under the North American Free Trade Agreement, has identified the burrowing owl as a priority grassland species for conservation action. It is a "High Priority" Watch List species in Wyoming and Nebraska, and a Colorado threatened species. It has a CNHP rank of G4/S4B (the species is apparently secure globally and in Colorado; breeding birds may be rare in parts of range) (CNHP 2002b).

Habitat

Burrowing owls use well-drained, level to gently sloping grassland habitats characterized by sparse vegetation, usually less than four inches high, and a relatively large proportion of bare ground (Pezzolesi 1994). In eastern Colorado, they are usually found associated with prairie dog colonies (Kingery 1998). Prairie dog colonies provide burrows for nesting and perching mounds, and the low vegetation structure provides a clear view of terrestrial predators (Jones 1998). In western Nebraska, the size of prairie dog colonies was positively correlated with fledging success rates (Desmond 1991). On the Buffalo Gap National Grassland, reproductive success of burrowing owls improved with increasing prairie dog colony size (Greibel 2000). In western Nebraska, 85 percent of burrowing owl nests occurred in prairie dog colonies (Desmond 1991). In the Oklahoma panhandle, 66 percent of nests occurred in prairie dog colonies, which

comprised less than 20 percent of available habitat (Butts 1973; Butts and Lewis 1982). In eastern Wyoming, nests occurred in colonies of either black-tailed or white-tailed prairie dogs (Thompson 1984; Thompson and Anderson 1988).

When a prairie dog colony is eradicated or greatly reduced, the vegetation in the colony grows taller than the owls will tolerate and the burrows begin to deteriorate. Under these circumstances, burrowing owls will abandon their nest burrows (Grant 1965; Butts 1973; MacCracken et al. 1985; Plumpton and Lutz 1993b). Black-tailed prairie dog colonies in Oklahoma became unsuitable for burrowing owls within one to three years after abandonment by prairie dogs, because of the encroachment of dense vegetation (Butts 1973). The density of burrowing owls in prairie dog colonies in northeastern Colorado was positively related to the percentage of active burrows (Hughes 1993). In Nebraska, burrowing owl density in black-tailed prairie dog colonies was negatively correlated with the density of inactive burrows (Desmond 1991) and positively correlated with density of active burrows (Desmond et al. 2000).

Burrowing owls forage in a variety of habitats, ranging from the low structure plant communities of prairie dog colonies, where they forage for insects, to areas of taller plant cover (right-of-ways and native grasslands) where small mammal prey is likely to be more abundant (Wellicome 1994). Generally they use shortgrass habitat typical of prairie dog colonies for nesting and roosting, and forage over areas of taller vegetation. Owls nesting near edges of prairie dog colonies may benefit from increased perch availability, high insect populations, and close proximity to foraging areas.

Conservation Planning

The Service has completed a draft status assessment and conservation plan for the burrowing owl in the United States (Anderson et al. 2001). The U.S. Government has signed several treaties with its neighbors for the conservation of migratory birds (16 USC 703-711). These treaties (with Great Britain for Canada, Mexico, Japan and the former Soviet Union) provide for the regulation of hunting and for conservation through the enhancement of habitat. MBTA calls for protecting migratory bird habitat from pollution, conversion and degradation as well as "...establish(ing) preserves, refuges, protected areas...intended for the conservation of migratory birds and their environments, and to manage such areas so as to preserve and restore the natural ecosystems." (Convention Between the United States of America and the Union of Soviet Socialist Republics 1978).

Cassin's Sparrow (*Aimophila cassinii*)

Species Description

The Cassin's sparrow is a shrub-grasslands specialist, endemic to the southwestern U.S. and northern Mexico. They have been reported to exhibit an opportunistic nesting strategy that takes advantage of rainfall because it stimulates insects and seeds (Phillips 1944; Maurer et al. 1989). Cassin's sparrows forage primarily on the ground in relatively open areas (Schnase 1984) for a diet composed largely of insects (beetles, grasshoppers, crickets and caterpillars) and seeds (Gillihan and Hutchings 2000). Young are fed almost exclusively on insects (Bock and Scharf 1994).

Nests are cups placed on the ground in bunchgrass, near the base of a shrub or cactus, or a few inches off the ground in a shrub or cactus (Ehrlich et al. 1988; Gillihan and Hutchings 2000).

Most birds leave for wintering grounds by late September (Gillihan and Hutchings 2000). Nesting in Colorado occurs from mid-May through July. Human disturbance at the nest often results in nest abandonment (Johnsgard 1979).

Distribution and Status

There is little information available on historical population densities or distributions of Cassin's sparrow (Ruth 2000). Populations exhibit great variability in distribution and numbers from year to year at any site (Hubbard 1977; Melcher 1998; Ruth 2000), making evaluation of BBS data

difficult. They likely move across the landscape in response to changes in habitat quality (Hubbard 1977).

Cassin's sparrows breed from southwestern Nebraska, western Kansas, southeastern Colorado (and irregularly into northeastern Colorado [Melcher 1998]), southern and eastern New Mexico, western Oklahoma, west Texas and into northern Mexico (Howell and Webb 1995; AOU 1998). Possibly 20 percent (Melcher 1998), and perhaps up to 40 percent, of the breeding distribution of Cassin's sparrow is contained within Colorado (CBO 1995; Yanishevsky and Petring-Rupp 1998). Cassin's sparrows are migratory in the northern part of their range, and probably migrate to the southern part of their range in winter (Ruth 2000). In Colorado, they are common summer residents in the southeast, and are irregular nesters to the northeast (Andrews and Righter 1992; Melcher 1998). Their core population is centered in the Comanche National Grasslands in Baca County (Ruth 2000). In general, however, their numbers vary both annually and geographically within Colorado (Gillihan 1999).

The Cassin's sparrow is not protected under the Act, but is included on the Service's "Migratory Nongame Birds of Management Concern in the United States: the 1995 List," where it is listed as a species of concern in Regions 2 and 6 (USFWS 1995). It is also listed on the National Audubon Society-Partners In Flight "WatchList." Cassin's sparrow has been assigned a CNHP rank of G5/S4B (demonstrably secure globally; breeding birds in Colorado apparently secure, but may be rare in parts of range) (CNHP 2002b).

Habitat

Cassin's sparrows inhabit shortgrass prairie with scattered shrubs or other tall vegetation (bunchgrasses, sagebrush, yucca, rabbitbrush, mesquite, oaks, cactus). Taller plants are used as song perches and nest cover. Territories typically contain 20-35 percent bare ground, 40-80 percent total cover of short and mixed grass, and at least five percent shrub cover. In Colorado, nearly 50 percent of all nesting birds were found on shortgrass prairie, while sandsage grasslands accounted for another 25 percent of nesting habitat (Melcher 1998). They appear to avoid grasslands without shrubs (or other suitable perches such as fences) and shrublands without grass (Hubbard 1977; Faanes et al. 1979). The shrubs are used as song perches (Schnase and Maxwell 1989) and for nesting. Nests are placed on the ground under shrubs or in shrubs a few inches off the ground (Johnsgard 1979).

Conservation Planning

The Cassin's sparrow is protected under the Migratory Bird Treaty Act (MBTA). The U.S. Government has signed several treaties with its neighbors for the conservation of migratory birds (16 USC 703-711). These treaties (with Great Britain for Canada, Mexico, Japan and the former Soviet Union) provide for the regulation of hunting and for conservation through the enhancement of habitat. MBTA calls for protecting migratory bird habitat from pollution, conversion, and degradation, as well as "...establish(ing) preserves, refuges, protected areas...intended for the conservation of migratory birds and their environments, and to manage such areas so as to preserve and restore the natural ecosystems" (Convention Between the United States of America and the Union of Soviet Socialist Republics 1978).

In 2001, RMBO and CDOW began a program of habitat-based bird monitoring throughout the state. Because Cassin's sparrows are one of the species for which BBS data in Colorado are inadequate, they are a priority species for this program (Ruth 2000).

Ferruginous Hawk (*Buteo regalis*)

Species Description

The ferruginous hawk is an uncommon, locally distributed buteo of grasslands, sagebrush, and desert scrub habitats in the Great Plains and Great Basin (Gilmer and Stewart 1983; Ehrlich et al. 1988). It is an opportunistic nester that will use trees, ledges, rock or dirt outcrops, the ground, haystacks, nest platforms, power poles, or other man-made structures (Olendorff 1973; Gilmer and Stewart 1983; Ehrlich et al. 1988; MacLaren et al. 1988; Finch 1991; Faanes and Lingle

1995). Fidelity to nest locations from year to year is high, and typically several nests may be built in an area (Davy 1930; Weston 1968; Olendorff 1973; Palmer 1988; Schmutz 1991; Houston 1995). In Colorado, ferruginous hawks begin to nest from mid-March to early April (Preston 1998; Gillihan and Hutchings 2000). Fledging occurs 38-50 days after hatching (Preston 1998) and, in Colorado, fledglings have been recorded from late June to late July (Preston 1998).

The ferruginous hawk feeds primarily on prairie dogs, ground squirrels, jackrabbits, and less frequently on locusts, crickets, birds, amphibians, and reptiles (Weston 1968; Gilmer and Stewart 1983; Ehrlich et al. 1988; Finch 1991; Gillihan and Hutchings 2000; Dechant et al. 2001c). In Colorado, ferruginous hawks feed most often on prairie dogs (Preston and Beane 1996; Preston 1998). Density and productivity of ferruginous hawks are closely associated with cycles of prey abundance (Woffinden 1975; Smith et al. 1981; White and Thurow 1985; Schmutz 1989; Schmutz and Hungle 1989; Bechard and Schmutz 1995), and local influxes of the birds have been documented in response to prey availability (Gilmer and Stewart 1983).

Like other raptors, ferruginous hawks are widely dispersed and are found at low densities, especially during the nesting season (Fuller et al. 1995; Preston 1998). In the Pawnee National Grassland, they have been found at an estimated breeding density of one pair per 108 square kilometers (Olendorff 1972). Wintering populations in Colorado seem to be associated with prairie dog colonies, though the relationship between prairie dogs and hawk survivorship is unknown.

Distribution and Status

Ferruginous hawks breed from northeastern Washington, southern Alberta and southern Saskatchewan, south to eastern Oregon, western Nevada, southern California, and northern Arizona, and east through northern Texas, western Oklahoma, and eastern North Dakota (National Geographic Society 1999). Two subpopulations are recognized - one residing east of the Rocky Mountains and one found west of the Rocky Mountains (Bechard and Schmutz 1995). Year-round range is in the southern Rockies and southwestern Great Plains, while wintering range includes the southern Great Plains west to California and south to Central Mexico from October-April (Commission For Environmental Cooperation 2000).

The breeding distribution of ferruginous hawks in Canada has declined to about 50 percent of its former range (Houston and Bechard 1984; Schmutz et al. 1992). However, during the past ten years, population declines have only been documented in eastern Nevada and northern Utah (Olendorff 1993), while populations have been stable or rebounding throughout the rest of its range. BBS data for the U. S. and Canada indicate an average annual increase of 0.5 percent for 1966-1989 (Droege and Sauer 1990), and CBC counts also indicate an increase in ferruginous hawk numbers from 1952-1984 (USFWS 1992). Olendorff (1993) has estimated the continent-wide population at 5,842-11,330 birds, while Schmutz et al. (1992) estimate there are 14,000 birds on the Great Plains. Because between-year movement of these birds is common (and is probably a result of local prey availability), estimation of abundance is difficult.

In Colorado, ferruginous hawks have been stable from 1979-1992 (Olendorff 1993). Ferruginous hawks are found in Colorado year round (Preston 1998; Gillihan and Hutchings 2000), though they are most common in winter in eastern Colorado. Johnsgard (1990) estimated that about 1,200 birds winter in Colorado, which comprises about 20 percent of the total winter population in the United States. Preston (1998) estimated about 150 nest sites in Colorado, primarily on the eastern plains.

The ferruginous hawk is listed as vulnerable in Canada (Commission for Environmental Cooperation 2000), as a species of conservation concern in Mexico (Commission for Environmental Cooperation 2000), as a Service Species of Concern (USFWS 1996), a USFS Region 2 sensitive species, a BLM sensitive species, and is listed on CITES Appendix II. It is a species of special concern in Arizona, Colorado, and Oklahoma, and is a threatened species in Utah. The Partners in Flight Watchlist identifies the ferruginous hawk as a “High Priority” species for Wyoming, North Dakota, South Dakota, and Nebraska. The Commission For Environmental Cooperation (2000) established under North American Free Trade Agreement,

has identified the hawk as a priority grassland species for conservation action. It has a CNHP rank of G4/S3B-S5N (apparently secure globally; breeding birds vulnerable in Colorado) (CNHP 2002b).

Habitat

The ferruginous hawk is a bird of open grasslands and shrub steppe communities (Stewart 1975; Wakeley 1978; Gilmer and Stewart 1983; Green and Morrison 1983; MacLaren et al. 1988; Palmer 1988; Leslie 1992; Bechard and Schmutz 1995; Faanes and Lingle 1995; Houston 1995; Leary et al. 1998; Gillihan and Hutchings 2000). In eastern Colorado they favor habitats associated with black-tailed prairie dogs.

Selection for nest sites appears to depend on a combination of available substrates and the surrounding land use. Ground nests are typically located far from human activities and on elevated landforms within grassland areas (Blair 1978; Gilmer and Stewart 1983; Preston 1998). When trees are the nesting substrate, lone or peripheral trees are preferred to densely wooded areas (Weston 1968; Lokemoen and Duebbert 1976; Gilmer and Stewart 1983; Woffinden and Murphy 1983; Palmer 1988; Bechard et al. 1990; Leslie 1992; Hansen 1994; Dechant et al. 2001c). Generally areas of intensive agriculture or high human disturbance are avoided (Gilmer and Stewart 1983; Schmutz 1984, 1987; Bechard et al. 1990; Schmutz 1991). Ferruginous hawks nested more frequently in grassland areas than in cultivated areas in eastern Colorado (Olendorff 1973; Leslie 1992; Preston 1998; Dechant et al. 2001c).

Prey availability also influences habitat selection. Small and mid-sized mammals comprise most of the diet of ferruginous hawks. Grazing by large herbivores or prairie dogs benefits ferruginous hawks by reducing plant cover and making prey more visible (Wakeley 1978; Gilmer and Stewart 1983). The hawks appear to avoid dense vegetation where visibility of prey is limited (Howard and Wolfe 1976; Wakeley 1978). Fire may also be beneficial to ferruginous hawks as it maintains grasslands in an early seral stage.

Population size and distribution may fluctuate with respect to the availability of small and mid-sized mammal prey (Grossman and Hamlet 1964; Lokemoen and Duebbert 1976; Ehrlich et al. 1988). Winter residents in eastern Colorado concentrate around prairie dog towns (Bechard and Schmutz 1995; Preston and Beane 1996).

Conservation Planning

The ferruginous hawk is protected under the Migratory Bird Treaty Act. The U.S. Government has signed several treaties with its neighbors for the conservation of migratory birds (16 USC 703-711). These treaties (with Great Britain for Canada, Mexico, Japan and the former Soviet Union) provide for the regulation of hunting and for conservation through the enhancement of habitat. MBTA calls for protecting migratory bird habitat from pollution, conversion and degradation as well as "...establish(ing) preserves, refuges, protected areas...intended for the conservation of migratory birds and their environments, and to manage such areas so as to preserve and restore the natural ecosystems" (Convention Between the United States of America and the Union of Soviet Socialist Republics 1978).

Because of their winter preference for habitats modified by prairie dogs, conservation plans benefiting prairie dogs will also benefit ferruginous hawks. The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that would protect large areas of ferruginous hawk habitat.

In 2001, RMBO and CDOW began a program of habitat-based bird monitoring throughout the state. Because ferruginous hawks are one of the species for which BBS data in Colorado are inadequate, they are a priority species for this program (Leukering et al. 2000).

Lark Bunting (*Calamospiza melanocorys*)

Species Description

The lark bunting is a breeding season resident of the shortgrass prairie, and is the state bird of Colorado. It shares breeding habitat within appropriate ranges with chestnut-collared longspurs, McCown's longspurs, horned larks, western meadowlarks, Cassin's sparrows, and Brewer's sparrows, among other species. However, compared to other grassland species, lark buntings begin nesting later, occupy habitat with taller vegetation, and feed larger insect prey to their young (Kingery 1998). They arrive on the breeding grounds in late April and early May, and leave for the southern U.S. and Mexico by mid-September. Lark buntings are gregarious, arriving on the breeding grounds in small flocks. Territory is not strongly developed, and nests may be found in close proximity (Ehrlich et al. 1988; Gillihan and Hutchings 2000). The nest is a small cup placed on the ground and partially concealed by tall grasses or shrubs. The diet consists of insects, mainly grasshoppers (75 percent), and seeds (25 percent) (Ehrlich et al. 1988; Gillihan and Hutchings 2000). The lark bunting is an irruptive species, making monitoring of populations difficult (Hibbard 1965; Baumgarten 1968; Wilson 1976).

Distribution and Status

Using data from the BBS (1966-91), Knopf (1995) found that over the last 25 years, grassland bird species have shown steeper, more widespread, and more consistent population declines than any other guild of North American birds. The population declines of mountain plover, Franklin's gulls, Cassin's sparrows and lark bunting are all significant (Knopf 1995; Peterjohn et al. 1995). Decline of lark bunting populations appear to be localized, though the cumulative effect is a continent-wide decline (Knopf 1995).

Lark buntings breed from southern Alberta through southern Manitoba, south to west Texas, and east to western Minnesota and northeastern Kansas. The Rocky Mountain Bird Observatory reports that lark bunting numbers have decreased by 50 percent over the last three decades. In Colorado, lark bunting numbers are highest in the shortgrass prairies of extreme eastern Colorado near the Kansas border (Kingery 1998).

Along BBS routes, lark buntings are normally most numerous on the central and western Great Plains from eastern Colorado and western Kansas north to Montana and North Dakota, with their numbers rapidly diminishing toward the peripheries of their range.

Lark buntings winter in the southwestern deserts, from south Texas to southern Arizona, and in Mexico. They occupy weedy, barren habitats within these desert communities (Phillips et al. 1964). They are also nomadic during the winter, apparently in response to food availability.

The lark bunting is on the Partners in Flight national watchlist. It has experienced long-term continent-wide population declines of two percent (Peterjohn et al. 1995). The lark bunting has a CNHP rank of G5/S4 (demonstrably secure across its range; apparently secure in Colorado) (CNHP 2002b).

Habitat

In Colorado, lark buntings are most numerous in shortgrass prairies, but they also occupy sagebrush habitats in mountain parks (Andrews and Righter 1992), shrubsteppe habitat and Conservation Reserve Program fields (Cameron 1908; Wiens 1973; Creighton 1974; Maher 1974; Pleszczynska and Hansell 1980; Kantrud 1981; Kantrud and Kologiski 1983; Johnson and Schwartz 1993). They prefer grasslands of low to moderate height, with bare ground of about 10-15 percent and 10-30 percent shrub cover (Baldwin et al. 1969; Wiens 1970; Creighton 1974). Rotenberry and Wiens (1980) found that abundance of lark buntings in parts of Colorado, Kansas, Montana, Nebraska, Oklahoma, South Dakota, Texas, and Wyoming was correlated positively with litter depth. Breeding Bird Survey data indicated that lark buntings preferred areas dominated by wheatgrass (*Agropyron* spp.), blue grama (*Bouteloua gracilis*), needle-and-thread (*Stipa comata*), and big sagebrush (*Artemisia tridentata*). Gillihan and Hutchings (2000) reported that lark buntings will not nest in areas with less than 30 percent grass cover or with greather than 60 percent bare ground. Ryder (1980) found that they did not use heavily grazed areas in summer in Colorado, though they would use them in winter.

Lark buntings often locate nests under protective vegetation, including forbs, tall grasses, low shrubs, cacti, and yucca (Woolfolk 1945; Baumgarten 1968; Baldwin et al. 1969; Creighton 1971; Wilson 1976; Pleszczynska 1977; Gillihan and Hutchings 2000).
This cover may provide protection from inclement weather, predation, shade from the hot sun for nestlings (Woolfolk 1945; Baumgarten 1968; Baldwin et al. 1969; Shane 1972; Creighton 1974; Pleszczynka 1977; Gillihan and Hutchings 2000), as well as open views in one or more directions (Baldwin et al. 1969; Wilson 1976). Protective cover may be a major factor in reproductive success (Strong 1971; Pleszczynska 1977).

Conservation Planning

There are no formalized conservation plans that specifically address lark buntings. However the Migratory Bird Treaty Act does apply. The U.S. government has signed several treaties with its neighbors for the conservation of migratory birds (16 USC 703-711). These treaties (with Great Britain for Canada, Mexico, Japan and the former Soviet Union) provide for the regulation of hunting and for conservation through the enhancement of habitat. MBTA calls for protecting migratory bird habitat from pollution, conversion and degradation as well as "...establish(ing) preserves, refuges, protected areas...intended for the conservation of migratory birds and their environments, and to manage such areas so as to preserve and restore the natural ecosystems" (Convention Between the United States of America and the Union of Soviet Socialist Republics 1978). The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that would protect large areas of lark bunting habitat.

Loggerhead Shrike (*Lanius ludovicianus*)

Species Description

The loggerhead shrike is a robin-sized passerine of pasture, grassland, and open brushland, but it is ecologically analogous to a small raptor. It preys primarily on large insects (especially crickets, beetles, and grasshoppers), but will also take small birds, mammals, and herpetofauna (Fraser and Kuukkonen 1986; Ehrlich et al. 1988). Breeding shrikes prefer habitat of high horizontal and vertical structural diversity. They nest in trees (below the crown), shrubs, or (occasionally) in a vine tangle (Ehrlich et al. 1988). Ehrlich et al. (1988) indicated that males show strong year-to-year fidelity to breeding territories. However, Haas and Sloane (1989) suggested that low site fidelity to breeding territories, rather than winter mortality, accounts for low return rates of migratory loggerhead shrikes. They hunt from elevated perches, and sometimes impale their prey on barbed wire or thorns (Fraser and Luukkonen 1986; Ehrlich et al. 1988; Dobkin 1994) to store for later use (Applegate 1977). Shrikes are present in southeast Colorado from early April through October (Andrews and Righter 1992). They winter in the southern U. S. and Mexico (National Geographic Society 1999).

Distribution and Status

Loggerhead shrikes breed from Washington, northern Alberta, central Saskatchewan and southern Manitoba south to California and Florida, east to southwestern Minnesota, southern Wisconsin, southern Michigan and Maryland (Yosef 1996; National Geographic Society 1999). They winter in the southern half of their breeding range south to the Gulf Coast, southern Florida and into Mexico.

The loggerhead shrike has experienced continent-wide population declines of about 3.6 percent per year (Commission for Environmental Cooperation 2000). Breeding Bird Survey (BBS) data for the period 1966-1979 indicate a 55 percent population decline nationally, 47 percent in the central states and 59 percent in the western states (Robbins et al. 1986). The decline is most severe in the northeast and north-central regions. Shrikes are now extirpated from most of the northeast, and are nearly extirpated from Minnesota, Michigan, and Wisconsin. Causes of the decline in shrike populations are not well understood, but are believed to be related to conditions on the breeding grounds (including habitat loss due to conversion of grasslands to agricultural uses, and loss of nesting substrate), accidental poisoning, loss of insect food due to pesticide use (Dobkin 1994), and collision with cars while hunting (Ehrlich et al. 1992; Gillihan 1999). Work

in the upper midwest and southeast also implicated problems on the wintering grounds (Brooks and Temple 1990; Gawlick and Bildstein 1990).

In Colorado, the loggerhead shrike is found primarily in rural areas (scattered farm buildings and shelterbelts) and shortgrass prairie, preferring open country with scattered trees and shrubs (Carter 1998). Colorado Breeding Bird Atlas workers found breeding shrikes to be conspicuous and, like raptors, sparsely distributed. Most nesting in Colorado occurs in eastern Colorado (Carter 1998).

The loggerhead shrike is a U.S. Forest Service sensitive species. The Committee on Environmental Cooperation, established under the North American Free Trade Act, has identified the loggerhead shrike as a priority grassland species for conservation action. In Canada, the eastern population was listed as endangered in 1991, and the prairie population was listed as threatened in 1986, under the Provincial Wildlife Act of Ontario and Manitoba (Commission for Environmental Cooperation 2000). It is a species of concern in Colorado and has a CNHP rank of G4/S3S4B-SZN (apparently secure rangewide; breeding birds watchlisted in Colorado) (CNHP 2002b).

Habitat

Loggerhead shrikes occupy a variety of habitats in plains grasslands, deciduous riparian woodlands, foothill and mountain grassland, piZon-juniper woodland, cold desert shrublands, deciduous shrublands, and ponderosa pine, in each case using open country with scattered trees and shrubs (Dobkin 1994; Dechant et al. 2001a). Scattered shrubs or trees, especially in thick patches, provide nesting sites and hunting perches (Porter et al. 1975; Woods 1995; Yosef 1996). On the plains, suitable nest sites include fencerows, shelterbelts and stream bottoms. Plant structure appears to be more important than species in nesting habitat selection.

Shrikes use perches of varying heights (ranging from tall grasses to utility poles). They forage over areas of shorter grass where insects may be abundant, including mowed highway ROWs (Dechant et al. 2001a). However, large expanses of very short grass (as in heavily grazed pastures) are avoided (Prescott and Collister 1993).

Conservation Planning

A conservation strategy has not been prepared for loggerhead shrikes in the United States, but there is one in Canada (Commission Environmental Cooperation 2000). The Migratory Bird Treaty Acts and associated regulations (16 USC 703-711) with Great Britain (for Canada), Russia, and Mexico provide for migratory bird conservation through the enhancement of habitat. The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that would protect large areas of loggerhead shrike habitat.

Long-billed Curlew (*Numenius americanus*)

Species Description

The long-billed curlew is a fairly long-lived member of the sandpiper family, and is the largest of the shorebirds. It is a migratory species, breeding in the northern regions of the American west and wintering in parts of California, Mexico and Guatemala. The long-billed curlew uses shortgrass prairies in addition to the wetlands typically used by wading birds. It is an opportunistic feeder, using its long, curved bill to probe for grasshoppers, beetles, caterpillars (Nelson 1998a; Gillihan and Hutchings 2000), marine and freshwater invertebrates, mollusks, amphibians, fruits, and even eggs and nestlings of other bird species (Ehrlich et al. 1988; Dobkin 1994). Curlew nests are shallow depressions on the ground, often near standing water. Following the breeding season, they form flocks and migrate to coastal habitats.

Long-billed curlews arrive on the breeding grounds from mid-March through May, and leave for the wintering grounds from August to October (Silloway 1900; Sugden 1933; Salt and Wilk 1958; Bent 1962; Maher 1973; Stewart 1975; Allen 1980; Pampush 1980; Renaud 1980;

Redmond et al. 1981; Bicak et al. 1982; Paton and Dalton 1994). In Colorado, adults arrive on the breeding grounds in April, and chicks are fledged by early July (Nelson 1998a). Nesting sites are reused from year to year, and some individuals demonstrate specific nest site fidelity (McCallum et al. 1977; Allen 1980; Redmond and Jenni 1982, 1986).

Distribution and Status

Long-billed curlews were once common nesters of the prairies throughout the west and mid-west. Their historical range extended from British Columbia east to Manitoba, southeast to Wisconsin, Illinois and Kansas, and west to northern California and north Texas (Nelson 1998a). Their populations have shown significant declines and range contractions (Sugden 1933; Harrington 1995) since the nineteenth century. Historically, populations of many North American shorebirds were dramatically reduced during the 19th century due to market hunting (Forbush 1912), conversion of native grasslands to agriculture, and loss of wetlands (Gill and Handel 1995). They have experienced a continent-wide annual decrease in population of three percent over the last ten years (Gill and Handel 1995).

Today, long-billed curlews breed from interior British Columbia and southern Alberta through southern Manitoba, south to central California, and east to western North Dakota, central South Dakota, central Nebraska, western Kansas, northeastern New Mexico, and northern Texas (National Geographic Society 1999). Winter range is discontinuously distributed across the southern United States south to Baja California and to Guatemala (National Geographic Society 1999).

A survey of birders and professionals in Colorado in 1974-1975 revealed a distribution in Colorado largely limited to Baca and Kiowa counties (McCallum et al. 1977). Today in Colorado, there are three clusters of breeding curlews: Baca and Las Animas counties, eastern El Paso County east to Kansas, and northeastern Colorado in prairies bordering the South Platte River and on the Pawnee National Grassland (Nelson 1998a). Habitat conversion from prairie to intensive agriculture or urbanization is the primary threat to their persistence in Colorado (Gillihan and Hutchings 2000).

The long-billed curlew is classified as a sensitive species by the U.S. Forest Service, and is a species of special concern in Colorado, Kansas, Nebraska, Oklahoma, and Wyoming. The Colorado Partners in Flight Land Bird Conservation Plan notes that it "is arguably the highest conservation priority in this physiographic area" (Colorado Partners in Flight 2000). It has a CNHP rank of G5/S2B-SZN (demonstrably secure globally; breeding season imperiled in Colorado) (CNHP 2002b).

Habitat

During the breeding season, long-billed curlews use open, level to gently sloping grasslands that are characterized by short vegetation (either shortgrass prairie or recently grazed mixed-grass prairie) (Graul 1971; Stewart 1975; Johnsgard 1979; Bicak et al. 1982; Cochran and Anderson 1987; Oakleaf et al. 1996; Gillihan and Hutchings 2000; Dechant et al. 2001d).

Nesting occurs where vegetation is less than 12 inches tall, and often less than four inches tall (Gillihan 1999; Gillihan and Hutchings 2000). After the precocial chicks hatch, adults move them to areas of taller, but not dense, vegetation where they are protected from predators and weather. Nests often occur on hummocks, possibly to improve visibility for predators and to prevent flooding in otherwise level fields (Cochran and Anderson 1987), or near an object (e.g., big sagebrush [*Artemisia tridentata*] branches, rocks, dirt mounds, manure, metal cans, and bunchgrasses [Bent 1962; Johnsgard 1979; Allen 1980; Cochran and Anderson 1987]). King (1978) found that long-billed curlews in Colorado used shortgrass, mixed-grass, and weedy areas more often than expected based on the availability of those habitats; they used agricultural areas (cropland, stubble fields, and bare ground) or bare ground less often than expected based on availability; and they did not use areas dominated by sand sagebrush (*Artemisia filifolia*).

Curlews forage in grasslands, cultivated fields, stubble fields, wet meadows, prairie dog colonies, and occasionally along wetland margins (Silloway 1900; Salt and Wilk 1958; Johnsgard 1979;

Shackford 1994). Throughout their range, they forage in areas of low, sparse vegetation (Gillihan 1999), avoiding dense forbs and shrubs (Pampush and Anthony 1993). In a study completed on the Comanche National Grassland, foraging was spread across habitat types, with selection favoring short and mixed-grass areas and avoiding bare ground and agricultural fields (King 1978). Long-billed curlews in Colorado and Mexico have been observed feeding among scattered junipers adjacent to grasslands (pers. obs., C. Pague).

Proximity to water may be an important factor in habitat selection (McCallum et al. 1977; Cochran and Anderson 1987; Shackford 1994). Curlews are frequently found within one quarter mile of standing water (Gillihan and Hutchings 2000), where they forage in wet meadows and wet soils. In a survey in Baca County, Colorado, in 1974-75, 42 percent of long-billed curlews were found within 100 yards of standing water, and 68 percent were found within one quarter of a mile of standing water (McCallum et al. 1977). In Colorado during May and June, at the height of nesting season, adults fly to the shorelines of reservoirs to feed and drink, and as soon as young can fly, family groups move to reservoirs to feed (Nelson 1998a). During migration, especially following breeding, long-billed curlews feed along shorelines of prairie reservoirs.

Habitat interspersion is an important component of high quality curlew habitat. Nesting habitat is close to foraging and brood-rearing habitat and roosting cover. More diverse habitat has been found to support smaller curlew territories than less diverse habitat (Allen 1980). Although long-billed curlews select nest sites in areas with short vegetation, vegetation within three to six meters of the nest may be taller than vegetation in the surrounding habitat patch (Maher 1973; King 1978; Allen 1980; Pampush 1980; Cochran and Anderson 1987; Pampush and Anthony 1993; Paton and Dalton 1994).

Conservation Planning

There are no state, regional, or national conservation plans for the long-billed curlew.

Through their work with the Canadian-U.S. Shorebird Monitoring and Assessment Committee, USGS scientists Jon Bart, Susan Skagen, Marshall Howe, and Robert Gill are helping to establish the Program for Regional and International Shorebird Monitoring, or PRISM. This project will link shorebird monitoring efforts of government agencies and private groups across North America, and will address specific goals of the Canadian and U.S. Shorebird Conservation Plans. The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that would protect large areas of long-billed curlew habitat.

McCown's Longspur (*Calcarius mccownii*)

Species Description

The McCown's longspur is a ground-foraging passerine of the central shortgrass prairie. The longspur genus consists of four stocky, ground-dwelling finches. McCown's longspur is distinguished by its preference for relatively barren habitat. It is found in habitats similar to those used by mountain plovers, long-billed curlews, burrowing owls, and horned larks (Gillihan and Hutchings 2000). McCown's nest cycle lags two weeks behind that of horned larks, thus decreasing competition for nest sites and food between these two species (Kuenning 1998).

The McCown's longspur breeding season extends from mid-March with the arrival of males, followed two weeks later by the arrival of females, through mid-October (Mickey 1943; Giezentanner and Ryder 1969; Felske 1971; Creighton 1974; Greer 1988; With 1994). Second broods have been reported in northcentral Colorado (Strong 1971), but are likely limited by the female's energy reserves (Felske 1971; With 1994).

The diet consists largely of grass and forb seeds, but young are fed almost exclusively on insects, and adults also include insects (especially grasshoppers) in their summer diet (Ehrlich et al. 1988; Dobkin 1994; Gilllihan and Hutchings 2000). On the Pawnee National Grassland, nestling diets consisted of grasshoppers, beetles, butterflies and moths (Kuenning 1998). The proportion of grasshoppers in both adult and juvenile diets increases as grasshoppers become more abundant

through the summer (Mickey 1943; With 1994). Pairs often nest near each other (Mickey 1943; Felske 1971).

Distribution and Status

The historic range of McCown's longspurs once extended from Alberta, Manitoba and Saskatchewan in Canada south to Oklahoma (Bent 1968), but has contracted significantly. Today they breed from southern Alberta and Saskatchewan, south through Montana, eastern and central Wyoming, and northcentral Colorado, and east to western Nebraska, and southwestern North Dakota (With 1994; Kuenning 1998; National Geographic Society 1999). The Pawnee National Grasslands in northern Weld County is the center of breeding in Colorado, with a few sites also confirmed on private ranches in Washington, Elbert, Lincoln, and Kit Carson counties (Kuenning 1998). Winter range includes western Oklahoma, west Texas, southern New Mexico and Arizona, southeast California, extreme northcentral Mexico (National Geographic Society 1999; Gillihan and Hutchings 2000), and extreme southeastern Colorado.

McCown's longspur has not been reported as a breeding bird in Oklahoma, South Dakota, Minnesota or Manitoba since 1915 (With 1994). Declines in abundance and range contractions since 1900 are attributable to several factors. Habitat loss due to conversion of native prairie to row crops, control of wildfires, and urbanization, have all been implicated as factors, as has use of pesticides, especially insecticides (Stewart 1975; With 1994; Kuenning 1998; Gillihan and Hutchings 2000; Dechant et al. 2001e).

The McCown's longspur is not protected under the Act. It is listed on the National Audubon Society-Partners In Flight "Watch List" (not adequately sampled by the BBS). It has a CNHP rank of G5/S2B-SZN (demonstrably secure globally; breeding season imperiled in Colorado) (CNHP 2002b).

Habitat

McCown's longspur breeding habitat is characterized by shortgrass prairie where vegetation cover is sparse (due to either low soil moisture or grazing), with little litter (Kuenning 1998), and interspersed with shrubs or tall grasses (Kuenning 1998). Areas of bare soil are required, and nest sites are often found on barren hillsides, including south-facing slopes (Giezentanner 1970; Felske 1971; Creighton 1974; Gillihan and Hutchings 2000). Nesting territories include 45 to 80 percent grass cover - largely blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*) (Creighton 1974), and 15 to 25 percent bare ground (Gillihan and Hutchings 2000). In northcentral Colorado, nests were exposed completely to solar radiation at midday, and experienced 45 percent total exposure per day. This may ameliorate cold stress associated with early breeding, as nests constructed later were more likely to be near plant cover, which probably served to shade the nest during hotter weather (With and Webb 1993). This suite of habitat requirements implies evolution in association with grazers, particularly bison (Kuenning 1998).

Conservation Planning

There are no formal conservation plans that address McCown's longspur, but the Migratory Bird Treaty Act does apply. The U.S. government has signed several treaties with its neighbors for the conservation of migratory birds (16 USC 703-711). These treaties (with Great Britain for Canada, Mexico, Japan and the former Soviet Union) provide for the regulation of hunting and for conservation through the enhancement of habitat. MBTA calls for protecting migratory bird habitat from pollution, conversion and degradation as well as "...establish(ing) preserves, refuges, protected areas...intended for the conservation of migratory birds and their environments, and to manage such areas so as to preserve and restore the natural ecosystems." (Convention Between the United States of America and the Union of Soviet Socialist Republics 1978). In addition, The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that would protect a large area of McCown's longspur habitat.

Brassy Minnow (*Hybognathus hanksinsoni*)

Species Description

Brassy minnows are members of the minnow family (Cyprinidae). The minnow family is large and highly variable. Sexual dimorphism is usually conspicuous; breeding, brightly colored males have nuptial tubercles on the head, body and along fin rays (Blair et al. 1968). Minnows construct a variety of nests, including piles of stones (carried by mouth to the nest), cup-shaped depressions in or above riffles, and excavations under a stone where the eggs are attached to the underside of the stone.

The abundance of minnows may be attributed to their tolerance, as a group, of diverse habitats (from fresh to brackish water, warm to cool waters, and moving to standing water), small size (thus a large number of minnows can occupy a small space and find sufficient food and shelter), and rapid attainment of sexual maturity. The smaller minnows usually live three or four years; larger species may live seven to ten years, and the carp even longer.

The brassy minnow is a fish of tributaries, and is generally found in clear, cool pools of sluggish water over sand or gravel (Scott and Crossman 1973; Woodling 1985). Food consists primarily of algae and phytoplankton, though zooplankton and aquatic insect larvae are also taken (Scott and Crossman 1973; Woodling 1985). The brassy minnow is preyed upon by larger fish, kingfishers, and mergansers (Scott and Crossman 1973). Spawning occurs in May or June, and adults grow to three to four inches in length (Scott and Crossman 1973). The brassy minnow can tolerate high water temperatures and low dissolved oxygen concentrations, and therefore can persist in small fluctuating streams and the pools that remain during intermittent flow (CDOW 2002b).

Distribution and Status

The brassy minnow is a native of North America, and is found from the upper St. Lawrence River and Lake Champlain drainages in Quebec and New York west to the Great Lakes and, Hudson Bay to the Peace and Fraser River systems of Alberta to British Columbia (Scott and Crossman 1973). It was introduced into British Columbia (Blair et al. 1968). It ranges south into the Missouri-upper Mississippi River basin into Kansas (Scott and Crossman 1973).

The species is native to Colorado, though Colorado is at the southern and western periphery of its distribution (Nesler et al. 1997; CDOW 2002b). It is found in low numbers in the South Platte and Republican River basins (CDOW 2002b). Propst (1982) found the brassy minnow in the South Platte, but restricted to portions of the mainstem and most abundant in the eastern portion of the plains. It was collected from only five sites in the South Platte River drainage during 1993-1994 (Nesler et al. 1997), whereas in similar surveys made from 1978-1980, it was found at 22 sites (Propst 1982). The frequency of occurrence decreased from 11 to two percent between the two surveys. Sampling locations in the 1993-1994 survey (Nesler et al. 1997) included those of Propst in 1982, and sampling frequency was more intense. While occurrence in natural streams has apparently decreased, the brassy minnow has been reported in significant numbers in irrigation ditches (Platania 1990). Today it is found in the South Platte River basin (St. Vrain River, Cache la Poudre River, Pawnee Creek, Lonetree Creek, the lower South Platte River [east of Sterling]), and in the Republican River basin (Arikaree River and the South Fork of the Republican River) (CDOW 2002b).

The brassy minnow is listed as a species of special concern in Illinois, Kansas, Vermont, and British Columbia. It is classified as rare in Missouri, is a candidate species in Quebec (Schmidt 1996), and is state threatened in Colorado. It has a CNHP rank of G5/S3 (demonstrably secure globally; vulnerable in Colorado) (CNHP 2002b).

Habitat

The brassy minnow uses cooler, clear, flowing water or pools that have a sand to gravel substrate and rooted aquatic vegetation (Nesler et al. 1997). It has been reported in significant numbers in irrigation ditches in the Fort Collins area (Platania 1990). It tolerates conditions typical of seasonally fluctuating plains streams (Woodling 1985), and is a species of tributaries, though it uses connection to the mainstem for colonization and dispersal (pers. comm., Nesler 2002). It is usually found in close association with the fathead minnow (*Pimephales promelas*) (Woodling 1985), and will establish populations in ponds and lakes, although brassy minnows are seldom abundant in this type of habitat.

Conservation Planning

CDOW is identifying suitable habitats and the limiting conditions for the brassy minnow. Once habitats are identified, habitat improvements and restoration stocking will be initiated (CDOW 2002b). The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that would protect large areas of brassy minnow habitat.

Common Shiner (*Notropis cornutus*)

Species Description

The minnow family (Cyprinidae) is large and highly variable. Sexual dimorphism is usually conspicuous; breeding, brightly colored males have nuptial tubercles on the head, body and along fin rays (Blair et al. 1968). Minnows construct a variety of nests, including piles of stones (carried by mouth to the nest), cup-shaped depressions in or above riffles, and excavations under a stone where the eggs are attached to the underside of the stone.

The abundance of minnows may be attributed to their tolerance, as a group, of diverse habitats (from fresh to brackish water, warm to cool waters, and moving to standing water), small size (thus a large number of minnows can occupy a small space and find sufficient food and shelter), and rapid attainment of sexual maturity. The smaller minnows usually live three or four years; larger species may live seven to ten years, and the carp even longer.

The genus *Notropis* contains more species than any other genus of American minnow (Blair et al. 1968). Breeding common shiner males develop a deep blue head with rose-pink fins and body, and extensive breeding tubercules (Woodling 1985). Colorado specimens reach six inches in length. The diet varies with season - in summer and winter, aquatic insects predominate; vegetation forms the bulk of the diet in spring; vegetation and small fish are eaten in the fall (Starrett 1950). Feeding occurs on the bottom, in the water column, or at the surface (Scott and Crossman 1973).

Common shiners spawn in spring on gravel beds in flowing water, often at the head of a riffle (Raney 1940). Males defend a small territory, and may move a few stones to provide some clearing of the spawning site, excavate a depression, or even spawn over the nest of another species (Raney 1940; Scott and Crossman 1973; Woodling 1985).

Distribution and Status

The common shiner is found from New England and Nova Scotia, south to Virginia and west to Saskatchewan and Colorado (Lee et al. 1980). In Canada it is found in the Saskatchewan, Qu'Appelle, Assiniboine, Red, English, Winnipeg, and Nelson Rivers (Crossman and McAllister 1986).

Historic distribution data for the common shiner in Colorado indicate a clear declining trend in the South Platte River basin, though it was once well-distributed in the Front Range (Nesler et al. 1997). Propst (1982) found common shiners in four streams tributary to the South Platte River. Nesler et al. (1997) found common shiners at only six sites in the St. Vrain and West Plum Creek systems of the South Platte River basin. The common shiner is uncommon both in relative abundance and frequency of occurrence in the South Platte River Basin (Nesler et al. 1997).

Today it is found in upper South Platte River tributaries and the St. Vrain drainage (CDOW 2002b). It is considered native to the Arkansas River Basin, though this has been questioned by Fausch and Bestgen (1996).

The common shiner is state threatened in Colorado and is recommended for special concern status in Wyoming (Patton 1997). It has a CNHP rank of G5/S2 (demonstrably secure globally; imperiled in Colorado) (CNHP 2002b).

Habitat

The common shiner requires streams of moderate gradient with cool, clear water, gravel bottoms, and shade from brush or trees (Trautman 1981). It will not spawn in silted streams (Miller 1964), and is intolerant of silt-dominated waters (Propst 1982; Woodling 1985).

Conservation Planning

There are no specific conservation plans in place for the common shiner. However, The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that would protect key areas of common shiner habitat.

Flathead Chub (*Platygobio* [= *Hybopsis*] *gracilis*)

Species Description

The minnow family (Cyprinidae) is large and highly variable. Sexual dimorphism is usually conspicuous; breeding, brightly colored males have nuptial tubercles on the head, body and along fin rays (Blair et al. 1968). Minnows construct a variety of nests, including piles of stones (carried by mouth to the nest), cup-shaped depressions in or above riffles, and excavations under a stone where the eggs are attached to the underside of the stone.

The abundance of minnows may be attributed to their tolerance, as a group, of diverse habitats (from fresh to brackish water, warm to cool waters, and moving to standing water), small size (thus a large number of minnows can occupy a small space and find sufficient food and shelter), and rapid attainment of sexual maturity. The smaller minnows usually live three or four years; larger species may live seven to ten years, and the carp even longer.

The flathead chub is a minnow that forms large schools and prefers shallow water to sand bars. It has a morphology that adapts it well to life in strong currents - a wedge-shaped head, large sickle-shaped pectoral fins, and, for a minnow, large size (to ten inches) (Eddy and Surber 1943; Woodling 1985). The flathead chub relies on external tastebuds for locating food in turbid water (Eddy and Surber 1943), and is an opportunistic feeder, taking aquatic and terrestrial insects, other invertebrates, algae, and plants (Lee et al. 1980; Woodling 1985). Spawning occurs when water levels recede to seasonal lows. In Missouri, the flathead chub is believed to spawn in July or August (Pflieger 1975) when water temperatures are maximal, turbidity is reduced, and the sandy bottoms have stabilized (Sublette et al. 1990).

Note: The flathead chub was returned to the genus *Platygobio* in 1989 and is sometimes referenced in the literature as *Hybopsis gracilis* (American Fisheries Society 1991).

Distribution and Status

The historic range of the flathead chub extended from the lower Mississippi River and its tributaries, including the southern Canadian River in Oklahoma and New Mexico, north and west through the Missouri River drainage of the Great Plains in the United States and Canada, to the McKenzie Delta and the Saskatchewan Basin east to Lake Winnipeg (Eddy and Surber 1943; Blair et al. 1968; Scott and Crossman 1973; Sublette, et al. 1990).

The flathead chub is scarce in Colorado, and detailed abundance is unknown (Woodling 1985). Early researchers found the flathead chub common in the Arkansas River mainstem up to Salida, where the river is a coldwater trout fishery (Ellis 1914). More recent work has failed to find the

flathead chub on the mainstem of the Arkansas River downstream of the John Martin Reservoir (Woodling 1985).

The flathead chub was a candidate species for listing under the Act, but was removed from that category February 28, 1996 (USFWS 1996). It is a U.S. Forest Service sensitive species in Region 2, and is a species of concern in Colorado. It has a global rank of G5/S5 (demonstrably secure globally and in Colorado) (CNHP 2002b).

Habitat

The flathead chub is tolerant of, and found in, a variety of aquatic habitats, but is most abundant in the main channels of turbid, moderate to strong current rivers that have mud, rock, or sand substrates (Lee et al. 1980). It is also found in pools in small clear streams (Woodling 1985). The typical occurrence in Colorado is over sandy bottoms on the mainstem of the Arkansas River (Woodling 1985). It also appears to be tolerant of organic enrichment. Specimens collected from Fountain Creek, downstream from the Fountain, Colorado, wastewater treatment effluent outfall, appeared to be in excellent condition, despite water chemistry showing extensive organic enrichment with high ammonia concentrations (Woodling 1985).

Conservation Planning

There are no conservation plans in place for the flathead chub. However, a rangewide status assessment for it has been prepared by Region 3 (Midwest Region) of the U.S. Fish and Wildlife Service (Tibbs 1998). The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that would act as refuges for flathead chub populations.

Plains Minnow (*Hybognathus placitus*)

Species Description

The minnow family (Cyprinidae) is large and highly variable. Sexual dimorphism is usually conspicuous; breeding, brightly colored males have nuptial tubercles on the head, body and along fin rays (Blair et al. 1968). Minnows construct a variety of nests, including piles of stones (carried by mouth to the nest), cup-shaped depressions in or above riffles, and excavations under a stone where the eggs are attached to the underside of the stone.

The abundance of minnows may be attributed to their tolerance, as a group, of diverse habitats (from fresh to brackish water, warm to cool waters, and moving to standing water), small size (thus a large number of minnows can occupy a small space and find sufficient food and shelter), and rapid attainment of sexual maturity. The smaller minnows usually live three or four years; larger species may live seven to ten years, and the carp even longer.

The plains minnow is a mainstem species adapted to the habitat provided by highly unstable plains rivers (Cross et al. 1985). It is a schooling, bottom-dweller of turbid river channels with a sandy bottom and some current (Cross et al. 1985). These fish feed by scraping algae, diatoms, and other microflora from the rocks, aquatic snags, and plant roots found on stream bottoms or margins. Spawning is sporadic and associated with high and receding, turbid flows in spring (Taylor and Miller 1990). Changes in distribution result from rare highflow events.

Distribution and Status

The plains minnow is a resident of the Great Plains states, from Texas north through North Dakota, and from Iowa west through Wyoming.

In Colorado, it was characterized as an "occasional resident" of the South Platte River in 1982 (Propst). Woodling found their distribution in 1985 to include the South Platte River in Logan County, a few individuals from the Republican River in Yuma County, and the Arkansas River basin in Kiowa County. Today it is found in the Arkansas River basin (Nesler et al. 1997), and is an uncommon fish of the South Platte River basin (Nesler et al. 1997). The only known recent occurrences are a few individuals from the South Platte River between Ft. Morgan and Sterling (Tate and Martin 1995; CDOW 2002b).

The plains minnow was listed in the Federal Register, November 15, 1994, as a Category 2 Candidate for listing as threatened or endangered under the Act. In 1996 it was removed from the list of candidate species (61FR40), though it remains a species of management concern. It is a U.S. Forest Service sensitive species, and in New Mexico, the Canadian River population of the plains minnow is "at risk." The plains minnow is listed as a species of concern in Arkansas and Kansas (Schmidt 1996), and is recommended for special concern status in Wyoming (Patton 1997). It is listed as endangered by the state of Colorado (CDOW 2002b), and has a CNHP rank of G4/SH (apparently secure globally; historically known from Colorado but not verified for an extended period) (CNHP 2002b).

Habitat

The plains minnow is a fish of main channels with sandy bottoms, abundant vegetation, and turbid water (Cross et al. 1985; Woodling 1985). It is adapted to the habitat provided by highly unstable plains rivers (Cross et al. 1985), including highly variable water levels, unstable streambeds, and fluctuating water temperature.

Conservation Planning

The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that could act as refuges for plains minnow populations.

Plains Topminnow (*Fundulus sciadicus*)

Species Description

The plains topminnow is a small, stout fish (approximately 2.5 inches long) adapted to surface feeding. Food consists of small crustaceans, aquatic insects (especially aquatic stages of mosquitoes), and filamentous algae (Williams 1995). Topminnows are found either singly or in small, isolated aggregations near the water surface. Spawning occurs in early summer (Woodling 1985; Williams 1995). Eggs are deposited on submerged vegetation and algae (Lee et al. 1980; Woodling 1985; Williams 1995).

Distribution and Status

There are two disjunct populations of the plains topminnow. One population is centered in Nebraska, with small populations found in northeastern Colorado, eastern Wyoming, and southern South Dakota (Woodling 1985). The second population is largely in south-central Missouri to southeast Kansas and northeast Oklahoma (USGS 2000).

The plains topminnow is a native of Colorado (Jordan 1891), and has been introduced into several drainages in Colorado, including the White River in Rio Blanco County and the Rio Grande in the San Luis Valley (Wick et al. 1981). It persists in the White River drainage, but has been extirpated from the Rio Grande (Fuller 2000). Historically it was widely distributed in Colorado in tributaries of the South Platte River basin (Propst 1982). Today it is found in isolated colonies in foothills streams, intermittent prairie streams, and the lower mainstem of the

South Platte River (Woodling 1985; Nesler et al. 1997). The Pawnee National Grasslands has found it in Coal Creek, Willow Creek, and tributaries of Pawnee Creek (Roosevelt National Forest, Arapaho National Forest and Pawnee National Grassland FEIS).

The plains topminnow was formerly a candidate for listing as a Category 2 species. It is classified as a sensitive species by Region 2 of the U.S. Forest Service, and is listed as threatened in Minnesota, Oklahoma, and South Dakota (Schmidt 1996). It is a species of concern in Colorado (CDOW 2002c) and has a CNHP rank of G4/S4 (apparently secure globally and in Colorado) (CNHP 2002b).

Habitat

The plains topminnow has specialized habitat needs that include still, clear water with sand or gravel substrates, and abundant macrophytes including filamentous algal growths (Propst 1982; Woodling 1985). It can also exist in sloughs and ponds (Nesler et al. 1997).

Conservation Planning

The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified high priority conservation areas that would protect areas of plains topminnow habitat.

Southern Redbelly Dace (*Phoxinus erythrogaster*)

Species Description

The southern redbelly dace is an herbivorous fish, feeding primarily on vegetation, diatoms, and blue-green algae gleaned from the stream bottom (Phillips 1969). It spawns in late spring in swift, shallow riffles over a gravel substrate, or in the nests of other minnow species (Cross and Collins 1975). Spawning usually occurs in schools with two males accompanying a female (Woodling 1985). Eggs require a high oxygen environment to hatch (BISON 2000a).

Distribution and Status

The southern redbelly dace is found throughout the Mississippi-Ohio River system, with disjunct populations in Kansas, Oklahoma, Colorado, and New Mexico (Miller and Robinson 1973; Cross and Collins 1975; Pflieger 1975; Starnes and Starnes 1980).

In Colorado, northern redbelly dace are found in the South Platte River basin, whereas southern redbelly dace are found in the Arkansas River basin (Miller 1982; Woodling 1985). Native populations are apparently extirpated, and today, the southern redbelly dace only occurs in relatively isolated populations at two pond sites on Fort Carson and at the Pueblo Army Depot (CDOW 2002b).

The southern redbelly dace is listed as a sensitive species in U.S. Forest Service Regions 2 (Colorado) and 3 (New Mexico and Arizona), and is designated as state endangered in Colorado (CDOW 2002b). It has a CNHP rank of G5/S1 (demonstrably secure globally; critically imperiled in Colorado) (CNHP 2002b).

Habitat

The southern redbelly dace prefers clean, cool headwaters of small, shallow streams with permanent flows, but can apparently tolerate periodic turbidity (Woodling 1985). The preferred bottom substrate is gravel, though they have been found over mud, detritus, or weed beds (Woodling 1985). In New Mexico, it is found in clear, cool, shaded streams and spring runs (BISON 2000a). In Wisconsin, Becker (1983) found that it used undercut stream banks for escape cover.

In Colorado, the southern redbelly dace is found where water flow is permanent, the water is cool, and the bottom consists of gravel, mud, or organic debris (Cross 1967; Miller and Robinson

1973; Pflieger 1975; Trautman 1981). In 1984, the single Colorado population was found in a small, slow flowing, clear creek with abundant algal growths covering a stream substrate of deep silt deposits. In addition, there was abundant riparian vegetation providing shade (Woodling 1985).

Conservation Planning

There are no formal conservation plans in place for the southern redbelly dace, but the City of Pueblo protects the riparian habitat of the stretch of stream within its jurisdiction. The Nature Conservancy (1998) developed a Central Shortgrass Prairie ecoregional conservation plan that identified reaches of the Arkansas River in and near Pueblo as high priority conservation areas for the southern redbelly dace.

Suckermouth Minnow (*Phenacobius mirabilis*)

Species Description

The minnow family (Cyprinidae) is large and highly variable. Sexual dimorphism is usually conspicuous; breeding, brightly colored males have nuptial tubercles on the head, body and along fin rays (Blair et al. 1968). Minnows construct a variety of nests, including piles of stones (carried by mouth to the nest), cup-shaped depressions in or above riffles, and excavations under a stone where the eggs are attached to the underside of the stone.

The abundance of minnows may be attributed to their tolerance, as a group, of diverse habitats (from fresh to brackish water, warm to cool waters, and moving to standing water), small size (thus a large number of minnows can occupy a small space and find sufficient food and shelter), and rapid attainment of sexual maturity. The smaller minnows usually live three or four years; larger species may live seven to ten years, and the carp even longer.

The suckermouth minnow has a snout and lips that are adapted to rooting in the streambed for insect larvae and invertebrates, as well as detritus and plant material (Ellis 1914; Starret 1950; Pflieger 1975; Woodling 1985). Spawning extends from April through August, which may be an adaptation to extreme fluctuations in the flow of plains streams (Cross and Collins 1975). It is more tolerant of silty waters than many other fish (Miller and Robinson 1973), but does appear to require permanent flows (Woodling 1985).

Distribution and Status

The suckermouth minnow is found across a large part of North America, from the Great Lakes states through the midwest to scattered locations in the Great Plains. It occurs throughout most of the Mississippi River basin, from Ohio west to Wyoming and south to Louisiana and Texas, where it is found in a few Gulf Coast drainages. Overall, the suckermouth minnow appears to be common over much of its range, and has extended its distribution in Ohio (Trautman 1981) and in Wisconsin (Becker 1983).

In Colorado, the suckermouth minnow had a distribution that was limited to the eastern plains and included the St. Vrain and Boulder Creek drainages (Ellis 1914), the main stem of the South Platte River (Propst 1982), Republican River (Cancalosi 1980), and the lower mainstem and some tributaries of the Arkansas River downstream of the John Martin Reservoir (Woodling 1985; Nesler et al. 1997). Today it is found in the Lodgepole Creek drainage of the mainstem South Platte, and there is a small population in the mainstem Arkansas River between John Martin Reservoir and the Kansas state line (CDOW 2002b).

The suckermouth minnow is a species of special concern in Arkansas (Schmidt 1996), threatened in New Mexico (BISON 2000b), and endangered in Colorado. It has a CNHP rank of G5/S2 (demonstrably secure globally; imperiled in Colorado) (CNHP 2002b).

Habitat

The suckermouth minnow prefers clear shallow water with riffles, a sand, gravel, or bedrock substrate, and year-round flows (Ellis 1914; Pflieger 1975; Propst 1982; Woodling 1985). In some areas it seems to tolerate high levels of turbidity and organic enrichment (Miller and Robinson 1973; Becker 1983), but it does require permanent flows (Propst 1982; Woodling 1985).

Conservation Planning

CDOW is establishing broodstocks of the suckermouth minnow to use in restoration stocking (CDOW 2002b). The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of suckermouth minnows in Wyoming and Colorado.

Northern Cricket Frog (*Acris crepitans blanchardi*)

Species Description

The northern cricket frog is a small, non-climbing tree frog in the family Hylidae. It is the most completely aquatic North America Hylid, and remains near permanent water year-round (Kellar et al. 1997). Its active season extends from May to October, but it may emerge from hibernation in April (Hammerson 1982a, 1999). Eggs float or stick to submerged plants and hatch after a few days. Newly metamorphosed cricket frogs have been observed in Colorado in early July (Hammerson 1982a). Food for juveniles and adults probably consists of small invertebrates captured at the water's edge (Stebbins 1951; Labanick 1976; Hammerson 1986; Kellar et al. 1997). Tadpoles are probably herbivorous (Stebbins 1951).

Small frogs like the northern cricket frog are preyed upon by many birds, snakes, raccoons (*Procyon lotor*), and diving beetles, as well as non-native bullfrogs (*Rana catesbeiana*).

Distribution and Status

The northern cricket frog has the most northerly range of the two species in the genus *Acris* (Kellar et al. 1997). The genus is endemic to eastern and central North America, and is largely restricted to the United States. The range of the subspecies *blanchardi* occurred from Michigan, Ohio, Kentucky, and Tennessee westward to northeastern Colorado, southeastern New Mexico, western Texas, northeastern Mexico, and two locations in Canada (Hubbard et al. 1979; Kellar et al. 1997).

In Colorado, the northern cricket frog was documented in the Republican River and South Platte River drainages, and was most abundant along the North Fork of the Republican River in Yuma County (Hammerson 1986), and perhaps in the South Platte River in Weld and Morgan counties (Hammerson 1999). Recent evaluation of northern cricket frog records indicates that it was present in the Republican River drainage and Platte River drainage in Colorado at least through the 1970s, but subsequent surveys indicate that its distribution has declined, and it may be extirpated from Colorado (Hammerson and Livo 1999.)

The northern cricket frog is a species of special concern in Michigan, and is listed as endangered in Wisconsin and Canada (Kellar et al. 1997). It is a species of special concern in Colorado, and has a CNHP rank of G5/SH (demonstrably secure globally; historically known from Colorado, but not verified for an extended period of time) (CNHP 2002b).

Habitat

The northern cricket frog prefers the gently sloping banks of ponds, ditches, and marshes (Kellar et al. 1997). It breeds in ponds and slow-moving pools, and is likely to be found within 0.25-0.5 miles of water in rainy weather and directly adjacent to water during dry weather (pers. comm., Livo 2002). In Colorado, it is found on sunny, muddy, or marshy edges of ponds, reservoirs, streams, and irrigation ditches (Hammerson and Langlois 1981; Hammerson 1982a; Hammerson 1986). Although cricket frogs usually are found near water in Colorado, Burnett (1926) found

one in the opening of a prairie dog burrow in Weld County (Hammerson 1986). The northern cricket frog hibernates in soil cracks on land (Regan 1972; Gray 1983).

Conservation Planning

There are no conservation plans in place in the United States for the northern cricket frog. There is a recovery plan for this frog in Canada, where it is at the northern periphery of its distribution (Kellar et al. 1997). The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of the northern cricket frog in Colorado.

Northern Leopard Frog (*Rana pipiens*)

Species Description

The northern leopard frog is a small frog in the Ranidae (the true frogs). In eastern Colorado, it inhabits bodies of permanent water, is active from March though October or November, and breeds in the non-flowing portions of permanent water bodies (Hammerson 1986). These frogs hibernate underwater (Livo 1981; Hammerson 1982a, 1986), forage on land or in shallow water (Post 1972; Hammerson 1982a), and bask on shore or in shallow water. Egg masses are attached to vegetation just below the water surface in shallow, relatively warm water (Hammerson 1999). Individuals gather during breeding and at over-wintering sites (Post 1972; Gillis 1975; Livo 1981). Food habits in Colorado are not well studied (Hammerson 1986), but anuran larvae often filter-feed on algae (Tanner 1931) and feed in still water (Hammerson 1982a).

Distribution and Status

The northern leopard frog ranges across much of the northern continental United States and southern Canada. In Colorado, it occurs throughout the state except in the Republican River drainage and south of the Arkansas River in southeastern Colorado (Hammerson 1986, 1999).

Livo (1995) updated known county distributions of Colorado amphibians and reptiles based on published reports of occurrences. The northern leopard frog is sympatric with the plains leopard frog in Cheyenne, El Paso, Lincoln, and Pueblo counties in Colorado, and these species are known to hybridize (Post 1972; Gillis 1975; Hammerson 1982a, 1999). In some areas, reduced or extirpated leopard frog populations are associated with the presence of bullfrogs (Hammerson 1982b). For example, northern leopard frogs were abundant in East Plum Creek (Douglas County) in the early 1990s, but recent observations showed hundreds of bullfrogs and only five leopard frogs in a 1,000 meter reach of stream (C. Pague, unpublished data). Bullfrogs now outnumber northern leopard frogs in areas of eastern Colorado (Hammerson 1999). The northern leopard frog has undergone documented declines in Colorado (Corn 1994).

The northern leopard frog has been designated a U.S. Forest Service sensitive species in Region 3 (New Mexico and Arizona) and in Region 2 (Colorado). It is a species of special concern in Arizona and Colorado, and has been assigned a CNHP rank of G5/S3 (demonstrably secure globally; vulnerable in Colorado) (CNHP 2002b).

Habitat

The northern leopard frog is a wetland obligate that typically uses the banks and shallow portions of marshes, ponds, lakes, reservoirs, beaver ponds, streams, and other bodies of permanent water, including irrigation ditches and wet meadows (Hammerson 1986, 1999). Permanent water bodies having rooted vegetation are particularly attractive (Hammerson and Langlois 1981; Hammerson 1982a, 1986), though the frogs are rarely found near ephemeral ponds (Finch 1991).

Conservation Planning

There are no government conservation plans in place for the northern leopard frog. However, The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of northern leopard frogs in Colorado.

Massasauga (*Sistrurus catenatus*)

Species Description

The massasauga is a small rattlesnake of the dry grasslands of eastern Colorado (Mackessy 1998; Hammerson 1999). Its annual period of activity extends from April to October. It is generally a crepuscular species (Hammerson 1986). Courtship has been documented in June and possibly in September, and births occur in August and September (Hammerson 1999). In Colorado, the massasauga is an opportunistic feeder of small rodents, lizards, frogs, large insects, and occasionally carrion (Mackessy 1998; Hammerson 1999). Smith et al. (1965) reported that a massasauga from Crowley County had eaten two white-footed mice (*Peromyscus leucopus*). The massasauga hibernates individually through the winter. In Colorado they use rodent burrows in hard packed soils for hibernacula (Mackessy 1998). Telemetry work completed on the Comanche National Grassland by Mackessy (1998) recorded movements as late as 21 November, and concluded that it is likely that snakes are active throughout the year as local temperature permits. In Colorado, the massasauga moves from shortgrass prairie with hard, loamy soils to sandsage habitat with softer, sandier soils in the spring (Mackessy 1998).

Distribution and Status

The massasauga ranges from the Great Lakes to northern Mexico. Data suggest that massasaugas in Colorado are intergrades between *Sistrurus c. edwardsii* (desert massasauga) and *Sistrurus c. tergemimus* (western massasauga) (Mackessy 1998; Hammerson 1999). Mackessy (1998) suggested that massasaugas in Colorado are most similar to *Sistrurus c. edwardsii* and should be assigned to *edwardsii*. In any case, the massasauga in Colorado appears to be geographically disjunct from both neighboring races, lying west of an area in Kansas that is possibly inhabited by the intergrading forms (Mackessy 1998).

The Colorado population is centered in southeastern Lincoln County and western Kiowa County, and is uncommon south of the Arkansas River (Hammerson 1986; Hobert et al. 1997; Mackessy 1998). Mackessy reported a small population of massasaugas in Baca County, and noted that, prior to his find, the most recent massasauga record for Baca County was in 1882 by A. E. Beardsley (no specific locality given). Mackessy (1998) also collected a road-killed massasauga in El Paso County. The Colorado Herpetological Society (2000a) shows recent records for massasaugas in Lincoln, El Paso, Pueblo, Crowley, Otero, Bent, Kiowa, Cheyenne, Prowers, Baca, and Las Animas Counties.

The massasauga is a species of concern in Colorado and has a CNHP rank of G3G4/S2 (watchlisted globally; imperiled in Colorado) (CNHP2002b).

Habitat

The massasauga inhabits dry plains grassland and sandhill regions in Colorado (Hammerson 1986, 1999). Sandy soils probably provide good habitat for potential prey. Rodent burrows in hard packed soils provide habitat for hibernacula (Mackessy 1998).

Conservation Planning

There are no government conservation plans in effect for this subspecies. The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of key native populations of the massasauga in Colorado.

Texas Horned Lizard (*Phrynosoma cornutum*)

Species Description

The Texas horned lizard is a ground-dwelling inhabitant of unplowed shortgrass prairie. It is a diurnal ant specialist, whose daily activities tend to be a response to temperature changes in the environment and the related activity of its primary prey, ants (Pianka and Parker 1975; Bockstanz 1998; Mackessy 1998). Texas horned lizards are most active on warm to hot days in late June through early September. Burrowing into the ground is an important behavior in thermoregulation, as it protects the lizard from heat or cold depending on the temperature of the soil in which the animal is buried (Potter and Glass 1931). They emerge from hibernation in early May and go into hibernation in September (Hammerson 1986).

The Texas horned lizard is oviparous and lays its eggs in moist, sandy soil (Pianka and Parker 1975; Bartlett and Bartlett 1999). Mating probably occurs in May or June, with egg-laying in June or July (Hammerson 1986, 1999), and eggs hatching at the end of August or early September (Mackessy 1998).

Distribution and Status

The Texas horned lizard occurs from central Kansas, extreme southwestern Missouri, and the southeastern corner of Colorado, south and westward throughout most of Oklahoma, Texas (including the coastal barrier islands), the southeastern half of New Mexico, and the southeastern corner of Arizona to the Mexican states of Sonora, Chihuahua, Durango, Coahuila, Nuevo Leon, Tamaulipas, San Luis Potosi, and Zacatecas (Reeve 1952; Hammerson 1986).

In Colorado, the Texas horned lizard occurs in the southeast corner of the state south of the Arkansas River (Hammerson 1986; Mackessy 1998). It was documented in extreme eastern Pueblo County and has been found in Kiowa County (Mackessy 1998). It has also been documented in Pueblo, Otero, Bent, Cheyenne, Baca, and Las Animas Counties (Livo 1995; Colorado Herpetological Society 2000b).

The Texas horned lizard and short-horned lizard (*P. hernandesi*) have virtually complementary ranges in Colorado; their ranges meet but show very little overlap (Hammerson 1982a, 1999).

The Texas horned lizard has largely disappeared from east Texas. Population declines have also occurred in parts of Oklahoma and other areas in Texas (Hammerson 1999). Recent work in Colorado by Hammerson, the Colorado Natural Heritage Program, and the University of Northern Colorado, indicates that the Texas horned lizard in Colorado remains widespread and fairly common within its historic range (Hammerson 1999).

The Texas horned lizard is considered threatened in all parts of its current range, including Colorado, where it is a species of special concern (Donaldson et al. 1994). It has a CNHP rank of G4G5/S3 (apparently secure globally; vulnerable in Colorado) (CNHP 2002b).

Habitat

The Texas horned lizard inhabits plains grasslands, especially where there are large patches of bare soil. It requires feeding habitat (generally where ants are abundant), basking habitat, habitat where digging is easy (for thermoregulation), and hibernation habitat. Bare ground typical of what occurs in association with grazing is a characteristic feature of Texas horned lizard habitat throughout its range (Whiting et al. 1993; Fair and Henke 1997), but the lizard seems to be absent from areas with the large bare areas typical of plowing (Hammerson 1999). The lower limit of juniper growth seems to delimit the upper limit of its habitat in canyons and at the foot of mesas (Hammerson 1986; Bartlett and Bartlett 1999). Texas horned lizards select sandy areas where they inhabit abandoned animal burrows (Bockstanz 1998), usually in close proximity to the nests of harvester ants (Seymour 1996). They will use berms along dirt roads as basking sites (Mackessy 1998). In Colorado, they have been found to be most abundant on sandy soils with sage (*Artemisia* spp.) and large areas of bare ground (Mackessy 1998).

Conservation Planning

There are no formal conservation plans in effect for this subspecies. The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of the Texas horned lizard in Colorado.

Western Box Turtle (*Terrapene ornata*)

Species Description

The western box turtle is a terrestrial species (though it has been observed using quiet water) (Rodeck 1949; Hammerson and Langlois 1981; Hammerson 1986) that can completely enclose itself in its shell. The front of the plastron is hinged, and can be drawn up tightly against the carapace (Hammerson 1986). The western box turtle is a diurnal turtle that spends the night in burrows dug by itself or by other animals (Legler 1960; Ernst and Barbour 1972). They move an average of 200-300 feet/day (60-90 meters) over a home range of about five acres (two hectares with mean maximum diameter of approximately 170 meters) in Kansas (Legler 1960). Another Kansas study reported a mean maximum home range diameter of 152 meters for males and 267 meters for females (Metcalf and Metcalf 1978). Blair (1976) calculated Texas home range diameters as approximately 100 meters. In central New Mexico, mean home range size is 1.6 hectares, or a mean maximum diameter of 276 meters (Nieuwolt 1996). There are large spurts of activity following summer rains (Rodeck 1949; Hammerson 1999).

Food of adults consists largely of beetles, lepidoptera larvae, and grasshoppers, but many other foods including carrion are taken (Legler 1960; Metcalf and Metcalf 1970; Ernst and Barbour 1972; Hammerson 1986). Cow dung is sometimes ingested during predation on insects (Legler 1960). Juveniles eat a greater variety of foods than individual adults (Legler 1960). Western box turtles may have evolved in conjunction with the large herds of grazing animals on the North American prairies, as their powerful front legs and strong claws are well-adapted for tearing apart manure piles which they search for dung beetles and grubs (Legler 1960). Research has shown that turtle numbers decline when cattle are removed from their home ranges (Legler 1960).

Western box turtles enter hibernation in October and November as day length decreases, temperatures drop, and autumn rains moisten and soften the soil. If suitable places to dig are not found, the burrows of other animals may be used for hibernating (Legler 1960; Ernst and Barbour 1972). They emerge from hibernation in April (Hammerson 1986).

Male western box turtles become sexually mature at eight to nine years of age, and females are sexually mature at ten or 11 years (Legler 1960; Ernst and Barbour 1972). Courtship and mating occur immediately after emerging from hibernation, but may extend into the summer and fall (Legler 1960; Ernst and Barbour 1972; Nieuwolt-Decanay 1997). Nesting occurs from May through July, reaching a peak in mid-June. An open area of soft, well-drained soil is selected for the nest, a clutch of one to four eggs is laid, and incubation duration is variable depending on temperature and moisture (Legler 1960; Ernst and Barbour 1972; Nieuwolt-Decanay 1997). Average incubation is 65-70 days (Legler 1960; Ernst and Barbour 1972). Sex is determined by incubation temperature (Voght and Bull 1982; Packard et al. 1985). Hatchlings usually leave the

nest from early September through October, but may overwinter in the nest, leaving the following spring (Legler 1960; Ernst and Barbour 1972). Natural longevity can be at least 28-32 years (Blair 1976; Metcalf and Metcalf 1985).

Distribution and Status

Western box turtles are found from southwestern South Dakota, southern Michigan, and Indiana south to the Gulf Coast and extreme northern Mexico, eastern Texas across southern New Mexico to southeastern Arizona and into Sonora (Ernst and Barbour 1972; Garrett and Barker 1987). This species occurs throughout most of eastern Colorado below 5,500 feet (1,676 m) (Hammerson 1986; Colorado Herpetological Society 2000c). The western box turtle is scarce or absent on the western crest of the Platte-Arkansas divide and west of Baca County south of the Arkansas River, but it is locally common within its range in Colorado, especially in the sandhill regions south of the South Platte River (Hammerson 1999) and just north of the Arkansas River (pers. obs., C. Pague). The most robust populations in Colorado coincide with the remaining areas of unplowed prairie (Hammerson 1999).

The western box turtle is listed in the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) Appendix II (species not now threatened with extinction, but could become so unless trade is strictly controlled). Export permits are needed from the country of origin (CITES 1994). The western box turtle has a CNHP rank of G5/S5 (demonstrably secure globally and in Colorado) (CNHP 2002b).

Habitat

The western box turtle inhabits open grasslands and sandhills (Garrett and Barker 1987; Hammerson 1999). It prefers soft, sandy soils that are easily penetrated for nesting, temperature regulation, and hibernation (Legler 1960; Ward 1978; Hammerson 1999). It is found in prairie dog colonies, where it uses prairie dog burrows for hibernation and temperature regulation (Clark et al. 1982; Hoogland 1995), finds soils suitable for digging nests, and forages for food.

Conservation Planning

There are no conservation plans in effect for this subspecies. The Colorado Wildlife Commission allows individuals to collect up to four western box turtles from the wild each year with a total of no more than 12 held in captivity (Article I - General Provisions #1000 - Protected Species). Doroff and Keith (1990) recommend establishing roadless preserves of at least 100 hectares. The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified large areas important for the conservation of native populations of western box turtles in Colorado.

Cylindrical Papershell (*Anodontoides ferussacianus*)

Species Description

The cylindrical papershell is a member of the class Bivalvia and family Unionidae that includes the clams, oysters, and mussels. These are filter-feeding burrowers of the benthos (Barnes 1974) that are parasitic for part of their life and require a vertebrate, usually a fish, as host (O'Dee and Watters 1998). The larval stage, the glochidium, is parasitic on the surface of fish whose body forms a cyst around the glochidium (Barnes 1974). After 10-30 days, the immature animal breaks out of the cyst, falls to the bottom, and burrows into the mud where it completes development (Barnes 1974). The adult mussel is a filter-feeding, sessile organism. Mussels are long-lived species; many live more than ten years, and some are reported to live more than 100 years. Thin-shelled species - the floaters and papershells - grow much faster than thicker-shelled species (Cummings and Mayer 1992). The cylindrical papershell has an elongated-oval shell that is yellowish white to olive or dark brown, and can grow to 114 millimeters (4.5 inches) in length (Wu 1989).

Distribution and Status

In Colorado, the cylindrical papershell is found only in the Platte River drainage, primarily in Boulder County, but was also recorded from Denver, Morgan, Sedgwick, and Weld counties (Wu 1989). It is most common in spring-fed lakes and ponds in Boulder County (Wu 1989). Cordeiro (1999) reported that this species' distribution has shrunk from 15 formerly documented locations to only two - Valmont Lake and Little Thompson River, both in Boulder County.

As a group, native mussels are the most rapidly declining animal group in the United States, and constitute the largest group of federally-listed endangered or threatened invertebrates (TNC 1996). The cylindrical papershell is state endangered in Missouri and state threatened in Iowa. It has a CNHP rank of G5/S2 (demonstrably secure globally; imperiled in Colorado).

Habitat

Mussels are found in waters where velocity allows for stable substrates for burrowing, but in which siltation does not occur (Ellis 1931; McMahon 1991). Being sessile filter feeders, mussels require good water quality and quantity for feeding, breathing, and reproducing, and thus typically inhabit unpolluted waters that are rich in oxygen, calcium, and suspended food particles. Because they are filter feeders, they are organic-nutrient sinks and are probably significant aquatic decomposers (McMahon 1991). The cylindrical papershell inhabits the mud and sand benthos of small creeks and the headwaters of larger streams (Cummings and Mayer 1992).

Conservation Planning

There are no conservation plans for cylindrical papershell, but the Service has drafted a national strategy for the conservation of native mussels (Biggins et al. 1995). The U. S. Environmental Protection Agency and The Nature Conservancy have also developed partnerships for water quality protection and habitat restoration that will benefit mussels (Jennings 2000).

Giant floater (*Pyganodon* = [*Anodonta*] *grandis*)

Species Description

The giant floater is a member of the class Bivalvia and family Unionidae that includes the clams, oysters, and mussels. These are filter-feeding burrowers of the benthos (Barnes 1974) that are parasitic for part of their life and require a vertebrate, usually a fish, as the host (O'Dee and Watters 1998). The larval stage, the glochidium, is parasitic on the surface of fish whose body forms a cyst around the glochidium (Barnes 1974). Thirty-seven hosts have been reported for the giant floater (Watters 1995). After 10-30 days, the immature animal breaks out of the cyst, falls to the bottom, and burrows into the mud where it completes development (Barnes 1974). The adult giant floater is a filter-feeding, sessile organism that has a fragile, elongate, oval shell 106-191 millimeters (4 - 7.5 inches) in length (Wu 1989).

Mussels are long-lived species; many live more than ten years, and some are reported to live more than 100 years. Thin-shelled species - the floaters and papershells - grow much faster than thicker-shelled species (Cummings and Mayer 1992).

Based on allozyme and morphological data, *Anodonta grandis* has been reclassified as *Pyganodon grandis* (Hoeh 1990).

Distribution and Status

The giant floater is found from the east coast to the Rocky Mountains in permanent bodies of water having a muddy or silty substrate (Wu and Brandauer 1978). In Colorado, Wu (1989) found the giant floater in the Platte and Republican River drainages in Boulder, Larimer, Morgan, and Yuma counties. Herrman and Fajt (1985) have recorded it in the Arkansas River drainage, and in reservoirs in Kit Carson, Adams and Pueblo counties. Wu (1989) found that the species is most abundant in spring-fed lakes and ponds in Boulder and Larimer counties. Cordeiro (1999) reported this species in Cherry Creek Reservoir and Boyd Lake (Platte River drainage), Flagler Reservoir (Republican River drainage), and Pueblo Reservoir and Colorado Fuel and Iron Reservoirs 1-3 (Arkansas River drainage).

As a group, native mussels are the most rapidly declining animal group in the United States, and constitute the largest group of federally-listed endangered or threatened invertebrates (TNC 1996). The giant floater has a CNHP rank of G5/S1 (demonstrably secure globally; critically imperiled in Colorado) (CNHP 2002b).

Habitat

Mussels are found in waters where velocity allows for stable substrates for burrowing, but in which siltation does not occur (Ellis 1931; McMahon 1991). Being sessile filter feeders, mussels require good water quality and quantity for feeding, breathing, and reproducing, and thus typically inhabit unpolluted waters that are rich in oxygen, calcium, and suspended food particles. Because they are filter feeders, they are organic-nutrient sinks and are probably significant aquatic decomposers (McMahon 1991). The giant floater is found in ponds, lakes, and sluggish mud-bottomed pools of creeks and rivers, though it can be found in a variety of other habitats as well (Cummings and Mayer 1992).

Conservation Planning

There are no conservation plans for the giant floater, but the Service has drafted a national strategy for the conservation of native mussels (Biggins et al. 1995). The U. S. Environmental Protection Agency and The Nature Conservancy have also developed partnerships for water quality protection and habitat restoration that will benefit mussels (Jennings 2000).

Arogos Skipper (*Atrytone arogos*)

Species Description

The arogos skipper is a member of the Hesperiidae. It has a short flight, with emergence occurring in late June through mid July in the Front Range, and one to two weeks earlier on the plains (Pineda and Ellingson 1997). Activity periods are in late afternoon when thunderstorms are forming, rather than clear sunny times of the day (Ferris and Brown 1981). Males perch on tall flowers or grasses to wait for females, who oviposit single eggs under host plant leaves (Pineda and Ellingson 1997).

Larvae are obligate feeders on grasses, including big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), side oats grama (*Bouteloua curtipendula*), and possibly switch grass (*Panicum* spp.). Caterpillars construct tents of two leaves silked together; fourth instar caterpillars enter diapause, complete feeding the next spring, and pupate in a leaf cocoon in vegetation about three feet above the ground (Opler et al. 1995).

Distribution and Status

Two subspecies of arogos skipper are recognized: *arogos* of the Atlantic and Gulf coastal plains and *iowa*, found in the Great Plains including Colorado (Ferris and Brown 1981).

The arogos skipper occurs in isolated colonies from Long Island south to Florida, and west along the coast to east Texas (Opler et al. 1995). The interior populations occur on the prairies from southeastern North Dakota and central Minnesota south to South Texas (Opler and Krizek 1984; Opler et al. 1995).

In Colorado, the arogos skipper is documented from the northern Front Range and extreme northeastern Colorado in Arapahoe, Boulder, Jefferson, Larimer, and Yuma Counties (Stanford and Opler 1993; Pineda and Ellingson 1997).

There is no long-term monitoring program comparable to the Breeding Bird Survey for butterflies, nor are the population dynamics as well documented for prairie butterflies as for birds. Fourth of July butterfly counts are not supported or distributed in a way that adequately monitors rare species of butterflies and skippers.

The arogos skipper has a CNHP rank of G3G4/S2 (watchlisted globally; imperiled in Colorado), and is a sensitive species in Region 1 of the U.S. Forest Service.

Habitat

The arogos skipper is found in relatively undisturbed mixed and tallgrass prairies, meadows, sand prairies, and serpentine barrens (Ferris and Brown 1981; Opler et al. 1995; Royer 2001). Larval host plants include big bluestem, little bluestem, and switchgrass (Scott 1986; Opler 1995).

Adult nectar plants include purple vetch (*Vicia* spp.), Canada thistle (*Cirsium arvense*), dogbane (*Apocynum* spp.), stiff coreopsis (*Coreopsis* spp.), purple coneflower (*Echinacea angustifolia*), green milkweed (*Asclepias* spp.), and ox-eye daisy (*Leucanthemum vulgare*) (Opler 1995).

Conservation Planning

There are no conservation plans specifically for the arogos skipper. The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of arogos skippers in Colorado.

In addition, there are several sources of general management guidelines for butterflies in the plains (Dana 1991; Royer and Marrone 1992; Moffat and McPhillips 1993). The goal for managers is to strive for diversity and patchiness within and among sites when managing for prairie butterflies. Mechanical cutting or light grazing seem to be most effective at maintaining prairie habitat preferred by prairie butterflies-implying an ecosystem adaptation to herbivory (Swengel and Swengel 1995). Invasive exotics such as crested wheatgrass (*Agropyron cristatum*), Kentucky bluegrass (*Poa pratensis*), and yellow sweet clover (*Melilotus officinalis*), many purposely introduced to increase forage for cattle, out-compete the native forbs that prairie butterflies need for adult nectar sources and larval host plants. Grazing, mowing, and small controlled burns (following surveys for concentrations of host and nectar plants) have been successfully used to manage prairie habitat for butterflies.

Hops feeding Azure (*Celastrina humulus*)

Species Description

The hops feeding azure is a recently described colonial species of butterfly found in the Front Range of Colorado (Pineda and Ellingson 1997; Scott and Wright 1998; Pineda 2002). Adult hops feeding azures emerge in late May and early June (Wright 1995; Royer 2001). The sole caterpillar host is hops (*Humulus lupulus*), and adult food is flower nectar (Royer 2001).

Distribution and Status

The hops feeding azure was formally described in 1998 (Scott and Wright 1998). The authors make a strong case for it as a valid taxon, although they note that it could be classified as a subspecies of an eastern azure (Scott and Wright 1998). It is probably endemic to the Front Range of Colorado, and has been documented in Adams, Arapahoe, Boulder, Douglas, El Paso, Elbert, Jefferson, and Larimer Counties (Stanford and Opler 1993, 1996; Pineda and Ellingson 1997) above 5,300 feet (Pineda 2002).

There is no long-term monitoring program comparable to the Breeding Bird Survey for butterflies, nor are the population dynamics as well documented for prairie butterflies as for birds. Fourth of July butterfly counts are not supported or distributed in a way that adequately monitors rare species of butterflies and skippers.

The hops feeding azure has a CNHP rank of G2G3/S2 (imperiled to vulnerable globally; imperiled in Colorado) (CNHP 2002b).

Habitat

The hops feeding azure has been found in mountain foothill canyons, valleys, and gulches from about 5,300-6,500 feet, and is always associated with permanent water and patches of hops (Opler 1999; Pineda and Ellingson 1997). Hops (a disturbance-tolerant species that requires open, sunny areas in canyon habitats) are the larval food. Adults sip nectar sources from waxflower (*Jamesia americana*) or coyote willow (*Salix exigua*) catkins (Pineda 2002).

Conservation Planning

There are no conservation plans specifically for the hops feeding azure. However, The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion (and subsequently in the Southern Rocky Mountain ecoregion) that identified areas important for the conservation of native populations of the hops feeding azure in Colorado.

In addition, there are several sources of general management guidelines for butterflies in the plains (Moffat and McPhillips 1993; Dana 1991; Royer and Marrone 1992). The goal for managers is to strive for diversity and patchiness within and among sites when managing for prairie butterflies. Mechanical cutting or light grazing seem to be most effective at maintaining prairie habitat preferred by prairie butterflies-implying an ecosystem adaptation to herbivory (Swengel and Swengel 1995). Invasive exotics such as crested wheatgrass (*Agropyron cristatum*), Kentucky bluegrass (*Poa pratensis*), and yellow sweet clover (*Melilotus officinalis*), many purposely introduced to increase forage for cattle, out-compete the native forbs that prairie butterflies need for adult nectar sources and larval host plants. Grazing, mowing, and small controlled burns (following surveys for concentrations of host and nectar plants) have been successfully used to manage prairie habitat for butterflies.

Ottoe Skipper (*Hesperia ottoe*)

Species Description

The Ottoe skipper is a moderately-sized butterfly that has the characteristic skipping flight of the skippers (Hesperiidae). After hatching, the nocturnally-active larvae move to a host plant, where they build a shelter of leaves and silk in which they spend the day. Larval host plants include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), needle-and-thread (*Stipa* spp.), and bluegrass (*Poa* spp.) (Scott 1986; Royer 2001). Larvae enter diapause and overwinter as fourth instar caterpillars, then continue feeding in the spring. Adults emerge in early summer (males preceding females by about one week) and feed on nectar from flowers of milkweed (*Asclepias* spp.), echinacea (*Echinacea purpurea*), sunflower (*Helianthus* spp.), lettuce (*Lactuca* spp.), alfalfa (*Medicago sativa*), prickly pear cactus (*Opuntia* spp.), and vetch (*Vicia* spp.). There is one flight of adults that usually lasts from June through August, peaking in July (Sedman and Hess 1985). Males perch near host

plants waiting for receptive females. Females oviposit at the base of forb or grass stems (Dana 1991).

Distribution and Status

There is no long-term monitoring program comparable to the Breeding Bird Survey for butterflies, nor are the population dynamics as well documented for prairie butterflies as for birds. Fourth of July butterfly counts are not supported or distributed in a way that adequately monitors rare species of butterflies and skippers. However, butterflies requiring prairie habitat have clearly experienced long-term declines (Swengel 1990). The Ottoe skipper occurs widely in the prairie, but has restricted habitat requirements that result in a localized distribution (Swengel and Swengel 1995). The Ottoe skipper is found from southern Manitoba and eastern Montana, south along the high plains to north Texas, east through Nebraska and Kansas to central Illinois and southwest Michigan (Ferris and Brown 1981; Scott 1986; Stanford and Opler 1993).

In Colorado the Ottoe skipper is restricted to mixed and tallgrass prairies, and has been documented in Front Range counties from El Paso County north to the Wyoming border. There are a few records from eastern Colorado (Pineda and Ellingson 1997). The populations in the Front Range are disjunct from the plains population. The Ottoe skipper has been documented in Arapahoe, Boulder, Douglas, Elbert, El Paso, Jefferson, Larimer, Phillips, and Yuma Counties (Stanford and Opler 1993).

The Ottoe skipper is listed as a sensitive species in Region 1 of the U.S. Forest Service. It has a CNHP rank of G3G4/S2 (watchlisted globally; imperiled in Colorado) (CNHP 2002b).

Habitat

The Ottoe skipper is a butterfly of unplowed, open mid-grass to tallgrass prairie, or high quality grazed prairie (Pineda and Ellingson 1997). They avoid weedy conditions (Ferris and Brown 1981; Scott 1986). Larval host plants include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), needle-and-thread (*Stipa* spp.), and bluegrass (*Poa* spp.) (Scott 1986; Royer 2001). Adult nectar plants include flowers of milkweed (*Asclepias* spp.), echinacea (*Echinacea purpurea*), sunflower (*Helianthus* spp.), lettuce (*Lactuca* spp.), alfalfa (*Medicago sativa*), prickly pear cactus (*Opuntia* spp.), and vetch (*Vicia* spp.). (Royer 2001).

Conservation Planning

There are no conservation plans specifically for the Ottoe skipper. However, The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of the Ottoe skipper in Colorado.

In addition, there are several sources of general management guidelines for butterflies in the plains (Moffat and McPhillips 1993; Dana 1991; Royer and Marrone 1992). The goal for managers is to strive for diversity and patchiness within and among sites when managing for prairie butterflies. Mechanical cutting or light grazing seem to be most effective at maintaining prairie habitat preferred by prairie butterflies-implying an ecosystem adaptation to herbivory (Swengel and Swengel 1995). Invasive exotics such as crested wheatgrass (*Agropyron cristatum*), Kentucky bluegrass (*Poa pratensis*), and yellow sweet clover (*Melilotus officinalis*), many purposely introduced to increase forage for cattle, out-compete the native forbs that prairie butterflies need for adult nectar sources and larval host plants. Grazing, mowing, and small controlled burns (following surveys for concentrations of host and nectar plants) have been successfully used to manage prairie habitat for butterflies.

Regal Fritillary (*Speyeria idalia*)

Species Description

The regal fritillary is a large member of the brush-footed butterflies (Nymphalidae). Eggs hatch in late summer, and the caterpillar overwinters in diapause as a first instar under leaf litter (Opler

et al. 1995). Caterpillars begin to feed in the spring on violets, including bird's foot violet (*Viola pedata*) and prairie violet (*V. pedatifida*) (Scott 1986; Royer and Marrone 1992). Adults emerge in early to mid-June through early July (Opler et al. 1995). Females emerge two weeks later through August (Opler et al. 1995). Adults are nectar feeders using milkweed *(Asclepias* spp.), bellflower *(Campanula* spp.), thistle *(Cirsium* spp.), echinacea (*Echinacea* spp.), fleabane (*Erigeron* spp.), blanketflower (*Gaillardia* spp.), mint (*Monarda* spp.), gayfeather (*Liatris* spp.), and black-eyed susan (*Rudbeckia* spp.) (Opler et al. 1995; Arnett 1997; Fritz 1997). Adult males patrol continuously when not feeding or basking, while adult females range widely and delay egg laying until late August (Royer 2001). Eggs are laid singly on or near violets (Opler et al. 1995).

This is a colonial species, but adults are highly mobile and probably require corridor or "stepping stone" habitats throughout the prairie to maintain genetic viability (Swengel and Swengel 1995; Pineda 2002).

Distribution and Status

There is no long-term monitoring program comparable to the Breeding Bird Survey for butterflies, nor are the population dynamics as well documented for prairie butterflies as for birds. However, butterflies requiring prairie habitat have clearly experienced long-term declines. The extinction wave of the regal fritillary from east to west, and the species' increasingly localized occurrence within the prairie region, are well documented (Swengel 1990). The regal fritillary was once widespread throughout the northeastern and mid-western United States, but today is largely limited to prairie remnants in the north-central plains from Montana and North Dakota south to Colorado, Nebraska, and Oklahoma.

Individuals have been confirmed in eastern Colorado north of the Arkansas River (Opler et al. 1995), but there is only one confirmed colony in Kit Carson County (Pineda and Ellingson 1997). Worn individuals have been sighted outside of the breeding season in Boulder, Douglas, El Paso, Gilpin, Jefferson, Kit Carson, Logan, Morgan, Park, Sedgwick, and Yuma Counties (Stanford and Opler 1993). The regal fritillary is the most widespread prairie butterfly, but it requires larger habitat patches or connected patches to maintain populations (Swengel and Swengel 1995).

The regal fritillary is a U.S. Forest Service sensitive species and was formerly a C2 candidate for listing under the Act (insufficient biological information available to support listing). It is included on the Watch List by the Missouri Department of Conservation, and is state endangered in Wisconsin. It has a CNHP rank of G3/S1 (very rare or local throughout its range; critically imperiled in Colorado) (CNHP 2002b).

Habitat

The regal fritillary is a species of tallgrass and mixed-grass prairie, where it is found in moist meadows, marshes and wet fields (Ferris and Brown 1981; Opler et al. 1995). Adults feed on the nectar of a variety of flowers, and caterpillars require habitat that supports violets. Since violets have a short growth form, they are displaced by tallgrass species. Therefore, regal fritillary habitat must include some form of disturbance so that violets remain in sufficient density to support caterpillars.

Conservation Planning

There are no conservation plans for the regal fritillary. However, The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of the regal frittilary in Colorado.

In addition, there are several sources of general management guidelines for butterflies in the plains (Moffat and McPhillips 1993; Dana 1991; Royer and Marrone 1992). The goal for managers is to strive for diversity and patchiness within and among sites when managing for prairie butterflies. Mechanical cutting or light grazing seem to be most effective at maintaining prairie habitat preferred by prairie butterflies-implying an ecosystem adaptation to herbivory (Swengel and Swengel 1995). Invasive exotics such as crested wheatgrass (*Agropyron cristatum*), Kentucky bluegrass (*Poa pratensis*), and yellow sweet clover (*Melilotus officinalis*), many purposely introduced to increase forage for cattle, out-compete the native forbs that prairie butterflies need for adult nectar sources and larval host plants. Grazing, mowing, and small controlled burns (following surveys for concentrations of host and nectar plants) have been successfully used to manage prairie habitat for butterflies.

Arkansas River Feverfew (*Bolophyta tetraneuris*)

[synonym = *Parthenium tetraneuris*]
family = Asteraceae

Species Description

The Arkansas River feverfew is a low, mat-forming herb with white to pale cream-colored flowers that bloom in April and May, and produce fruit from late May through June. It is a long-lived, slow-growing plant (Spackman et al. 1997).

Distribution and Status

The Arkansas River feverfew is found in Harding County, New Mexico, and in Colorado (Spackman et al. 1997). In Colorado, it is found in Chaffee, Fremont, Las Animas, and Pueblo Counties (Spackman et al. 1997). In 1983, intense surveys found the Arkansas River feverfew in 19 very small populations (Colorado Native Plant Society 1997), many along roadsides (CNHP 2000d).

The Arkansas River feverfew has a CNHP rank of G3/S3 (vulnerable throughout its range and in Colorado) (CNHP 2002b), and it is a BLM Sensitive species in the CaZon District (Spackman et al. 1997). It was formerly a Category 2 species under the Act.

Habitat

The Arkansas feverfew is endemic to gypsum ridges (Weber and Wittmann 1999) and barren shale or limestone cliffs and bluffs derived from the Niobrara Formation (Colorado Native Plant Society 1997; CNHP 2000d), in the Pueblo-CaZon City area of the Arkansas River Valley. It is often found in association with stemless hymenoxys (*Tetraneuris acaulis*) (Weber and Wittmann 1999) and in communities composed of Colorado piZon pine (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*), mountain mahogany (*Cercocarpus* spp.), and frankenia (*Frankenia* spp.) (CNHP 2000d). Two other rare limestone barrens species, the round-leaf four-o'clock (*Oxybaphus rotundifolius*), and golden blazing star (*Nuttallia chrysantha*) occur in the same habitat and are often found with the Arkansas River feverfew (Spackman et al. 1997).

Conservation Planning

There are no conservation plans specifically for the Arkansas River feverfew. However, The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of the Arkansas River feverfew in Colorado.

Arkansas Valley Evening Primrose (*Oenothera harringtonii*)

family = Onagraceae

Species Description

The Arkansas Valley evening primrose is an annual herb with an erect, well-developed, leafy stem (Spackman et al. 1997). It flowers from mid-May through June (Spackman et al. 1997). Though typically an annual, in the southern part of its range some individuals may overwinter, flowering for a second season (Wagner et al. 1985). Weber describes the species, based on garden trials, as at least a biennial or perhaps perennial (Weber and Wittmann 1999).

Distribution and Status

The Arkansas Valley evening primrose is endemic to the Arkansas River drainage in Colorado (Weber and Wittmann 1999). It has been found in El Paso, Fremont, Huerfano, Las Animas, Pueblo and Otero Counties (Spackman et al. 1997). Ten occurrences (two historical) have been documented (Spackman 1996).

The Arkansas Valley evening primrose has a CNHP rank of G2/S2 (globally imperiled; imperiled in Colorado) (CNHP 2002b).

Habitat

The Arkansas Valley evening primrose grows on compacted silty clays, looser rocky soils, and sandy soils in open grasslands (Wagner et al. 1985), especially shortgrass prairie, within an elevational range of 1,433-1,859 meters (Spackman et al. 1997).

Conservation Planning

There are no conservation plans specifically for the Arkansas Valley evening primrose. However, The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of the Arkansas Valley evening primrose in Colorado.

Golden Blazing Star (*Nuttallia chrysantha*)

[synonym = *Mentzelia chrysantha*]
family = Loasaceae

Species Description

The golden blazing star is an upright, branched herb that flowers in the early evening, from mid-July through early September, and fruits from late August through early September (Spackman et al. 1997; Weber and Wittmann 1999). Flowers are 10-petaled and golden yellow.

Distribution and Status

The golden blazing star is a Colorado endemic. Its global range comprises approximately 50 miles of the Arkansas River Valley in Fremont and Pueblo Counties between CaZon City and Pueblo (Spackman et al. 1997).

There have been 14 reported occurrences of the golden blazing star in the two counties: two from 1874 and 1921, and the rest since 1990 (CNHP 2000a). Of the 12 recent occurrences, one is on private land, two in the Garden Park Registered Natural Area, one in the Pueblo Reservoir Recreational Area, and three in highway ROWs (CNHP 2000a).

The golden blazing star has a CNHP rank of G1G2/S1S2 (Critically imperiled globally because of extreme rarity; critically imperiled in Colorado) (CNHP 2002b). It is a BLM sensitive species, and was formerly a Category 2 species for listing.

Habitat

The golden blazing star is narrowly endemic and is known only from chalk, gypsum, and limestone outcrops along the Arkansas River in Pueblo and Fremont Counties (Spackman et al. 1997; Weber and Wittmann 1999). These sites, on barren, eroding slopes of the Niobrara shale in the Arkansas River Valley, are rich in calcite or gypsum; are unusually hot and dry; and are stressful but low competition sites for species that can tolerate the conditions (Kelso 1999). These conditions often occur on highway ROWs in Pueblo and Fremont Counties.

Two other rare limestone barrens species, the Arkansas River Feverfew (*Bolophyta tetraneuris*), and the round-leaf four-o'clock (*Oxybaphus rotundifolius*), occur in the same habitat, and are often found with the golden blazing star (Spackman et al. 1997).

Conservation Planning

There are no conservation plans specifically for the golden blazing star. There are only two protected populations of the plant, both in the Garden Park Registered Natural Area. The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of the golden blazing star in Colorado.

Pueblo Goldenweed (*Oönopsis puebloensis*)

family = Asteraceae

Species Description

The Pueblo goldenweed is a recently described perennial subshrub with yellow ray and disk flowers that bloom in July (CNHP 1996; Spackman et al. 1997).

Distribution and Status

The Pueblo goldenweed is a Colorado endemic, occurring only in Fremont and Pueblo counties (Spackman et al. 1997; CNHP 2000c).

The Pueblo goldenweed has a CNHP rank of G1G2/S1S2 (critically imperiled globally; critically imperiled in Colorado) (CNHP 2002b).

Habitat

The Pueblo goldenweed is found on barren outcrops of shale of the Niobrara Formation in sparse shrublands or piZon-juniper woodlands at an elevations range of 4,800-5,500 feet (Spackman et al. 1997), as well as on shortgrass prairie swales where soils are silty and often hold water longer than in surrounding areas of shortgrass prairie (pers. comm., Rondeau 2002). These conditions are found along roadsides in Fremont and Pueblo Counties, and also in non-roadside settings.

Conservation Planning

There are no conservation plans specifically for the Pueblo goldenweed. The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of the Pueblo goldenweed in Colorado.

Round-leaf Four O'clock (*Oxybaphus rotundifolius*)

[synonym = *Mirabilis rotundifolia*]
family = Nyctaginaceae

Species Description

The round-leaf four-o'clock is a bushy, branching herb. It has round, thick, leathery basal leaves that are shed early in the growing season, and are usually not present when the plant blooms (Colorado Native Plant Society 1997; Spackman et al. 1997). It blooms from early to mid-June and has magenta, trumpet-like, tubular flowers that open before dawn and remain open until mid morning (Colorado Native Plant Society 1997; Spackman et al. 1997). Pollination may be by bees and moths, or it may self- pollinate; seeds might be dispersed by wind (CNHP 2000b).

Distribution and Status

The round-leaf four-o'clock is a Colorado endemic restricted to limestone outcrops of the Niobrara Formation in Fremont and Pueblo Counties, in the Arkansas River Valley, between Pueblo and CaZon City (Spackman et al. 1997). It has also been found on the U.S. Army's PiZon Canyon maneuver site in the Purgatoire River drainage (Colorado Native Plant Society 1997).

The round-leaf four-o'clock has a CNHP rank of G2/S2 (imperiled globally; imperiled in Colorado) (CNHP 2002b). It was formerly a Category 2 species under the Act.

Habitat

The round-leaf four-o'clock is found only on sedimentary soils of the Arkansas and Purgatoire River drainages, barren shale outcrops of the Niobrara Formation (Spackman et al. 1997), gypsum soils (Weber and Wittmann 1999), or limestone outcrops of the Niobrara Formation (Colorado Native Plant Society 1997). It is commonly found in association with Frankenia (*Frankenia* ssp.), Juniper (*Juniperus* spp.), piZon pine (*Pinus edulis*), and saltbush (*Atriplex* spp.) (O'Kane 1988). It is also found associated with Arkansas River feverfew, Indian millet (*Oryzopsis hymenoides*), buckwheat (*Eriogonum fendlerianum*), paperflower (*Zinnia grandiflora*), broom snakeweed (*Gutierrezia sarothrae*), and golden blazing star (Spackman et al. 1997; CNHP 2000b).

Conservation Planning

There are no conservation plans specifically for the round-leaf four-o'clock. The Nature Conservancy (1998) developed a conservation plan for the Central Shortgrass Prairie ecoregion that identified areas important for the conservation of native populations of the round-leaf four-o'clock in Colorado.

Environmental Baseline

The Environmental Baseline describes the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process. [50 CFR §402.02] According to the section 7 handbook (Endangered Species Consultation Handbook. U.S. Fish and Wildlife Service and National Marine Fisheries Service. March 1998.), the Environmental Baseline provides a "snapshot" of species health at a specified point it time, and describes the status of the species and factors affecting the species environment in the action area.
The biological opinion contains a description of the current status of Colorado's central shortgrass prairie and the bald eagle. The status of the remaining listed species as well as the non-listed species in the action area is presented here. The description of the baseline is meant to stand alone, therefore some information or effects common to each member of a certain taxon (e.g., prairie birds), is present the description of each species.

Native Plains Fishes

Over the past 300 - 400 years, native fish communities in North America have undergone significant changes as a direct result of dramatic physical, chemical, and biological changes in aquatic habitat. These changes are due to diversions, groundwater depletions, impoundments,

non-point source pollution, channelization, alteration of streambed characteristics, power generation, and the introduction of non-native species (Echelle et al. 1995; Maughan 1995; Ostlie et al. 1997). The result has been modification of flows and degradation of the quality of natural waters (Echelle et al. 1995; Johnson 1995; Ostlie et al. 1997).

Historically, 31 native fish species were found in the South Platte; today there are 28 native and 44 non-native species (Nesler et al. 1997). Reduced stream flows in tributaries due to irrigation and urban water projects, increased turbidity from agricultural runoff, pollution from agricultural and urban development, and stream channelization and reservoir construction have been implicated in native fish declines (Clausen et al. 1989; Sidle and Faanes 1997).

According to Nesler et al. (1999), historic composition of native fishes in the Arkansas River has not been well documented. However, there are 22 species that are considered native to the Arkansas River basin in Colorado. Of these, one species is federally-listed, five other species are state listed or are recognized as species of special concern, and four are extirpated. A variety of human activities have contributed to alteration of native fish populations and habitat, including pollution from mining (Jordan 1891; Ellis 1914; Woodling 1985), other industries, urbanization, and agriculture (Woodling 1985), water diversions (Jordan 1891; Ellis 1914; Woodling 1985), overharvest (Ellis 1914), and introduction of non-native fishes (Ellis 1914; Woodling 1985).

Herpetofauna

Most grassland reptiles and amphibians are widely distributed. The number of species in any location is a function of the presence of water (which amphibians need to complete their life cycle) and of complex habitats (Samson et al. 1998).

There is no region-wide or continent-wide baseline information on population status and health of amphibians and reptiles, and few states monitor these species. However, researchers believe that all species of native true frogs have declined in the western United States over the past decade (Hayes and Jennings 1986). Hammerson (1999), using natural heritage rankings, provided the most comprehensive status assessment of amphibians and reptiles in Colorado, concluding that while most species in the state are secure on a global scale, many species are of conservation concern, largely due to restricted ranges.

The following factors are believed to contribute to reptile and amphibian declines in Colorado: loss of small, temporary water bodies; presence of non-indigenous terrestrial and aquatic predators; overgrazing; and prairie dog control, which results in loss of burrows that provide winter retreats and summer nesting sites (Mackessy 1998; Samson et al. 1998; Hammerson 1999). Other threats to amphibian and reptile species include natural cycles of species attrition, loss or degradation of habitat that can be exacerbated by natural events such as drought or flood (Wake 1991), the introduction of bullfrogs (*Rana catesbeiana*), introduction of non-native predatory fish (pers. comm., Pague 2002), and direct mortality due to actions of humans (pesticide application, roadkill, collection [Hammerson 1986; McDiarmid 1995]). Of these, loss of habitat may have the largest impact (McDiarmid 1995). However, the release and subsequent spread of bullfrogs is also known to have severe impacts on many other amphibian species (Fisher and Shaffer 1996), and probably are having a severe impact on Colorado's prairie amphibians (Hammerson 1999; pers. comm., Pague 2002; unpublished data, Livo).

Invertebrates

Ninety percent (or more) of animal species worldwide are invertebrates. There are 90,000 described insects in North America (Powell 1995). Within any quantum of terrestrial or aquatic habitat, hundreds of different invertebrates create a network consisting of primary and secondary consumers and, perhaps most importantly, detritivores.

Most invertebrates can tolerate the effects of extreme events that occur within the environment in which they exist, but are susceptible to long-term changes in that environment. Butterflies are particularly susceptible to environmental insults (Opler 1995). Because most larvae and many adults are dependent on one or a few species of plant, activities that result in vegetation changes can have population level effects on invertebrates. In aquatic environments, changes in flow

regime, siltation, pollution, and the presence of non-native species have resulted in significant decreases in 72 percent of mussel species (Mason 1995).

Prairie Butterflies

There are more than 1,600 insect species known from the shortgrass prairie in Colorado (Kumar et al. 1976), and this is not a complete inventory. Some taxa are present in hot, dry years, while others favor wet years, and there is no sampling method that is adequate to detect all species. The lepidoptera comprise about 13 percent of the described and named insect species in North America (Powell 1995). There are some local inventories available, with the most comprehensive ones being in the eastern United States (Powell 1995). In addition, the Xerces Society has coordinated an annual Fourth of July Butterfly Count (modeled on the Christmas Bird Counts) since 1975.

The prairie-specialist butterflies are year-round residents on distinct prairie patches, with relatively little dispersal among patches (Opler and Krizek 1984; Moffat and McPhillips 1993; Opler 1999); thus, they require resources that are consistently available within a particular habitat patch. Because the caterpillars of most butterflies are herbivorous, lepidoptera species richness is reflective of plant species richness (Opler 1995). As the processes that define prairies are disrupted, habitat is lost and fragmented, and native plants displaced by exotics, prairie butterflies are increasingly restricted in their range (Swengel and Swengel 1995). Like other prairie inhabitants, it appears that prairie butterflies flourish in habitat mosaics, with caterpillars using one habitat type and adults another.

Mussels

The United States supports the greatest diversity of freshwater mussels in the world (Williams and Neves 1995). Mussels were an important food source for Native Americans, and from the late 1800s to early 1900s mussels supported a major commercial economy for button manufacture (Williams and Neves 1995). One mussel bed in the Mississippi was reported to cover an area of 2.4 kilometers by 288 meters; it failed after several years of commercial exploitation (Carlander et al. 1986). There are no federal regulations relating to the harvest of mussels except for species listed under the Act. There continues to be a limited commercial harvest, regulated at the state level, largely to produce beads that are exported to Asia for insertion into oysters and other shellfish that produce pearls (Williams and Neves 1995).

The continent-wide decline in freshwater mussels has been linked to habitat changes including dam construction, pollution, siltation, channelization, dredging, and the introduction of non-indigenous species (Williams and Neves 1995). Altered flow regimes and reservoirs that result from dams have been identified as the cause of 30 - 60 percent of native mussel extirpations in some rivers of the United States (Williams et al. 1992). Siltation resulting from poor agricultural practices and deforestation, especially of the riparian corridor, can destabilize stream bottoms; and heavy metals, pesticides and acid mine drainage have all polluted streams, resulting in mussel declines (Fuller 1974).

The American Fisheries Society has identified 213 of 297 species of mussels native to the United States and Canada as threatened, endangered or species of concern (Williams et al. 1993); 70 are listed as federally endangered or threatened (50 FR §17.11, §17.12, Dec. 31, 1999), and 72 are species of special concern (Williams et al. 1993). Because mussels are sessile, long-lived, bioconcentrate contaminants, and are sensitive to changes in water quality, they are important indicators of the health of aquatic ecosystems (Havlik and Marking 1987). Without increased water quality conservation, extinction of much of the North American mussel fauna in the near future is a distinct possibility (Neves 1993).

Historically, there were seven species of freshwater mussel documented from Colorado (Cordeiro 1999). Wu and Brandauer (1978) and Wu (1989) suggest that only three species remain, one of which is only known from one dead shell that likely did not originate in the place where it was found (Cordeiro 1999). Of the two remaining freshwater mussel species, one (the giant floater) occurs in the South Platte River drainage and in reservoirs in the Arkansas River drainage. The other (the cylindrical papershell) occurs only in the South Platte drainage (Cordeiro 1999).

Because of the dynamic nature of the South Platte River, mussels along this river have probably always had a limited distribution. However, reservoirs constructed in conjunction with power and irrigation projects have resulted in a steady source of water, and mussels are now found along canals and in reservoirs along the Platte River (Lingle 1992). However, populations from numerous historic locations in the South Platte drainage are thought to be extirpated (Cordeiro 1999).

Interior Least Tern

In Colorado, least terns have consistently been found nesting in Bent, Otero, and Kiowa counties since 1978, though the number of nesting pairs and nests has fluctuated since that time.

Within Colorado's central shortgrass prairie, there has been a loss of nesting areas due to reduced river flows and the development of sandbars along the Platte and Arkansas Rivers caused by reservoirs and irrigation diversions.

Piping Plover

Piping plovers are known to breed in Prowers, Bent, Kiowa, and Baca Counties in the southeast corner of Colorado (Nelson 1998b). The number of birds nesting in this area has consistently been low since 1991, ranging from three to eight pairs. Nesting attempts have occurred at John Martin Reservoir, Adobe Reservoir, and the four Great Plains Reservoirs in Kiowa County (Neesopah, Neegronda, Neeskah, and Neenoshe) (Nelson 1998b).

Colorado Butterfly Plant

Surveys for the Colorado butterfly plant have confirmed its occurrence in north central Colorado on land owned by the City of Fort Collins, adjacent to I-25, the only known extant location in the state. The population is believed to be stable at that location.

Arkansas Darter

In Colorado, Arkansas darters have been found as far north as Limon and as far west as CaZon City. They are known to occur in the Fountain Creek, Rush Creek, Big Sandy Creek, Horse Creek, and Chico Creek drainages. In addition, Arkansas darters have been introduced to ten previously unoccupied sites within the known range of the species since 1980.

Black-tailed Prairie Dog

The black-tailed prairie dog occurs in all of Colorado's eastern counties, and are especially common in those counties bordering on the Front Range. The range of the species has not changed considerably in Colorado since the early 1900s however, the size of the colonies has sharply decreased. According to EDAW (2000), the average current colony size is 75 acres, with a range of 0.04 acres to 4,129 acres. Of 2,578 colonies, they found that only one percent, or 17 active colonies, were greater than 1,000 acres, two percent (45 colonies) were greater than 500 acres and less than 1000 acres, and the remainder less than 500 acres.

Plague is a serious threat to the persistence of prairie dogs, although this disease is apparently less prevalent in eastern Colorado than in the Front Range (EDAW 2000). EDAW (2000) states that Center for Disease Control maps of known plague-positive black-tailed prairie dog colonies in Colorado show little incidence of plague in eastern Colorado although this may be due to insufficient records. However, the Comanche National Grassland in southeastern Colorado experienced a 90 percent loss of prairie dogs due to plague in the mid-90s (USFWS 2000b). Once established in an area, plague becomes persistent and periodically erupts, with the potential to extirpate local black-tailed prairie dog populations (Mulhern and Knowles 1997). Prairie dog colonies virtually eradicated by plague require approximately four to five years to regenerate, and then again become susceptible to a plague epizootic (Cully 1989). Recovery from an epizootic may take as long as ten years (Knowles 1998).

Knowles and Knowles (1994) have suggested that prairie dogs have survived the introduction of the plague bacterium due to their dispersed populations. Cully and Williams (2001) found that on the Cimarron National Grassland in southeastern Colorado, in the presence of plague, prairie dogs most likely to survive were found in complexes of small colonies that were greater than three kilometers from their nearest neighbor. Thus a diverse pattern of connected colonies in conjunction with isolated colonies of various sizes is probably the best condition to ensure that prairie dogs survive plague.

Lesser Prairie-chicken

Colorado's lesser prairie-chicken population is estimated at 2,000-4,000 birds found primarily in the Comanche National Grasslands in Otero, Bent, Baca, and Las Animas counties, and on private lands south of the Cimarron River. Colorado's population has increased since 1977 largely due to habitat protection on the Comanche National Grassland, and is the only population exhibiting consistently positive trends (Andrews and Righter 1992). Between 1986 and 1990, CDOW identified 58 active leks, 40 of them in Baca County and most on the Comanche National Grasslands (Giesen 1994a).

Mountain Plover

Colorado is one of the two most important breeding sites for the mountain plover. The species is widely distributed throughout the state occurring in low densities in ten eastern Colorado counties, but being the most numerous in Kiowa and Park Counties. Park County, which is not considered part of Colorado's central shortgrass prairie, currently is the most productive breeding area. Mountain plover numbers have sharply declined in the Pawnee National Grasslands in Weld County since the mid-1990s.

Burrowing Owl

Along the Front Range of Colorado, burrowing owls have largely disappeared from much of their historic range (Jones 1998). Breeding burrowing owls currently occur almost exclusively in eastern Colorado, despite their once having been more widespread throughout the state. RMBO documented 468 burrowing owl colonies and 2,675 individuals in eastern Colorado in 1999 (Hutchings et al. 1999).

Cassin's Sparrow

Cassin's sparrows breed primarily in southeastern Colorado and irregularly into northeastern Colorado (Melcher 1998). Potentially 20 percent (Melcher 1998), and perhaps up to 40 percent, of the breeding distribution of Cassin's sparrow is contained within Colorado (CBO 1995; Yanishevsky and Petring-Rupp 1998). Their core population is centered in the Comanche National Grasslands in Baca County (Ruth 2000). In general, however, their numbers vary both annually and geographically within Colorado (Gillihan 1999).

Ferruginous Hawk

In Colorado, ferruginous hawks have been Ferruginous hawks occur in Colorado year round (Preston 1998; Gillihan and Hutchings 2000), where populations have been stable from 1979-1992 (Olendorff 1993). They are most common in winter in eastern Colorado. Johnsgard (1990) estimated that about 1,200 birds winter in Colorado, which comprises about 20 percent of the total winter population in the United States. Preston (1998) estimated about 150 nest sites in Colorado, primarily on the eastern plains.

Lark Bunting

In Colorado, lark bunting numbers are highest in the shortgrass prairies of extreme eastern Colorado near the Kansas border (Kingery 1998). The species is normally most numerous on the central and western Great Plains from eastern Colorado and western Kansas north to Montana and North Dakota, with their numbers rapidly diminishing towards the peripheries of their range.

Loggerhead Shrike

In Colorado, the loggerhead shrike is found primarily in rural areas (scattered farm buildings and shelterbelts) and shortgrass prairie, preferring open country with scattered trees and shrubs (Carter 1998). Great Plains populations, including populations within Colorado's central shortgrass prairie, appear to be healthy and stable or increasing slightly. Colorado Breeding Bird Atlas workers found breeding shrikes to be conspicuous and, like raptors, sparsely distributed. The vast majority of nesting in Colorado occurs in eastern Colorado (Carter 1998).

Long-billed Curlew

The breeding distribution of long-billed curlews within Colorado occurs in three clusters in Baca and Las Animas counties, eastern El Paso County east to Kansas, and northeastern Colorado in prairies bordering the South Platte River and on the Pawnee National Grassland (Nelson 1998a). Birds in this last cluster occur in lower densities than in the other two clusters, and select prairies bordering the South Platte River and, occasionally, on the Pawnee National Grassland.

McCown's Longspur

The Pawnee National Grasslands in northern Weld County is the center of breeding in Colorado, with a few sites also confirmed on private ranches in Washington, Elbert, Lincoln, and Kit Carson counties (Kuenning 1998), all within Colorado's central shortgrass prairie. Winter range includes extreme southeastern Colorado.

Brassy Minnow

The brassy minnow is found in low numbers in the South Platte and Republican River basins (CDOW 2002b). In the South Platte, it is restricted to portions of the mainstem and most abundant in the eastern portion of the plains (Propst 1982). While occurrence in natural streams has apparently decreased, the brassy minnow has been reported in significant numbers in irrigation ditches (Platania 1990). Today it is found in the South Platte River basin (St. Vrain River, Cache la Poudre River, Pawnee Creek, Lonetree Creek, the lower South Platte River [east of Sterling]), and in the Republican River basin (Arikaree River and the South Fork of the Republican River) (CDOW 2002b).

Common Shiner

The common shiner is uncommon both in relative abundance and frequency of occurrence in the South Platte River Basin (Nesler et al. 1997). Today it is found in upper South Platte River tributaries and the St. Vrain drainage (CDOW 2002b) at the western periphery of the project area. At one time it was found in four South Platte River tributaries (Propst 1982) but more recently it has been found at only six sites in the St. Vrain and West Plum Creek systems of the South Platte River basin (Nesler et al. 1997).

Flathead Chub

The flathead chub is scarce in Colorado, and detailed abundance is unknown (Woodling 1985). Early researchers found the flathead chub common in the Arkansas River mainstem up to Salida, where the river is a coldwater trout fishery (Ellis 1914). More recent work has failed to find the flathead chub on the mainstem of the Arkansas River downstream of the John Martin Reservoir (Woodling 1985).

Plains Minnow

In Colorado's central shortgrass prairie, the plains minnow occurs in the South Platte River between Ft. Morgan and Sterling, and the Arkansas River basin in Kiowa County.

Plains Topminnow

The plains topminnow is found in Colorado's central shortgrass prairie in intermittent prairie streams, and the lower mainstem of the South Platte River (Woodling 1985; Nesler et al. 1997). It occurs on the Pawnee National Grasslands in Coal Creek, Willow Creek, and tributaries of Pawnee Creek (Roosevelt National Forest, Arapaho National Forest and Pawnee National Grassland FEIS).

Southern Redbelly Dace

In Colorado, southern redbelly dace are found in the Arkansas River basin (Miller 1982; Woodling 1985). Native populations are apparently extirpated, and today, the southern redbelly dace only occurs in relatively isolated populations at two pond sites on Fort Carson and at the Pueblo Army Depot (CDOW 2002b).

Suckermouth Minnow

In Colorado's central shortgrass prairie, the suckermouth minnow occurs in the Lodgepole Creek drainage of the mainstem South Platte, as well as in the mainstem Arkansas River between John Martin Reservoir and the Kansas state line (CDOW 2002b).

Northern Cricket Frog

In Colorado, the northern cricket frog was documented in the Republican River and South Platte River drainages, and was most abundant along the North Fork of the Republican River in Yuma County (Hammerson 1986), and perhaps in the South Platte River in Weld and Morgan counties (Hammerson 1999). Recent evaluation of northern cricket frog records indicates that it was present in the Republican River drainage and Platte River drainage in Colorado at least through the 1970s, but subsequent surveys indicate that its distribution has declined, and it may be extirpated from Colorado (Hammerson and Livo 1999.)

Northern Leopard Frog

In Colorado, the northern leopard frog occurs throughout the state except in the Republican River drainage and south of the Arkansas River in southeastern Colorado (Hammerson 1986, 1999). The northern leopard frog is sympatric with the plains leopard frog in Cheyenne, El Paso, Lincoln, and Pueblo counties in Colorado, and these species are known to hybridize (Post 1972; Gillis 1975; Hammerson 1982a, 1999). In some areas, reduced or extirpated leopard frog populations are associated with the presence of bullfrogs (Hammerson 1982b). Bullfrogs now outnumber northern leopard frogs in areas of eastern Colorado (Hammerson 1999). The northern leopard frog has undergone documented declines in Colorado (Corn 1994).

Massasagua

Colorado's massasagua population is centered in southeastern Lincoln County and western Kiowa County, and is uncommon south of the Arkansas River (Hammerson 1986; Hobert et al. 1997; Mackessy 1998). Recent records show massasaugas in Lincoln, El Paso, Pueblo, Crowley, Otero, Bent, Kiowa, Cheyenne, Prowers, Baca, and Las Animas Counties.

Texas Horned Lizard

In Colorado, the Texas horned lizard occurs in the southeast corner of the state south of the Arkansas River (Hammerson 1986; Mackessy 1998). It was documented in extreme eastern Pueblo County and has been found in Kiowa County (Mackessy 1998). It has also been documented in Pueblo, Otero, Bent, Cheyenne, Baca, and Las Animas Counties (Livo 1995; Colorado Herpetological Society 2000b).

Western Box Turtle

Western box turtles occur throughout most of eastern Colorado below 5,500 feet (1,676 m) (Hammerson 1986; Colorado Herpetological Society 2000c). The western box turtle is scarce or

absent on the western crest of the Platte-Arkansas divide and west of Baca County south of the Arkansas River, but it is locally common within its range in Colorado, especially in the sandhill regions south of the South Platte River (Hammerson 1999) and just north of the Arkansas River (pers. obs., C. Pague). The most robust populations in Colorado coincide with the remaining areas of unplowed prairie (Hammerson 1999).

Cylindrical Papershell

In Colorado, the cylindrical papershell is found only in the Platte River drainage, primarily in Boulder County, but has also been recorded from Denver, Morgan, Sedgwick, and Weld counties (Wu 1989). It is most common in spring-fed lakes and ponds in Boulder County (Wu 1989). Cordeiro (1999) reported that this species' distribution has shrunk from 15 formerly documented locations to only two - Valmont Lake and Little Thompson River, both in Boulder County.

Giant Floater

In Colorado, Wu (1989) found the giant floater in the Platte and Republican River drainages in Boulder, Larimer, Morgan, and Yuma counties. Herrman and Fajt (1985) have recorded it in the Arkansas River drainage, and in reservoirs in Kit Carson, Adams and Pueblo counties. Wu (1989) found that the species is most abundant in spring-fed lakes and ponds in Boulder and Larimer counties. Cordeiro (1999) reported this species in Cherry Creek Reservoir and Boyd Lake (Platte River drainage), Flagler Reservoir (Republican River drainage), and Pueblo Reservoir and Colorado Fuel and Iron Reservoirs 1-3 (Arkansas River drainage).

Arogos Skipper

In Colorado, the arogos skipper is documented from the northern Front Range and extreme northeastern Colorado in Arapahoe, Boulder, Jefferson, Larimer, and Yuma Counties (Stanford and Opler 1993; Pineda and Ellingson 1997).

Hops Feeding Azure

The hops feeding azure was formally described in 1998 (Scott and Wright 1998). It has been documented in Adams, Arapahoe, Boulder, Douglas, El Paso, Elbert, Jefferson, and Larimer Counties (Stanford and Opler 1993, 1996; Pineda and Ellingson 1997) above 5,300 feet (Pineda 2002) at the western edge of Colorado's central shortgrass prairie.

Ottoe Skipper

In Colorado the Ottoe skipper is restricted to mixed and tallgrass prairies, and has been documented in Front Range counties from El Paso County north to the Wyoming border. There are a few records from eastern Colorado (Pineda and Ellingson 1997). The populations in the Front Range are disjunct from the plains population. The Ottoe skipper has been documented in Arapahoe, Boulder, Douglas, Elbert, El Paso, Jefferson, Larimer, Phillips, and Yuma Counties (Stanford and Opler 1993).

Regal Fritillary

The regal fritillary occurs in eastern Colorado north of the Arkansas River (Opler et al. 1995). Worn individuals have been sighted outside of the breeding season in Boulder, Douglas, El Paso, Gilpin, Jefferson, Kit Carson, Logan, Morgan, Park, Sedgwick, and Yuma Counties (Stanford and Opler 1993).

Arkansas River Feverfew

In Colorado, the Arkansas River feverfew is found in Chaffee, Fremont, Las Animas, and Pueblo Counties (Spackman et al. 1997). In 1983, intense surveys found the Arkansas River feverfew in 19 very small populations (Colorado Native Plant Society 1997), many along roadsides (CNHP 2000d).

Arkansas Valley Evening Primrose

Ten occurrences (two historical) of the Arkansas Valley evening primrose have been documented in El Paso, Fremont, Huerfano, Las Animas, Pueblo and Otero Counties (Spackman et al. 1997). have been documented (Spackman 1996).

Golden Blazing Star

There have been 14 reported occurrences of the golden blazing star in Colorado's central shortgrass prairie in Fremont and Pueblo counties: two from 1874 and 1921, and the rest since 1990 (CNHP 2000a). Of the 12 recent occurrences, one is on private land, two in the Garden Park Registered Natural Area, one in the Pueblo Reservoir Recreational Area, and three in highway ROWs (CNHP 2000a).

Pueblo Goldenweed

The Pueblo goldenweed is a Colorado endemic, occurring only in Fremont and Pueblo counties (Spackman et al. 1997; CNHP 2000c).

Roundleaf Four-o'clock

The round-leaf four-o'clock is a Colorado endemic restricted to limestone outcrops of the Niobrara Formation in Fremont and Pueblo Counties, in the Arkansas River Valley, between Pueblo and CaZon City (Spackman et al. 1997). It has also been found on the U.S. Army's PiZon Canyon maneuver site in the Purgatoire River drainage (Colorado Native Plant Society 1997).

Effects of Action

Effects of the action include the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species for purposes of preparing a biological opinion on the proposed action. [50 CFR §402.02]

General effects from FHWA/CDOT's routine maintenance and upgrade activities have already been described in the biological opinion. Although the piping plover, the interior least tern, and the Colorado butterfly plant are already listed, the effects of the proposed action to these species are presented in this section because those effects are not likely to adversely affect them for reasons already described. This information is also included here in the event that reinitiation of consultation is required. The description for each species is meant to stand alone, therefore some information or effects common to each member of a certain taxon (e.g., prairie birds), is present in the description of each species.

Additional effects specific to the non-listed species include those of fragmentation, which could possibly prevent populations of some species, especially the herpetofauna, from migrating along historical movement corridors or accessing entire home ranges. Some of the species considered in this Conservation Strategy for Non-listed Species may be directly killed by construction equipment or workers.

Interior Least Tern

CDOT activities will not affect sandbars and islands in rivers or on lakes because these impacts are generally caused by actions such as water diversion or channelization, neither of which will occur as part of the proposed action. Therefore, CDOT activities should have little effect on either the nesting habitat of the interior least tern or on individuals. Road widening near least tern habitat could disrupt surface flows or groundwater movement in feeding habitat. However, BMPs as previously described in this document will be implemented at any transportation

improvement project site near feeding areas for interior least terns. Therefore, this impact is not expected to occur.

Piping Plover

No CDOT projects will occur near the playa lakes and reservoirs of Prowers, Bent, Kiowa, or Baca counties that are used by nesting piping plovers. Additionally, CDOT activities are not likely to affect water flows or sandbar deposition because these impacts are generally caused by actions such as water diversion or channelization, neither of which will occur as part of the proposed action. However, there may be impacts associated with road widening that could disrupt surface flows or groundwater movement in or near piping plover feeding habitat. BMPs as previously described in this document will be implemented at any transportation improvement project site near feeding areas for piping plovers in order to minimize these impacts.

Colorado Butterfly Plant

According to the City of Fort Collins (pers. comm., Comstock 2002), the only known plants are at least one-half mile away from I-25. Transportation improvement projects and maintenance activities are not expected to result in direct adverse impacts to the documented occurrence. However, plants occur downstream from the interstate, so indirect impacts to the known occurrence could result if the local hydrology were altered such that downstream habitat was lost or degraded. In addition, potential habitat (currently unoccupied) exists in the ROW, and this could potentially be eliminated or degraded by transportation improvements.

Arkansas Darter

The primary concern from the proposed activity for the Arkansas darter is the construction of permanent barriers to movement within the stream. The critical threshold for gradients that prohibit fish movement is not known. Other impacts associated with roadwork (e.g., siltation, turbidity) are not thought to be a concern unless they continue for more than one year. If the impacts are of short duration, they are probably little different from the impacts associated with storm and flood events to which this species is adapted. Continuance of these types of impacts for longer than a year may affect life cycles; continuance for longer than two years could extirpate local populations (pers. comm., Nesler 2002). On-site BMPs will minimized the effects of the proposed activities.

Black-tailed Prairie Dog

The primary concern for impacts to black-tailed prairie dogs from CDOT actions is permanent habitat loss. CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards and stockpiling, rest area construction, and bridgework. Other CDOT activities with potential for temporary impacts are mowing, re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), and weed management. These temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction projects should be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract prairie dogs.

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 10,744 acres. This represents approximately 0.55% of the identified habitat in the project area (Grunau and Lavender 2002).

In our 12-month administrative finding, the Service made no mention of roads as a major threat to black-tailed prairie dogs (USFWS 2000b). The 12-month finding considered habitat fragmentation a moderate threat, but roads were not singled out as a source of fragmentation. However, improvement of roadways can, in the long term, result in strip development of the adjacent land, though this is more common in urban areas than in the rural areas that make up most of the project area.

Lesser Prairie-chicken

There is strong consensus among the experts that the primary concern over the long term for prairie birds, including the lesser prairie-chicken, is loss of habitat. In some cases, ROWs may be attracting nesting or foraging birds (i.e., creating habitat), but this was generally not considered a desirable situation by most experts (note that field data are not available to either support or reject this theory). Most commonly, nesting birds appear to avoid ROWs, and experts considered these areas permanently lost as breeding habitat (Grunau and Lavender 2002).

CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards and stockpiling, rest area construction, and bridgework. Other CDOT activities with potential for temporary impacts are mowing, re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), and weed management. There was consensus among experts that these temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction projects should be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract birds (Grunau and Lavender 2002).
The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 78 acres. This represents approximately 0.016% of the identified habitat in the project area (Grunau and Lavender 2002). There are currently no existing leks documented near state or federal highways in Colorado (pers. comm., Kindler 2002).

Mountain Plover

There is strong consensus among the experts that the primary concern over the long term for prairie birds, including the mountain plover, is loss of habitat. In some cases, ROWs may be attracting nesting or foraging birds (i.e., creating habitat), but this was generally not considered a desirable situation by most experts (note that field data are not available to either support or reject this theory). Most commonly, nesting birds appear to avoid ROWs, and the experts considered these areas permanently lost as breeding habitat (Grunau and Lavender 2002).

CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards and stockpiling, rest area construction, and bridgework. Other CDOT activities with potential for temporary impacts are mowing, re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), and weed management. There was consensus among experts that these temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction projects are believed to be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract birds (Grunau and Lavender 2002).

The maximum potential for permanent habitat loss was estimated to be 9,936 acres. This represents approximately 0.052% of the identified habitat within the project area (Grunau and Lavender 2002).

In addition, prairie dog colonies create suitable habitat for mountain plovers, and birds are often seen in areas where prairie dogs occur on the eastern plains of Colorado. Therefore, transportation improvements that result in loss of prairie dog colonies could also adversely impact mountain plover.

Burrowing Owl

There is strong consensus among the experts that the primary concern over the long term for prairie birds, including the burrowing owl, is loss of habitat. In some cases, ROWs may be attracting nesting or foraging birds (i.e., creating habitat), but this was generally not considered a desirable situation by most experts (note that field data are not available to either support or reject this theory). Most commonly, nesting birds appear to avoid ROWs, and experts considered these areas permanently lost as breeding habitat (Grunau and Lavender 2002).

CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards and stockpiling, rest area construction, and bridgework. Other CDOT activities with potential for temporary impacts are mowing, re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), and weed management. There was consensus among experts that these temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction projects should be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract birds (Grunau and Lavender 2002).

Also, because burrowing owls are so dependent on active prairie dog colonies for nesting habitat, any actions CDOT takes that negatively impact prairie dogs are likely to impact burrowing owls. Further, because large insects, particularly grasshoppers, comprise more than 80 percent of burrowing owl summer diet (Gillihan and Hutchings 2000), insecticide use on ROWs near burrowing owl nests may limit food availability, and thus impact reproductive success.

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 11,246 acres. This represents approximately 0.051% of the identified habitat in the project area (Grunau and Lavender 2002).

Cassin's Sparrow

There is strong consensus among the experts that the primary concern over the long term for prairie birds, including Cassin's sparrow, is loss of habitat. In some cases, ROWs may be attracting nesting or foraging birds (i.e., creating habitat), but this was generally not considered a desirable situation by most experts (note that field data are not available to either support or reject this theory). Most commonly, nesting birds appear to avoid ROWs, and these areas are considered permanently lost as breeding habitat.

CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards and stockpiling, rest area construction, and bridgework. Other CDOT activities with potential for temporary impacts are mowing, re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), and weed management. There was consensus among experts that these temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction projects should be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract birds (Grunau and Lavender 2002).

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 2,284 acres. This represents approximately 0.055% of the identified habitat in the project area (Grunau and Lavender 2002).

Ferruginous Hawk

Ferruginous hawks are sensitive to disturbance during the breeding season (Gilmer and Stewart 1983; Schmutz 1984; White and Thurow 1985; Bechard et al. 1990; Preston 1998; Gillihan and Hutchings 2000). In eastern Colorado, nests in remote locations exhibited higher productivity than did nests in more accessible locations (Olendorff 1973). Sensitivity to disturbance has also been found to increase during years of low prey abundance (White and Thurow 1985). Because ferruginous hawks in eastern Colorado preferentially hunt on prairie dog colonies, any CDOT actions that negatively impact prairie dogs are likely to impact ferruginous hawks.

CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards and stockpiling, rest area construction, and bridgework. Other CDOT activities with potential for temporary impacts are mowing, re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), and weed management. There was consensus among experts that these temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction

projects should be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract birds (Grunau and Lavender 2002).

The maximum potential for permanent loss of ferruginous hawk habitat from transportation improvement projects was estimated to be 10,773 acres. This represents approximately 0.055% of the identified habitat in the project area (Grunau and Lavender 2002).

Lark Bunting

There is strong consensus among the experts that the primary concern over the long term for prairie birds, including the lark bunting, is loss of habitat. In some cases, ROWs may be attracting nesting or foraging birds (i.e., creating habitat), but this was generally not considered a desirable situation by most experts (note that field data are not available to either support or reject this theory). Mowing during the breeding season could destroy nests on the ground if lark buntings were to use ROWs for nesting. Most commonly, however, nesting birds appear to avoid ROWs, and experts considered these areas permanently lost as breeding habitat.

CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards, rest area construction, and stockpiling, and bridgework. Other CDOT activities with potential for temporary impacts are mowing, re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), and weed management. There was consensus among experts that these temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction projects should be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract birds (Grunau and Lavender 2002).

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 12,124 acres. This represents approximately 0.054% of the identified habitat in the project area (Grunau and Lavender 2002).

Loggerhead Shrike

There is strong consensus among the experts that the primary concern for prairie birds over the long term is loss of habitat. In some cases, ROWs may be attracting nesting or foraging birds (i.e., creating habitat), but this was generally not considered a desirable situation by most experts (note that field data are not available to either support or reject this theory). Most commonly, nesting birds appear to avoid ROWs, and experts considered these areas permanently lost as breeding habitat.

CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards and stockpiling, rest area construction, and bridgework. Other CDOT activities with potential for temporary impacts are mowing, re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), and weed management. There was consensus among experts that these temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction projects should be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract birds (Grunau and Lavender 2002).

In addition, the Commission for Environmental Cooperation (2000), Ehrlich et al. (1992), and Gillihan (1999) identify vehicle collision while the birds are hunting as another factor contributing to continent-wide declines in shrike populations. In a non-road context, grazing has been found to have a beneficial effect on loggerhead shrike habitat by providing conditions amenable to the large insects preferred by shrikes. Mowing of ROWs may mimic these conditions, and therefore provide areas adjacent to highways that are attractive to shrikes. This is most likely to be true if there are also fences or utility lines (perch sites) running along the road. However, as noted above, experts consulted during this project suggested that habitat along ROWs could be population sinks, and that birds should be discouraged from using these areas.

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 8,780 acres. This represents approximately 0.061% of the identified habitat in the project area (Grunau and Lavender 2002).

Long-billed Curlew

There is strong consensus among the experts that the primary concern over the long term for prairie birds, including the long-billed curlew, is loss of habitat. In some cases, ROWs may be attracting nesting or foraging birds (i.e., creating habitat), but this was generally not considered a desirable situation by most experts (note that field data are not available to either support or reject this theory). Most commonly, nesting birds appear to avoid ROWs, and experts considered these areas permanently lost as breeding habitat.
CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards and stockpiling, rest area construction, and bridgework. Other CDOT activities with potential for temporary impacts are mowing, re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), and weed management. There was consensus among experts that these temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction projects should be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract birds (Grunau and Lavender 2002).

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 5,058 acres. This represents approximately 0.049% of the identified habitat in the project area (Grunau and Lavender 2002).

McCown's Longspur

There is strong consensus among the experts that the primary concern over the long term for prairie birds, including McCown's longspur, is loss of habitat. In some cases, ROWs may be attracting nesting or foraging birds (i.e., creating habitat), but this was generally not considered a desirable situation by most experts (note that field data are not available to either support or reject this theory). Mowing could potentially destroy any nests on the ground if McCown's longspurs were to use the ROW. Most commonly, however, nesting birds appear to avoid ROWs, and experts considered these areas permanently lost as breeding habitat.

CDOT activities that are most likely to result in permanent habitat loss are road widening (including shoulder work, lane addition, interchange improvements, etc.), maintenance yards and stockpiling, rest area construction, and bridgework. Other CDOT activities with potential for temporary impacts are re-surfacing and shoulder improvements, winter maintenance (e.g., sanding, de-icing), weed management, and mowing. There was consensus among experts that these temporary impacts would be localized and unlikely to result in long-term adverse impacts to populations. Use of best management practices and seasonal restrictions during construction projects should be sufficient to offset temporary impacts. Otherwise, ROWs should be managed such that they do not attract birds (Grunau and Lavender 2002).

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 1,888 acres. This represents approximately 0.054% of the identified habitat in the project area (Grunau and Lavender 2002).

Brassy Minnow

According to expert opinion, the primary concern for prairie fish, including the brassy minnow, is the construction of permanent barriers to upstream/downstream movement (e.g., conduit pipes). The critical threshold for gradients that prohibit fish movement is unknown. Other impacts commonly associated with roadwork, such as siltation and turbidity, are not thought to negatively affect these species unless such impacts continue for longer than one year. If these impacts are of short duration, they are not substantially different from the types of storm and flood events that these species are adapted to. Continuance of these types of impacts for longer

than a year may affect life cycles; continuance for longer than two years could extirpate local populations (pers. comm., Nesler 2002). On-site BMPs will avoid impacts to the fish.

Common Shiner

According to expert opinion, the primary concern for prairie fish, including the common shiner, is the construction of permanent barriers to upstream/downstream movement (e.g., conduit pipes). The critical threshold for gradients that prohibit fish movement is unknown. Other impacts commonly associated with roadwork, such as siltation and turbidity, are not thought to negatively affect these species unless such impacts continue for longer than one year. If these impacts are of short duration, they are not substantially different from the types of storm and flood events that these species are adapted to. Continuance of these types of impacts for longer than a year may affect life cycles; continuance for longer than two years could extirpate local populations (pers. comm., Nesler 2002). However, the common shiner is intolerant of silt-dominated habitats (Propst 1982; Woodling 1985). Therefore, the common shiner could be adversely affected by any changes that substantially increased siltation (Nesler et al. 1997). On-site BMPs will avoid impacts to the fish.

Flathead Chub

According to expert opinion, the primary concern for prairie fish, including the flathead chub, is the construction of permanent barriers to upstream/downstream movement (e.g., conduit pipes). The critical threshold for gradients that prohibit fish movement is unknown. Other impacts commonly associated with roadwork, such as siltation and turbidity, are not thought to negatively affect these species unless such impacts continue for longer than one year. If these impacts are of short duration, they are not substantially different from the types of storm and flood events that these species are adapted to. Continuance of these types of impacts for longer than a year may affect life cycles; continuance for longer than two years could extirpate local populations (pers. comm., Nesler 2002). On-site BMPs are expected to avoid impacts to this fish.

Plains Minnow

The elimination of highly variable water levels, unstable streambeds, and fluctuating water temperature can contribute to the decline of short-lived fish species, like the plains minnow, that are adapted to highly unstable plains rivers (CDOW 2002b). However, according to expert opinion, the primary concern for prairie fish, including the plains minnow, is the construction of permanent barriers to upstream/downstream movement (e.g., conduit pipes). The critical threshold for gradients that prohibit fish movement is unknown. Other impacts commonly associated with roadwork, such as siltation and turbidity, are not thought to negatively affect these species unless such impacts continue for longer than one year. If these impacts are of short duration, they are not substantially different from the types of storm and flood events that these species are adapted to. Continuance of these types of impacts for longer than a year may affect life cycles; continuance for longer than two years could extirpate local populations (pers. comm., Nesler 2002). On-site BMPs will avoid impacts to this fish.

Plains Topminnow

CDOT actions that result in silting or toxic spills into water courses, or that change the flow regime could adversely affect the plains topminnow. However, according to expert opinion, the primary concern for prairie fish, including the plains topminnow, is the construction of permanent barriers to upstream or downstream movement (e.g., conduit pipes). The critical threshold for gradients that prohibit fish movement is unknown. Siltation and turbidity are not thought to negatively affect these species unless such impacts continue for longer than one year. If these impacts are of short duration, they are not substantially different from the types of storm and flood events that these species are adapted to. Continuance of these types of impacts for longer than a year may affect life cycles; continuance for longer than two years could extirpate local populations (pers. comm., Nesler 2002). On-site BMPs will avoid impacts to this species.

Southern Redbelly Dace

The primary concern for the southern redbelly dace is construction of permanent barriers to movement. Siltation may pose a threat, though this species is adapted to survival in turbid water resulting from storm and flood events. If siltation should persist for more than one year, there may be an impact on population viability (pers. comm., Nesler 2002). An accidental spill of any toxicant into the stream could easily eliminate these populations of southern redbelly dace. On-site BMPs will avoid impacts to the species.

Suckermouth Minnow

The primary concern for this species is the construction of permanent barriers to movement. Siltation may also pose a threat, though these fish are adapted to survival in turbid water resulting from storm and flood events. If siltation should persist for more than one year, there may be an impact on population viability (pers. comm., Nesler 2002). On-site BMPs will avoid impacts to this fish.

Northern Cricket Frog

Potential impacts to the northern cricket frog derive from changes in local hydrology, and include habitat loss due to de-watering, pollution (salts, de-icing compounds, hydrocarbons), siltation, and changes in the aquatic regime that favor the non-native bullfrog (pers. comm., Loeffler 2002; pers. comm.,. Livo 2002; pers. comm., Mackessy 2002). Changes in local hydrology will be avoided through implementation of on-site BMPs.

Northern Leopard Frog

Potential impacts to the northern leopard frog are largely related to changes in local hydrology. Primary concerns would be habitat loss through temporary or permanent de-watering, and indirect effects from aquatic alteration, pollution (e.g., salts, de-icing compounds) and siltation. If aquatic alteration results in habitat that favors the exotic bullfrog, additional impacts may include increased predation on adult leopard frogs, loss of tadpoles due to increased competition, and an increase in pathogens (pers. comm., Livo 2002). On-site BMPs will avoid impacts due to alterations in local hydrology.

The experts consulted for this project identified local roadkill as among the most significant threats to some amphibian populations (Grunau and Lavender 2002).

Massasauga

According to experts consulted, roads are among the most significant threats to local reptile populations (Grunau and Lavender 2002). The primary highway impacts are those that cause direct mortality such as mowing and roadkill (pers. comm., Mackessy 2002). CDOT activities that result in increased speed and traffic volume, such as road widening, may lead to an increase in roadkill.

Roads may attract reptiles for basking or hunting prey (pers. comm., Livo 2002; Mackessy 1998). In addition, massasaugas cross roads when moving between hibernation and foraging areas in Lincoln County, and likely elsewhere (pers. comm., Mackessy 2002). Also, they frequently cross roads during the active season (April to October) in places where roads bisect habitat, and are therefore subject to significant risk. From 1995-1998, over 200 road-killed massasaugas were collected in southeastern Colorado, virtually all killed by vehicles (pers. comm., Mackessy 2002).

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 1,891 acres. This represents approximately 0.036% of the identified habitat in the project area (Grunau and Lavender 2002).

Texas Horned Lizard

Roads are among the most significant local threats to reptile populations. Roads tend to attract reptiles such as horned lizards for basking or hunting prey (Mackessy 1998). The primary

impacts from highways are those that cause direct mortality such as mowing and roadkill (pers. comm., Mackessy 2002). CDOT activities that result in increased speed and traffic volume, such as highway widening, may lead to increased roadkill.

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 1,568 acres. This represents approximately 0.033% of the identified habitat in the project area (Grunau and Lavender 2002).

Western Box Turtle

Roads are among the most significant local threats to reptile populations, and are often cited as a primary source of mortality for the western box turtle (Legler 1960; Hammerson 1999). Box turtles are very slow when crossing roads, often enclosing within their shells for extended periods upon sensing an automobile, thereby exposing themselves to the vehicles for prolonged periods of time. Roads attract western box turtles for basking (Mackessy 1998), and they are known to feed on roadkilled animals, further exposing themselves to the hazards of traffic (Mackessy 1998; Hammerson 1999; pers. obs., C. Pague). Also, turtles use road banks for breeding sites (egg deposition), and are potentially susceptible to impacts from ground disturbance. The locations of such breeding sites are not available, so scope or severity of this impact cannot be estimated (pers. comm., Livo 2002).

Hammerson (1986, 1999) reports hundreds of box turtles killed on roads each year. The primary highway impacts are those that cause direct mortality, such as mowing and roadkill. Box turtles are common victims of roadkill on some roads (e.g., Dr. Mackessy's crew once counted 75 roadkilled box turtles on a single pass of US287 - approximately 21 miles - between Kit Carson and Eads). Because box turtles are long-lived, populations may not be able to sustain current levels of highway mortality (pers. comm., Livo 2002), and population effects are not readily observable in a short time frame (pers. comm., Pague 2002). CDOT activities that result in increased speed or traffic volume could lead to increased roadkill.

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 1,910 acres. This represents approximately 0.061% of the identified habitat in the project area (Grunau and Lavender 2002).

Cylindrical Papershell

CDOT projects could negatively impact the cylindrical papershell if they result in increased runoff or siltation, or disruption of surface or groundwater flow. Bridge repair resulting in removal of riparian vegetation could destabilize stream bottoms and eliminate mussels and other benthic organisms (Jennings 2000). However, according to experts consulted for this project, the only potential impacts anticipated would be altered quantity or quality of permanent water sources if BMPs were not employed (Grunau and Lavender 2002). Other impacts from future CDOT activities were considered temporary because the disturbance mechanism (the road) is already present (pers. comm., Loeffler 2002).

Giant Floater

CDOT projects could negatively impact the cylindrical papershell if they result in increased runoff or siltation, or disruption of surface or groundwater flow. Bridge repair resulting in removal of riparian vegetation could destabilize stream bottoms and eliminate mussels and other benthic organisms (Jennings 2000). However, according to experts consulted for this project, the only potential impacts anticipated would be altered quantity or quality of permanent water sources if BMPs were not employed (Grunau and Lavender 2002). Other impacts from future CDOT activities were considered temporary since the disturbance mechanism (the road) is already present (pers. comm., Loeffler 2002).

Arogos Skipper

The greatest concern for potential impacts to butterflies, including the arogos skipper, is any adverse effect on host plants and nectar sources from mowing, spraying, and construction

activities (pers. comm., Kondratieff 2002; pers. comm., Pineda 2002). Many invertebrates are host-plant specific species. ROWs on the prairie may contain more host plant and nectar source plants than surrounding landscapes that are heavily grazed. However, mowing, herbicide application, or re-seeding after construction with non-native plants may result in reduced availability of host plant and nectar sources, thereby reducing reproductive success of the butterflies. Also, grasshopper spraying in ROWs when larvae are feeding or adults are flying, or mowing while larvae are actively feeding, could lead to direct mortality of individuals.

Ground disturbance that accompanies highway construction, presence of heavy equipment, and maintenance activities are usually vectors for introduction and spread of noxious weeds. Seasonal mowing (mid-spring) may be beneficial because reduction in the growth of weedy cool season grasses will benefit the native, warm-season grasses that are used as host plants by butterflies. However, the arogos skipper is sensitive to management, and will avoid recently grazed or mowed areas (Moffat and McPhillips 1993). Prescribed fires, depending on timing, generally result in fewer butterflies for the next several years, though as vegetation recovers the butterfly benefits (Dana 1991; Swengel and Swengel 1995).

Hops Feeding Azure

There are no documented extant occurrences of this species within the project area, but there is potential habitat within the species' overall range. If this species occurs in the project area, the greatest concern for potential impacts would be any adverse effect on host plants and nectar sources from mowing, spraying, and construction activities. Many invertebrates are host-plant specific species. ROWs on the prairie may contain more host plant and nectar source plants than surrounding landscapes that are heavily grazed. However, mowing, spraying, or re-seeding after construction with non-native plants may result in reduced availability of host plant and nectar sources, thereby reducing reproductive success of the butterflies. Ground disturbance that accompanies highway construction, presence of heavy equipment, and maintenance activities are usually vectors for introduction and spread of noxious weeds. Seasonal mowing (mid-spring) may be beneficial because reduction in the growth of weedy cool season grasses will benefit the native, warm-season grasses that are used as host plants by butterflies.

Ottoe Skipper

The greatest concern for potential impacts to butterflies, including the Ottoe skipper, is any adverse effect on host plants and nectar sources from mowing, herbicide application, and construction activities. Many invertebrates are host-plant specific species. ROWs on the prairie may contain more host plant and nectar source plants than surrounding landscapes that are heavily grazed. However, mowing, spraying, or re-seeding after construction with non-native plants may result in reduced availability of host plant and nectar sources, thereby reducing reproductive success of the butterflies. Also, grasshopper spraying in the ROW when larvae are feeding or adults are flying, and mowing while larvae are actively feeding, could lead to direct mortality of individuals.

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Regal Fritillary

The greatest concern for potential impacts to butterflies, including the regal fritillary, is any adverse effect on host plants and nectar sources from mowing, spraying, and construction activities. Many invertebrates are host-plant specific species. ROWs on the prairie may contain more host plant and nectar source plants than surrounding landscapes that are heavily grazed. However, mowing, herbicide application, or re-seeding after construction with non-native plants

may result in reduced availability of host plant and nectar sources, thereby reducing reproductive success of the butterflies. Also, grasshopper spraying in the ROW when larvae are feeding or adults are flying, or mowing while larvae are actively feeding, could lead to direct mortality of individuals.

In addition, ground disturbance that accompanies highway construction, presence of heavy equipment, and maintenance activities are usually vectors for introduction and spread of noxious weeds. Seasonal mowing (mid-spring) may be beneficial because reduction in the growth of weedy cool season grasses will benefit the native, warm-season grasses that are used as host plants by butterflies.

CDOT activities that lower groundwater levels could negatively impact the regal fritillary by decreasing the ability of the land to support its larval and adult food plants (Nagel 1992).

Arkansas River Feverfew

The Arkansas River feverfew is a long-lived, slow-growing plant. Disturbance to a population may result in loss of individuals, reduced reproductivity, and potential loss of the entire population, depending on the scope and severity of the disturbance. This plant does not re-colonize easily after being disturbed (pers. comm., Coles 2002; pers. comm., Rondeau 2002). Road clearing, road widening, and herbicide application could extirpate local populations (pers. comm., Coles 2002; pers. comm., Spackman 2002). BMPs to avoid impacts will be implemented.

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 141 acres (Grunau and Lavender 2002).

Arkansas Valley Evening Primrose

Almost all known occurrences of the Arkansas Valley evening primrose are along roads (pers. comm., Spackman 2002). Herbicide spraying, road widening, and growing-season mowing would be particularly harmful to this species (pers. comm., Spackman 2002). BMPs will be employed that will avoid impacts to the species.

Golden Blazing Star

Road widening, mowing (especially in late August through September when the plant is blooming), and pesticide use can all have negative impacts on the golden blazing star. This species does not transplant well. Re-seeding disturbed areas may be a viable mitigation alternative, but it is very important not to decimate the original seed source population. This species is not abundant, and seed availability is limited. Seed harvest would need to be restrained so as not to deplete the soil seed bank in remaining populations (pers. comm., Kelso 2002; pers. comm., Coles 2002). BMPs to avoid impacts will be implemented.

Pueblo Goldenweed

The population of Pueblo goldenweed that occurs at the intersection of State Highways 50 and 115 is currently being affected by CDOT and utility maintenance activities (pers. comm., Coles 2002). Road widening, mowing, or pesticide use could all have negative impacts on the Pueblo goldenweed. BMPs will be employed to avoid impacts to this species.

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 82 acres (Grunau and Lavender 2002).

Round-leaf Four-o'clock

Road widening, mowing, or pesticide use could all have negative impacts on the round-leaf four-o'clock (pers. comm., Kelso 2002; pers. comm., Spackman 2002). BMPs will be implemented that will avoid impacts to this plant.

The maximum potential for permanent habitat loss from transportation improvement projects was estimated to be 117 acres (Grunau and Lavender 2002).

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Arkansas Darter

Any activity resulting in loss or fragmentation of habitat could negatively affect the Arkansas darter. Such activities include development in riparian areas that lead to streambank degradation and decreased water quality, reductions in water flow and quality resulting from water diversions, and groundwater depletions (Miller 1984). The spring-fed riparian habitats required by darters could also be threatened by overgrazing, which can lead to bank degradation, filling of wetlands, channelization, and conversion of rangeland to croplands.

Current threats to the Arkansas darter are the limited existing habitat and the potential degradation or loss of that habitat due to land use changes such as increased grazing, pollution, or water diversions resulting in modified flow regimes. Natural dispersal may be impeded by increased pollution or siltation, physical obstructions such as dams or culverts, and by seasonal decreased flows resulting from storage and diversion (CDOW 2001). The primary challenge to recovery of the darter is the continuing demand for surface and ground water for uses other than for in-stream flow (CDOW 2001).

Black-tailed Prairie Dog

Across most of Colorado's mid- and shortgrass prairie, most prairie dog colonies occur on private land (174,549 acres versus 39,783 acres on public lands) (EDAW 2000). It is likely that reductions in their populations, if they occur, will result from private landowners poisoning prairie dogs on their property or converting habitat from grazing to developed or cultivated lands.

Lesser prairie-chicken

According to TNC (1998), approximately 91 percent of Colorado's central shortgrass prairie is privately owned. Continued habitat loss on these private lands, largely through conversion from native prairies to cultivated fields, could result in lesser prairie-chicken population declines. Additionally, removal of brush to enhance pasture could continue to degrade habitat. Use of herbicides to limit shrubs and/or forbs directly eliminates both cover and food. In southeastern Colorado, grazing, plowing, and drought (especially through the Dust Bowl of the 1930s) have been identified as causes of habitat loss (Winn 1998).

Mountain Plover

Because the mountain plover has a narrow range of habitat requirements, and exhibits high site fidelity, it is susceptible at the population level to cumulative or stochastic impacts on the breeding grounds. However, the species is highly vagile and can rapidly locate suitable habitat, which facilitates recolonization (pers. comm., Knopf 2002).

Conversion of native shortgrass prairie to cropland, urbanization, eradication of prairie dog colonies and complexes (Knowles et al. 1982; Knopf 1994), oil and gas development, plowing and planting on nesting grounds, and insect control on nesting and wintering areas (Graul 1973; Knopf 1996c; Knopf and Rupert 1996) all represent threats to mountain plovers (USFWS 1999). Recent evidence suggests that long term grazing management of shortgrass grasslands can have a strong effect on the maintenance or degradation of mountain plover habitat (pers. comm., Knopf 2002).

Burrowing Owl

Conversion of rangeland to taller non-native grassland or cropland, urban growth, and the eradication of prairie dog colonies, have contributed to the decline of burrowing owls (Commission for Environmental Cooperation 2000; Anderson et al. 2001), and if these activities continue, they could contribute to additional declines. This intensification of land use could result in additional loss and fragmentation of nesting habitat. In many areas, the fate of burrowing owls is tied to that of active prairie dog colonies. Poisoning of prairie dog colonies and plague outbreaks could eliminate nest sites. Dechant et al. (2001b) identified the elimination of burrowing rodents (prairie dogs and ground squirrels) by rodenticides as a primary factor in burrowing owl declines.

Burrowing owls prefer grasslands of low structure that are typical of grazed grasslands (MacCracken et al.1985). Cessation of grazing, either through loss of prairie dogs or removal of ungulates, can negatively impact burrowing owls. Owls in Saskatchewan and Alberta nested in pastures with shorter vegetation than occurred in randomly chosen pastures (Clayton 1997). Owls in North Dakota nested in moderately or heavily grazed mixed-grass pastures, but not in hayed or lightly grazed mixed-grass pastures (Kantrud 1981). In Colorado, Montana, Nebraska, North Dakota, South Dakota, and Wyoming, optimal habitat occurred in heavily grazed areas (Kantrud and Kologiski 1982).

Pesticide poisoning of insects and vehicle collisions (as the birds hunt along right-of-ways) have also contributed to their decline (Haug et al. 1993) and increases in these activities will worsen the situation. Burrowing owls ingest poisoned rodents and forage in areas where insects have been poisoned (James et al. 1990). Pesticide use targeting the large insects on which burrowing owls depend during the nesting season (grasshoppers, crickets and beetles) depletes the prey base, and may impact reproduction. Owls in pastures treated with strychnine-coated grain weighed less than owls in control pastures, suggesting either a sub-lethal effect on the owls themselves, or reduction in prey availability (James et al. 1990). The use of insecticides and rodenticides in burrowing owl habitat can have several effects: pesticides not only reduce the owl's food supply and the number of burrowing mammals, but these chemicals may also be toxic to the owl (James and Fox 1987, James et al. 1990).

Almost 80 percent of eastern Colorado's prairie dog colonies occur on private land (EDAW 2000). Continued use of insecticides, conversion of rangeland to cropland or to urbanization, and reductions of prairie dog colonies can be expected to occur (Ostlie et al. 1997). It is also likely that prairie dog colonies on private land will tend to be small, and therefore will not provide the higher quality nesting habitat of large colonies and complexes.

Cassin's Sparrow

Cassin's sparrows are at risk from habitat conversion and degradation resulting from conversion of native prairie to cropland, urbanization, planting non-native grasses, and fire exclusion (Gillihan and Hutchings 2000; Ruth 2000). Grazing in areas with sparse vegetation devalues habitat, probably because of the need for some tall vegetation for nest protection and song perches (Bock et al. 1984; Bock and Bock 1988). Management practices that result in complete removal of the shrub component, or the loss of grass cover with an increase of shrub density beyond some threshold negatively affect Cassin's sparrow (Ruth 2000).

Ferruginous Hawk

Conversion of grasslands to row crops has been recognized as a major threat to ferruginous hawks (Lokemoen and Duebbert 1976; Gilmer and Stewart 1983; Finch 1991; Ostlie et al. 1997; Preston 1998; Commission for Environmental Cooperation 2000; Gillihan and Hutchings 2000). Invasive plant species and overgrazing have also contributed to habitat loss in some locations (Dobkin 1994; Commission for Environmental Cooperation 2000). Loss of nesting sites (Dobkin 1994; Commission for Environmental Cooperation 2000) and lack of prey (e.g., eradication of prairie dogs, other mid-sized rodents, and rabbits) have also negatively affected ferruginous hawk populations (Commission for Environmental Cooperation 2000; Gillihan and Hutchings 2000).

Almost 80 percent of eastern Colorado's prairie dog colonies occur on private land (EDAW 2000). Continued use of insecticides, conversion of rangeland to cropland or to urbanization, and reductions of prairie dog colonies can be expected to occur (Ostlie et al. 1997). It is also likely that prairie dog colonies on most private land will tend to be small, and thus not provide the higher quality foraging habitat of large colonies and complexes.

Lark Bunting

The pattern of local population declines and local increases within a context of a continent-wide decline implies loss of breeding habitat (Knopf 1995). In shortgrass prairie, heavy grazing has been found to be detrimental to lark buntings because of the increase in bare ground, reduction of vegetation height, and loss of tall cover (Rand 1948; Finzel 1964; Wiens 1973; Ryder 1980; Finch et al. 1987; Bock et al. 1993).

Like many other grassland birds, habitat destruction has been responsible for declines in lark bunting populations since the nineteenth century (Andrews and Righter 1992; Kingery 1998). Continued destruction in the form of urbanization, conversion to crops, or intense grazing will remove additional habitat.

Loggerhead Shrike

The primary long-term concern for this species is loss of habitat, especially on private lands, because of conversion of grasslands to row crops, development, or succession of areas to later seral stages dominated by woody species (Yosef 1996; Ostlie et al. 1997). Pesticide use, especially for grasshoppers, may also affect the species by decreasing or contaminating insect populations (Yosef 1996; Commission for Environmental Cooperation 2000; Gillihan and Hutchings 2000).

Long-billed Curlew

The conversion of rangeland to cropland can be expected to continue on some private lands in short and mixed-grass prairie (Chuluun et al. 1997; Ostlie et al. 1997). Although curlews may use cropland for foraging, cropland does not provide sufficiently high quality habitat to support viable curlew populations. In the Platte River Valley of Nebraska, conversion of upland prairie to cropland had a negative impact on curlews through the destruction of nesting habitat (Faanes and Lingle 1995). Habitat conversion to cropland in Colorado occurs more frequently in the northern (northeastern Colorado) and middle populations (north of the Arkansas River from eastern El Paso County to Kansas) of long-billed curlews (as defined by Nelson 1998a). Fire suppression is likely to continue on private lands, thereby reducing the open habitat preferred by curlews (Redmond and Jenni 1986; Dechant et al. 2001d).

McCown's Longspur

Declines in abundance and range contractions since 1900 are attributable to several factors. Habitat loss due to conversion of native prairie to row crops, control of wildfires, and urbanization, have all been implicated as factors contributing to declines in abundance and range contractions, as has use of pesticides, especially insecticides (With 1994; Kuenning 1998; Gillihan and Hutchings 2000; Dechant et al. 2001e). Continuation of these activities could have deleterious effects on the McCown's longspur and its habitat.

Brassy Minnow

Woodling (1985) suggested that further decreases in distribution and abundance would likely result from continued elimination of the preferred habitat through dewatering, increased siltation, and higher temperatures due to impoundments (Woodling 1985). Current threats also include nonpoint source pollution from agricultural or other activities such as golf courses, and mainstem impoundments that alter natural flow regimes (Echelle et al. 1995).

Common Shiner

Species such as the common shiner, that require clean gravel for spawning, are becoming increasingly rare in Colorado because of increased siltation (CDOW 1994). The limited range of the common shiner in Colorado puts the species at threat of extirpation due to stochastic events (Nesler et al. 1997).

Current threats also include nonpoint source pollution from agricultural activities or golf courses, and mainstem impoundments that alter natural flow regimes. Other threats across its range include dewatering of rivers from irrigation and degradation of riparian areas from overgrazing or development (Echelle et al. 1995).

Flathead Chub

The greatest threats to the flathead chub include nonpoint source pollution from agricultural activities or golf courses, dewatering of stream channels for irrigation, and mainstem impoundments that alter natural flow regimes (Woodling 1985; Echelle et al. 1995; Ostlie et al. 1997).

Plains Minnow

The elimination of highly variable water levels, unstable streambeds, and fluctuating water temperatures have contributed to the decline of this species (Cross et al. 1985).

Current threats include nonpoint source pollution from agricultural activities or golf courses, and mainstem impoundments impacting natural flow regimes. Other threats include dewatering of rivers from irrigation and degradation of riparian areas from overgrazing or development (Echelle et al. 1995).

Plains Topminnow

Habitat loss and competition with introduced mosquitofish have been identified as the primary causes of rangewide population declines (Lynch 1988). In Colorado, habitat loss has resulted from dewatering for agriculture, channelization, siltation (which covers spawning substrates), and urbanization in the Front Range corridor (Nesler et al. 1997).

Southern Redbelly Dace

Throughout much of its range, the southern redbelly dace is common in suitable habitat. However, small, disjunct populations, such as those in New Mexico and Colorado, are subject to extirpation through habitat degradation such as siltation, pollution, bank destabilization, introduction of exotics, and dewatering (BISON 2000a).

In Colorado, habitat loss has resulted from dewatering, channelization, and siltation (which covers spawning and feeding substrates). Current threats also include nonpoint source pollution and mainstem impoundments that impact natural flow regimes. Other threats across its range include dewatering of rivers from irrigation and degradation of riparian areas (Echelle et al. 1995).

Suckermouth Minnow

In Colorado, habitat loss has resulted from dewatering, channelization, and siltation (which covers spawning and feeding substrates). Current threats also include nonpoint source pollution from agriculture or other activities, and mainstem impoundments that impact natural flow regimes. Threats across its range include dewatering of rivers from irrigation and degradation of riparian areas from overgrazing or development (Echelle et al. 1995). The suckermouth minnow remains at risk because of its narrow food niche as a bottom feeder, and because of habitat deterioration as a result of loss of permanent flows and riffle habitat, increased siltation, water diversion, and nutrient enrichment (Propst et al. 1985; Nesler et al. 1997).

Northern Cricket Frog

The bullfrog is widely established in western North America, and is implicated in restricting the range of many native North American frogs (Jennings and Hayes 1994; McCoid 1995; Corn and Peterson 1996; Hammerson 1999). Hammerson (1982b, 1986) and Finch (1991) identified predation and competition from introduced bullfrogs as factors in declines of small frogs in Colorado. Habitat degradation and loss due to conversion of wetlands have also been identified as factors in the decline of North American frogs (Jennings and Hayes 1994). The application of pesticides, especially during metamorphosis, has been shown to cause mortality (Ferguson 1963; Porter 1972). Any activity resulting in habitat degradation or pesticide use could negatively affect the northern cricket frog.

Northern Leopard Frog

The bullfrog is widely established in western North America, and is implicated in restricting the range of native North American ranids (Corn 1982; Livo 1984; Jennings and Hayes 1994; McCoid 1995; Corn and Peterson 1996; Hammerson 1999). Bullfrogs are not native to Colorado, but have been intentionally introduced in numerous locations. They are large, aggressive, and highly competitive predators that are increasing in number and abundance. It is expected that concomitant with bullfrog increases there will be a decrease in leopard frog (*Rana pipiens and R. blairi*) numbers and populations (Hammerson 1986; Mackessy 1998). Hammerson (1999) and Finch (1991) identified predation and competition from introduced bullfrogs as factors in northern leopard frog declines in Colorado. Habitat degradation and loss due to conversion of wetlands have also been identified as factors in the decline of North American ranids (Jennings and Hayes 1994). Any activity resulting in habitat degradation or pesticide use could negatively affect the northern leopard frog.

Massasauga

In addition to road mortality, the massasauga has suffered loss of habitat and has been collected indiscriminately for the pet trade; and, like most snakes, particularly venomous species, it is often killed on sight (Mackessy 1998). Activities resulting in loss of habitat or in habitat fragmentation such as development or conversion to incompatible agricultural use could negatively affect the massasauga.

Texas Horned Lizard

The Texas horned lizard is threatened primarily by habitat loss and conversion. Much of the appropriate habitat in Baca County has been lost to agriculture, and if this trend continues, populations in this area will become threatened (Mackessy 1998). The Texas horned lizard has declined for several reasons, including collection for the pet trade, the invasion of the imported fire ant (*Solenopsis invicta*), and loss of habitat (Donaldson et al. 1994).

Western Box Turtle

The greatest source of mortality for adult western box turtles is vehicle collisions (Rodeck 1949; Legler 1960; Blair 1976; Knight and Collins 1977; Doroff and Keith 1990; Mackessy 1998; Hammerson 1999). Because of high local mortality due to vehicle collisions, late age of sexual maturity, and low fecundity, there are localities that may function as population sinks (Hammerson 1999). Western box turtles are also vulnerable to collection for the pet trade (they are particularly visible when crossing roads), to habitat fragmentation and to pesticide poisoning (because of the large number of insects in their diet).

Cylindrical Papershell

The decline, extirpation, or extinction of many mussel species likely results from ecological and biological traits that make them particularly vulnerable to anthropogenic effects (Neves 1993). Their life cycle includes a larval stage that is an obligate parasite of fishes. Therefore, they are susceptible to reproductive failure because of a lack of fish host availability. The fish faunas of many rivers have changed in response to changes in hydrologic regimes stemming from water development projects, flood control, power generation, and some agricultural practices. Species

composition changes that disfavor host species for mussel larvae adversely affect mussels, and because mussels can disperse only during the larval stage, barriers to fish dispersal are also barriers to mussel dispersal.

Habitat loss is the main problem facing cylindrical papershells. Among the factors thought to be responsible for their decline are changes in the hydrologic regime stemming from dam construction, water development, pollution, siltation, commercial navigation, and over harvest (Fuller 1974; Wu 1989; Williams et al. 1992; Williams and Neves 1995; Jennings 2000). Decline of host fish and encroachment by non-native mollusks also pose threats (Cummings and Mayer 1992; Williams et al. 1993; Williams and Neves 1995).

Giant Floater

The decline, extirpation, or extinction of many mussel species likely results from ecological and biological traits that make them particularly vulnerable to anthropogenic effects (Neves 1993). Their life cycle includes a larval stage that is an obligate parasite of fishes. Therefore, they are susceptible to reproductive failure because of a lack of fish host availability. The fish faunas of many rivers have changed in response to changes in hydrologic regimes stemming from water development projects, flood control, power generation, and some agricultural practices. Species composition changes that disfavor host species for mussel larvae adversely affect mussels, and because mussels can disperse only during the larval stage, barriers to fish dispersal are also barriers to mussel dispersal.

As with most wildlife, habitat loss is the main problem facing giant floaters. Among the factors thought to be responsible for their decline are changes in the hydrologic regime stemming from dam construction, water development, pollution, siltation, commercial navigation, and over harvest (Fuller 1974; Wu 1989; Williams et al. 1992; Williams and Neves 1995; Jennings 2000). Decline of host fish and encroachment by non-native mollusks also pose threats (Cummings and Mayer 1992; Williams et al. 1993; Williams and Neves 1995).

Arogos Skipper

Conversion of tallgrass prairie to agricultural use has greatly reduced the habitat and numbers of the arogos skipper (Ostlie et al. 1997). Livestock grazing, if heavy, and non-native grasses and forbs can reduce the suitability of grassland habitat (Royer and Marrone 1992). Broad-scale insecticide applications pose a threat to the persistence of the butterfly in grasslands (Ostlie et al. 1997), as do use of herbicides, which can diminish larval food (Pineda and Ellingson 1997). While possibly a concern in small roadside populations, the impact of long term mortality due to vehicular collisions is not known.

Hops Feeding Azure

Loss of habitat due to urbanization and the spread of non-native plants both threaten the persistence of the hops feeding azure (Pineda and Ellingson 1997). Fire suppression may also pose a threat because the larval host plant is an early-successional plant requiring sunny, open areas in canyons of the foothills.

Ottoe Skipper

Conversion of tallgrass prairie to agricultural use has greatly reduced the habitat and numbers of the Ottoe skipper (Ostlie et al. 1997). Livestock grazing, if heavy, and presence of non-native grasses and forbs, can reduce the suitability of grasslands habitat for the butterfly. Broad-scale insecticide applications pose a threat to the persistence of the butterfly in grasslands (Ostlie et al. 1997), as do use of herbicides, which can diminish larval food (Pineda and Ellingson 1997). While possibly a concern in small roadside populations, the impact of long term mortality due to vehicular collisions is not known.

Regal Fritillary

Loss and fragmentation of grasslands have a direct impact on this species, as does loss of disturbance, such as fire (Royer and Marrone 1992). Livestock grazing, if heavy, can reduce the suitability of grasslands habitat for the regal fritillary. Broad-scale insecticide applications pose a threat to the persistence of the regal fritillary in grasslands (Ostlie et al. 1997), and use of herbicides can diminish larval food (Pineda and Ellingson 1997).

Arkansas River Feverfew

Habitat loss, primarily from limestone quarrying and urbanization, is the major threat to this species (Colorado Native Plant Society 1997).

Arkansas Valley Evening Primrose

Very little is understood about why this plant is rare. Although loss of habitat may be an important issue, there are probably numerous other factors to consider, including change in grazing regime, change in pollinators, and change in disturbance regime. The Arkansas Valley evening primrose is not known from high quality natural habitats, and is found primarily along roadways (pers. comm., Spackman 2002).

Golden Blazing Star

Because this plant has a narrow distribution and occurs along roads, activities in the ROWs where it occurs, including widening, growing-season mowing, and herbicide application, will have negative effects on the golden blazing star.

Pueblo Goldenweed

The Pueblo goldenweed is threatened by mining for cement products, residential expansion, and increased recreation use from off road vehicles (CNHP 2000c).

Round-leaf Four-o'clock

The primary threats to persistence of the round-leaf four-o'clock are limestone mining for use in cement and the expansion of suburbs west of Pueblo (O'Kane 1988; Colorado Native Plant Society 1997).

Future Consultations

If the Service proposes to list a species that is addressed in this Conservation Strategy, the Service will notify FHWA, and FHWA will prepare a Biological Assessment, incorporating by reference the information already contained in Appendix A, along with any and all new information. The Service and FHWA can complete consultation either formally or informally, as appropriate.

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