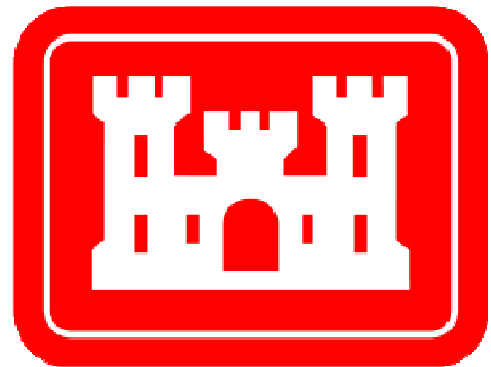


# Potential Restoration Benefits for the Cache la Poudre River General Investigation Study Flood Control/Environmental Restoration Project

W9128F-08-T-0129

*Prepared for:*



U.S. Army Corps of Engineers, Omaha District  
Environmental and Economics Section  
1616 Capital Avenue  
Omaha, Nebraska 68102-4901  
Contact: Johnathan Shelman

*Prepared by:*



10200 West 44<sup>th</sup>, Suite 210  
Wheat Ridge, Colorado 80033

March, 2010



## 1.0 INTRODUCTION

The 17-mile reach of the Cache la Poudre River running through Greeley, Colorado and ending at its confluence with the South Platte River has been the subject of planning efforts by the Corps of Engineers (COE) and the City of Greeley to reduce the potential for flood damage and to enhance habitat value. This reach of the river passes through the northeast corner of downtown Greeley and has been termed the *high damage reach* by City planners due to flooding of neighboring properties. The Corps of Engineers is investigating opportunities for flood control through the implementation of wetland and riparian restoration projects.

The area of concern to the COE, hereinafter referred to as the Study Area, begins west of Greeley, at 83<sup>rd</sup> Avenue (Weld County Road 27) and ends at the river's confluence with the South Platte River to the east of Greeley (**Figure 1**). The Study Area encompasses the river and 0.5 mile of floodplain and uplands on either side, creating an approximately one-mile wide corridor.

The goal of this study is to identify wildlife species that would benefit from habitat restoration projects within the Study Area and to identify design criteria necessary to benefit wildlife. If habitat restoration does not occur within the Study Area then biodiversity along this portion of the Cache la Poudre River will likely decline as a relatively small number of species that thrive in human-dominated landscapes replace those species less tolerant of human activities.

## 2.0 METHODS

The species list referenced for this report is based on the list provided in the wildlife inventory produced for the Study Area by OtterTail Environmental in 2009 (OtterTail 2009d). That list was developed using a historical data survey and three site surveys conducted in 2009. Not all species provided in the list were subject to direct observation, but, unless there was cause to delete a species from the list, such as known extirpation from the area, all species identified in the historical data search were retained and are assumed to be present, at least as intermittent migrants.

For this study, OtterTail's 2009 wildlife inventory was reviewed to identify species that would benefit from restoration in each of the habitat types identified in the report: *Habitat Types and Wetland and Riparian Habitat Restoration Potential for Cache la Poudre River* (OtterTail 2009a). Biologists at the U.S. Fish and Wildlife Service (USFWS), the Colorado Division of Wildlife (CDOW), and the University of Colorado were questioned regarding bird, mammal, amphibian, reptile, and fish species that might benefit from improvements to these habitat types. CDOW's Natural Diversity Information Source (NDIS), USFWS, Colorado Partners in Flight, and the United States Geological Survey websites provided detailed information on many species and their preferred habitats. The species list from OtterTail's wildlife inventory is reprinted here for reference in **Appendix A** and lists species by common and scientific name and whether or not the species was observed during OtterTail's 2009 surveys. The species list was also expanded to identify each species' Habitat Type preferences and each species' likelihood to occur in the Study Area.<sup>1</sup>

---

<sup>1</sup> Details of benefits to fish species were not included as all fish species generally benefit from improved habitat.

Information on design criteria for habitat restoration and creation was obtained from general habitat knowledge, the NDIS web site, wildlife field guides, and scientific papers (Elphick 2001; Johnson 2007; Klapproth 2009; Law 1998; NDIS 2010; Trainor 2007; Terres 1996; Sibley 2000; Stebbins 1985; Wheeler 2003; Whitaker 2005).

### **3.0 RESULTS AND DISCUSSION**

Many species listed in Appendix A occupy more than one habitat type and will utilize multiple habitats to obtain different resources at different stages of their life-cycles. The requirement by many species for multiple habitats suggests that their conservation will be most effective in a mosaic environment and that protection of or improvements to one habitat alone, such as wetlands, will be insufficient to achieve conservation goals (Law 1998).

Restoration of habitats in the Study Area has the potential to attract migrant species, locally stabilize or improve populations of threatened, endangered, and species of special concern, improve water quality, reduce the potential for damaging floods, and increase the quality of existing wildlife-related recreational opportunities.

Restoration is a difficult process and does not always lead to an increase in habitat quality or an increase in species abundance and diversity. If not planned thoroughly, executed properly, and managed adequately, efforts to create new habitat or improve existing habitat can produce the opposite of desired results, ultimately leaving an area in less than satisfactory condition. Before beginning restoration or creation projects, design considerations should include several key factors that will influence success: location, situation, patch size, patch variety, edge size, and edge shape.

When choosing a restoration or creation site it is important to consider site location and situation within the landscape. Success may be influenced by abiotic factors and biotic factors within and outside the project area. These influences may include hydrology, topography, surrounding, land use, and human activity.

Each species requires a minimum area or patch size to be able to use the site. Efforts to create or improve habitat for a particular species should include involvement with a wildlife biologist knowledgeable in that species habitat requirements, including minimum patch size.

Across the landscape, patches should not only vary in size but also in structure; variety promotes biodiversity. Habitat patches that vary in size, substrate composition, vegetation structure, and hydrology provide opportunities for a greater diversity of species than multiple habitat patches of the same size and structure. With such variety, each patch would have its own unique community of species and would attract others based on the unique resources it provides.

Edge size and shape are important factors that influence habitat sustainability. Edges are ecological boundaries where two or more ecosystems meet. Edge habitats contain characteristics common to adjoining habitat types. Edges serve to buffer habitats from disturbances and reduce tendencies for fragmentation and homogenization. Typically, larger edge habitats generate a greater buffer capacity, protecting habitat cores from negative influences like fire, preserving microclimates, and slowing the rate at which invasive species spread. Edge creation and restoration should take into account patch size, habitat buffering needs, and species' needs. Edge habitats become increasingly important within the

Study Area as urban development and agriculture continue to encroach on native habitats within the Study Area.

Habitats identified in the report: *Habitat Types and Wetland/ Riparian Habitat Restoration Potential for the Cache la Poudre River General Investigation Study Flood Control/Environmental Restoration Project* are discussed in the following sections. Each habitat type, except those dominated by human activities, are examined concerning 1) the species that benefit from restoration, 2) new species and uses that may occur after restoration, and 3) design criteria needed to achieve benefits for wildlife. The species mentioned in each section are those that would most benefit from restoration efforts to a single habitat type. Species listed in Appendix A, but not mentioned in this text are either edge species<sup>2</sup> or species that will most benefit from restoration to multiple habitat types. **Appendix A** lists species by common and scientific name that are present, likely to occur, or known to occur from past observations in the Study Area and the habitat types important to these species.

### **3.1 Riparian Forest Restoration**

Riparian and wetland habitats comprise less than two-percent of the land cover in Colorado, but provide benefits to over 25-percent of the wildlife in the state (CDOW 2008). Two riparian forest types are present within the Study Area; Plains Cottonwood Riparian Forest and Exotic Riparian Forest. The Plains Cottonwood Riparian Forest is dominated by plains cottonwood, peachleaf willow and mostly non-native understories of grasses and forbs. Exotic Riparian Forests within the Study Area are dominated by Siberian elm, Russian olive, and contain mostly non-native understories of grasses and forbs. Plains Cottonwood Riparian Forest is a unique and valuable habitat within the Study Area due to its relatively high productivity, proximity to water, multi-story structure, and sometimes dense cover. Riparian habitats are highly valued by both state and federal resource agencies because of their limited distribution combined with the high percentage of wildlife known to inhabit them, at least for brief periods of their life cycles (CDOW 2008a).

#### **3.1.1 Species that may benefit from restoration**

Lowland riparian systems, such as the Plains Cottonwood Riparian Forest, have the richest avian species component of any of Colorado's habitats (CPF 2000). Avian species common to this habitat type include the American kestrel, mourning dove, northern flicker, western wood-pewee, western kingbird, eastern kingbird, house wren, black-billed magpie, American robin, yellow warbler, blue grosbeak, and Bullock's oriole (CPF 2000). Although many diurnal raptors spend a large portion of their daily lives foraging in open areas, riparian forests provide vital nesting, perching and/or roosting opportunities for the bald eagle, eastern red-tailed hawk, Swainson's hawk, and to a lesser extent, Cooper's hawk, which may over-winter in the area, but only occasionally nests (Wheeler 2003). Sharp-shinned, western red-tailed, and rough-legged hawks may benefit from improved cover for over-wintering (rough-legged rarely), but these species do not nest in the area (Wheeler 2003).

The Bell's vireo is listed as a species of concern by Colorado Partners in Flight and the USFWS's Birds of Conservation Concern program. This species nests in riparian habitats and is a very rare spring migrant and a casual fall migrant in Weld County (NDIS 2009a). Bell's vireo was not observed during

---

<sup>2</sup> Edge species are those plant or animal species which thrive on the edges of habitats. These species benefit from resources provided by the habitats on either side of the edge.

OtterTail's 2009 surveys, but has been recorded as present in the area (Mark Sherman, CDOW Wildlife Biologist. Personal communication Nov. 17, 2008). This species may benefit from establishment of multi-story riparian habitats within the Study Area.

The yellow-billed cuckoo, a State Species of Special Concern, is known to occur in the Study Area, although it was not observed during OtterTail's surveys (OtterTail 2009b). The yellow-billed cuckoo is considered a rare spring and summer migrant to the eastern plains of Colorado and is associated with riparian habitats.

The fox squirrel, western harvest mouse, prairie vole, meadow vole, common muskrat, and white-tailed deer are all mammals commonly found in riparian habitats and would likely benefit from expansion or restoration of riparian forests in the Study Area. As well, generalists, such as coyote, Virginia opossum, raccoon, and red fox would also benefit from increases in food sources that would likely be created through restoration or expansion of riparian habitats (Whitaker 1995).

The common garter snake, a State Species of Special Concern, is known to use riparian habitats, as well as wetland and open water habitats. This species prefers dense cover within riparian habitats adjacent to wetland and open water habitats. No other reptile or amphibian species within the Study Area are likely to benefit from restoration of riparian forests, although some may occur in wetlands and small ponds contained within riparian forests.

### **3.1.2 New species or uses that may occur in the Study Area after restoration**

Lowland riparian systems provide dispersal corridors for woodland birds across an otherwise treeless terrain (CPF 2000). Examples of this habitat type, such as Plains Cottonwood Riparian Forest, also provide migration stopover areas and corridors for neotropical species and other migrants. Habitat restoration or expansion may attract uncommon migrants to the Study Area and this would likely benefit populations of these species and would also be appreciated by bird enthusiasts.

The red bat, little brown myotis, fringed myotis, eastern pipistrelle, and big free-tailed bat are not commonly found within the Study Area but restoration to riparian forests may attract these mammals.

Beavers, considered to be keystone species in riparian communities by the Colorado Division of Wildlife, are not likely to occur within the Study Area based on its current conditions. Beavers have been sited downstream of the Study Area but this species has been pressured out of the Study Area due to human activity and development, and declining habitat quality. Efforts to improve riparian habitat, associated ponds, and water quality within the Study Area will increase their chances of return to the area.

The federally-threatened Preble's meadow jumping mouse (*Zapus hudsonius preblei*) has not been observed in the Study Area. It is unknown if this species is present on the nearby South Platte River, but it is unlikely to directly benefit from habitat improvements within the Study Area (Plage, USFWS. Personal communication, December 9, 2009). Nevertheless, improvements to structural diversity within the riparian habitat would constitute creation of potential Preble's habitat which in turn may provide an opportunity for Preble's establishment should an unanticipated introduction occur. Preble's mice prefer well developed riparian vegetation, preferably wetland habitats, near relatively undisturbed grassland communities and open water (Trainor et al. 2007). In addition to its federal and state listing as a threatened species, the Preble's meadow jumping mouse is also designated as a *Priority Wildlife* species by CDOW's *Wetland Wildlife Conservation Program*.

Riparian ecosystems offer an opportunity for big and small game, turkey, and waterfowl hunting. Poudre River wildlife contributes approximately ten million dollars to the Greeley economy annually from geese and duck hunting and the river is a significant regional waterfowl resource (Brandon Muller, CDOW, District Wildlife Manager. Personal communication, December 5, 2008).

### **3.1.3 Design criteria needed to achieve benefits**

The following design elements should be included in riparian restoration, enhancement, or creation projects to maximize benefits to wildlife:

- Incorporation of floodplain hydrology into created or restored riparian habitats. Decreased peak flows and river constriction (Andersen 2008) have resulted in fewer flood events in the riparian forest, which in turn has depressed or eliminated regeneration of cottonwoods and willows. Reestablishment of hydrology in these existing riparian habitats or incorporation of hydrology in created riparian habitats is the most critical element to successful riparian habitat establishment.
- Establishment of plains cottonwood and peachleaf willow trees as well as native riparian shrubs, herbs and grasses in order to create a multi-story habitat. Densely vegetated riparian habitats are lacking in the Study Area due to depressed flood events which help support shallow rooted shrubs, grasses, and herbs. Recruitment of cottonwoods and willows will likely follow establishment of hydrology; however, native grass and herb species may require direct planting to provide a competitive advantage against aggressive, non-native plant species currently dominating the riparian forest understory.
- Removal of Russian olive and Siberian elm from the Study Area. These species are invading Plains Cottonwood Riparian Forest throughout the Study Area and cause an incremental decline in habitat value as they slowly spread.
- Construction of fencing to exclude livestock from grazing in restored, created, or existing riparian habitats, and to exclude livestock from river and its banks. Livestock are partially responsible for eroding banks and degraded water quality within the Study Area.
- Establish small and large patches of created riparian habitat adjacent to open water and wetland and grassland habitats to create a mosaic of habitat types.
- Maximize distance of restored or created habitats from human uses or, where distances of more than 100 feet are not possible, incorporate dense plantings to increase buffer value between human use-areas and valued riparian habitat
- Where development meets the Cache la Poudre River, even restoration and creation of narrow buffers is beneficial; aiding to bank stabilization and acting as a corridor for wildlife to move throughout the Study Area.

### 3.2 Wetland Restoration

Wetland Habitat Types within the Study Area include Cattail-Rush-Sedge Wetlands, Reed Canarygrass Wetlands, and Shrub Riparian Wetlands.<sup>3</sup> These wetland types commonly support cattails, rushes, sedges, bulrush, reed canarygrass, and narrowleaf willow. Wetlands are a declining habitat within the Study Area due to decreased flows in the river caused by increased upstream diversions for agriculture (Anderson 2008). Wetlands are highly valued by state and federal resource agencies because they support a high diversity of plant and wildlife species. These habitats can also support an open water component that is rare in arid northeast Colorado.

#### 3.2.1 Species that may benefit from restoration

It is likely that all wetlands play a role in the lives of birds, at least as a source of water (CPF 2000). Within Colorado, 14 percent of breeding species depend on this habitat type that makes up less than 2 percent of the state's area (CPF 2000, CDOW 2008). Avian species common to the Study Area's wetlands are the great blue heron, black-crowned night heron, great egret, snowy egret, northern harrier, American coot, Wilson's phalarope, marsh wren, red-winged blackbird, and yellow-headed blackbird. All or some members of bitterns, herons, egrets, ibis, geese, ducks, rails, coots, soras, cranes, plovers, stilts, avocets, sandpipers, curlews, godwits, dowitchers, snipes, phalaropes, woodpeckers, and song birds spend all or a portion of their life within wetlands and so would strongly benefit from wetland restoration or creation projects within the Study Area.

No state or federally-listed avian species are directly associated with wetland habitats within the Study Area; however, CDOW's *Wetland Wildlife Conservation Program* has designated eight *Priority Waterfowl* species that are the subject of statewide conservation and management programs. All eight of these species are recorded as being present within the Study Area and are known to occur in wetlands (OtterTail 2009b). These species are mallard, green-winged teal, blue-winged teal, cinnamon teal, gadwall, American wigeon, northern pintail, and lesser scaup. With the exception of northern pintail and lesser scaup these species were designated as *Priority Waterfowl* due to their importance to the overall duck harvest and wildlife viewing resource in Colorado. Northern pintail and lesser scaup were included due to their overall population declines. The *Wetland Wildlife Conservation Program's* intent is that other wetland-dependent species will benefit from habitat conservation and management activities targeting the Priority Waterfowl (CDOW 2008). The *Wetland Wildlife Conservation Program* has also identified *Priority Wildlife* species associated with Colorado wetlands habitats and known to be declining or at risk (CDOW 2008). This list includes the least tern, piping plover, western snowy plover, long-billed curlew, and greater sandhill crane, each of which spend much of their life near wetlands, but are more strongly associated with shallow open water, mud flats. This list also includes the American bittern which has a strong association with wetland habitats, since it commonly occurs in cattail marshes and wet meadows. Also listed is the short-eared owl, an occasional inhabitant of marshes. This species is also listed, along with the northern harrier, by Colorado Partners in Flight as a priority species due to its declining population.

The Great Plains toad, Woodhouse's toad, northern cricket frog, northern leopard frog, western chorus frog, plains spadefoot, and the tiger salamander are all potential beneficiaries of improved wetland and

---

<sup>3</sup> These Wetland Habitat Types were not confirmed as jurisdictional wetlands pursuant to COE regulations. These wetland designations should be considered tentative until confirmed by field evaluation (OtterTail 2009a).

seasonal pond habitats. The northern leopard frog and the northern cricket frog are State Species of Special Concern (NDIS 2009d and NDIS 2009e). The northern leopard frog is designated as a *Priority Wildlife* species by CDOW's *Wetland Wildlife Conservation Program*.

The CDOW's NDIS database lists one reptile species of State Special Concern for wetland habitats: the common garter snake (NDIS 2009f and NDIS 2009g). The common garter snake prefers dense cover within aquatic, wetland, and riparian habitats along the floodplains of streams and so would likely benefit from habitat improvements within the Study Area (NDIS 2009g). The common garter snake is designated as a *Priority Wildlife* species by CDOW's *Wetland Wildlife Conservation Program*.

Fish, clams, crustaceans, and many insects are restricted to the water environment for all or part of their life-cycle. Wetland restoration can improve water quality and food quality for these species and in turn provide a valuable food source for higher order wildlife.

### **3.2.2 New species or uses that may occur in the Study Area after restoration**

Many species of neotropical migrant birds, songbirds, waterfowl, amphibians, reptiles and other animals depend on wetland habitats. Wetlands also function as migration stopover areas and migration corridors for many species of birds. Restoration and creation of wetlands may attract migrating species that would otherwise pass over the area and may increase population numbers of those species of special concern within the state.

The Ute ladies'-tresses orchid and Colorado butterfly plant are federally-designated as threatened species and occur in wetland habitats or very moist floodplain areas. The CDOW does not believe either of these species is present in the Study Area (Agency Meeting 2008); however, future establishment may be possible with restoration and reintroduction.

### **3.3.3 Design criteria needed to achieve benefits**

The following design elements should be included in wetland restoration, enhancement or creation projects to maximize benefits to wildlife:

- Establishment of wetland hydrology in existing degraded wetlands or in sites targeted for wetland creation is critical to success. Abandoned oxbows located within the Study Area offer excellent opportunities for wetland restoration or creation. These old oxbows support well drained floodplain soils that can efficiently store high water flows diverted from the river's main channel. Stored waters can both support wetland and riparian vegetation, and serve to supplement late summer low flows as the stored waters discharge back into the main channel.
- Wetlands should exhibit varying surface water/groundwater regimes to increase diversity of benefits to wildlife. Varied regimes include: 1) Inundation throughout the growing season; 2) brief inundation in spring followed by prolonged saturation; 3) saturation to surface with late spring/summer drying; and 4) brief spring saturation followed by rapid drying. Each of these regime types will support different types of wetland plant communities. Bulrush and cattail-dominated wetlands require inundation through nearly the entire growing season, sedge-dominated wetlands can typically tolerate briefer inundation periods followed by quickly dropping water levels. Many rush-dominated wetlands thrive in sub-irrigated communities, where surface water may only be present for brief periods following storm or flood events. These latter wetland types might also be classified as wet meadows and may only marginally satisfy

COE criteria for jurisdictional wetlands (COE 2008). A mosaic of these wetland types throughout the Study Area would provide benefits to a greater diversity of wildlife species than would a wetland program that focused only on restoration of one type of wetland.

- Incorporation of floodplain hydrology into created or restored wetland habitats is the most critical element to successful wetland establishment.
- Many highly invasive wetland species are present in the Study Area and the most notable are reed canarygrass and whitetop; therefore planting desired native wetland species would be recommended to ensure successful native plant establishment. Seeding of wetland species does not typically work well since inundation can result in seed or seedling mortality. Native wetland plants such as bulrush, sedges and rushes establish quickly through rhizomatous growth (spreading roots which produce shoots) and so are often easy to establish on sites where hydrology is well managed.
- Construction of fencing to exclude livestock from grazing in restored, created, or existing wetland habitats.
- Establish small and large patches of created wetland adjacent to open water and riparian and grassland habitats to create a mosaic of habitat types. This variety will support a broad diversity of wildlife species.

### **3.4 Shore/Bank and Open Water Restoration**

The appendices break out the benefits of open water restoration into two categories: 1) riverine and 2) ponds and lakes. While these habitat types do provide varying benefits to wildlife, there is also much overlap. Many species that use open water habitats have preferences toward either ponds or lakes and rivers; however, these species will also routinely use the less favored type. For these reasons, this discussion references species known to use all open water habitat types found within the Study Area.

#### **3.4.1 Species that may benefit from restoration**

Species commonly found in open water habitats are loons, grebes, pelicans, cormorants, wading birds, waterfowl, coots, rails, cranes, shorebirds, gulls, terns, muskrats, frogs, turtles, and various fish species.

Thirteen of Colorado's breeding bird species are dependent on shore/bank habitats (CPF 2000). This is 5% of the state's breeding species relying on less than 1% of the state's surface area (CPF 2000). The interior least tern and piping plovers are critically imperiled in the state of Colorado. Two of the three high priority species, piping plover and least tern, no longer breed in native habitat in Colorado; all of their reproduction takes place on the shores and islands of reservoirs (CPF 2000). The third, the snowy plover, has its largest populations associated with reservoirs (CPF 2000).

The *Wetland Wildlife Conservation Program* has also identified *Priority Wildlife* species associated with shore/bank and open water habitats that are known to be declining or at risk (CDOW 2008). This list includes the interior least tern, piping plover, western snowy plover, long-billed curlew, and greater sandhill crane. These species are strongly associated with shallow open water and mud flats.

The state-threatened northern river otter (*Lutra canadensis*) has been observed near the Study Area, on the South Platte River, near Kersey, Colorado; however, there have been no confirmed sightings since

1992 (Larry Rogstad, CDOW. Personal communication, November 10, 2008 and January 13, 2010). There was an unconfirmed sighting approximately 2 miles west of the Study Area in 1995, but no other sightings, confirmed or not, have occurred since that date. The river otter requires clean water and a food supply of small fish and crustaceans (NDIS 2009c); therefore any improvements to water quality and expanded open water habitat may benefit this population, if in fact, any individual otters remain in the area. The northern river otter is listed as threatened by the state of Colorado and is designated as a *Priority Wildlife* species by CDOW's *Wetland Wildlife Conservation Program*.

Improvements to water quality or expansion of perennial ponds and their shorelines would benefit amphibian populations within the Study Area. Amphibian species listed as beneficiaries in the wetland section would also benefit from restoration to shores, banks, and open waters.

Improvements to water quality and increases in the diversity of riverine habitat, including connected or off-channel ponds, overhanging banks, and riffle-pool complexes would serve to increase habitat for all fish found within the Study Area. The common native species found within the Study Area include the bigmouth shiner, fathead minnow, green sunfish, Johnny darter, sand shiner, and white sucker (Harry Vermillion, CDOW, Aquatic Specialist. Personal communication, Nov. 21, 2008). The native red shiner is found within the Study Area and thrives in the current river conditions that are dominated by fluctuating flows, pollution, and silt; therefore, its competitive advantage might decrease with improved water quality (Johnson 2007). Otherwise, habitat improvements can only serve to increase abundance and, possibly, the diversity of native fish within the Study Area.

Of the native species identified as present within the Study Area from a CDOW database search containing records as early as 1914, three are listed as threatened or endangered or of special concern by the State: northern redbelly dace, brassy minnow, and Iowa darter. The most recent sighting of the northern redbelly dace was 1914, the brassy minnow 1988, and the Iowa darter 1994 (Harry Vermillion, CDOW, Aquatic Specialist. Personal communication, Nov. 21, 2008); therefore a return of these species may be unlikely.

Fish, clams, crustaceans, and many insects are restricted to the water environment for all or part of their life-cycle. Shore, bank, and open water expansion and restoration can improve water quality and food quality for these species and in turn provide a valuable food source for higher animals

### **3.4.2 New species or uses that may occur in the Study Area after restoration**

Restoration that improves water quality, foraging areas, and nesting grounds may increase visitation from species considered to be uncommon or rare.

Improvements to lakes, ponds, and streams can increase the quality of recreation activities such as birding and fishing. Birding, fishing, and hunting are some of the few activities that connect humans and the environment.

### **3.4.3 Design criteria needed to achieve benefits**

The following design elements should be included in open water projects to maximize benefits to wildlife:

- Ponds and lakes should have a minimum depth of 3 feet to ensure persistence of open water. Depths shallower than 3 feet may become choked with cattails.

- Gradually sloping and irregular shorelines should be maintained or created to provide suitable foraging and nesting habitat for species that use this habitat.
- Maintaining water levels is critical for the survival of species that depend on this habitat type for foraging and nesting. Ponds and lakes supplied by groundwater allow more consistent water levels and so can provide more reliable waterfowl habitat.
- Creation of islands within larger ponds or lakes can provide rare and valuable bird habitat.
- Fish stocking should be managed in areas intended as bird habitat, as large fish can drown young birds.
- Ponds and lakes intended to provide nesting habitat should be well removed from human use areas. In areas where development and human activity are in close proximity to nesting ponds, incorporation of dense planting buffers will minimize disturbances.

### **3.5 Short-Grass Prairie Restoration**

In Colorado, only about 40 percent of short grass prairies still remain and of those remaining, many are degraded due to fragmentation, invasive species, and over grazing (TNC 2005). No examples of native short-grass prairie are present in the Study Area. It is likely not possible to restore the current grasslands within the Study Area to the way they once existed as native grasslands and meadows. However, restoration of the grassland types present in the Study Area will benefit many species.

The two grassland Habitat Types located within the Study Area are Grass/Forb Mixed Rangeland and Ruderal Rangeland. These Habitat Types are dominated by non-native species and so restoration would result in increased plant species diversity which in turn would benefit area wildlife.

#### **3.5.1 Species that may benefit from restoration**

Grassland habitat loss and alteration due to development, agriculture, and grazing have contributed to population declines among shortgrass bird species (CPF 2000). This habitat is represented by 14 avian priority species--more than any other habitat in Colorado (CPF 2000). Within the Study Area, these priority species include the long-billed curlew, mountain plover, upland sandpiper, Cassin's sparrow, lark bunting, grasshopper sparrow, and McCown's longspur. Grasslands also provide foraging grounds for diurnal raptors, owls, and upland game birds.

Prairie dog colonies provide nesting opportunities for the state-threatened burrowing owl, which nests in abandoned burrows, most commonly located within active prairie dog colonies. Removal of prairie dog colonies in an effort to create wetland or riparian habitats would, therefore, have a potential impact on burrowing owls. The retention of at least portions of the existing prairie dog colonies could benefit both burrowing owls, prairie dogs, and the raptors and coyotes that prey on prairie dogs.

#### **3.5.2 New species or uses that may occur in the Study Area after restoration**

Many waterfowl and larger wading birds, such as egrets, herons and bitterns will use grassland habitats for foraging. The restoration of grassland habitats would improve species diversity and improve foraging habitat.

Cassin's sparrow, grasshopper sparrow, lark bunting, McCown's longspur and chestnut-collared longspur are not common to the Study Area, but their use could increase if the quality of grasslands were improved.

### 3.5.3 Design criteria needed to achieve benefits

The following design elements should be included in short-grass prairie projects to maximize benefits to wildlife:

- Locate short-grass restoration projects adjacent to wetland, riparian or open water in order to increase wildlife values.
- Select grasses and herbs appropriate to area soils and hydrology.
- Reduce weed and invasive species populations.
- Mowing may be necessary during the first few years to reduce competition from annual weeds and undesirable grasses.
- Construct livestock enclosure fencing to eliminate destruction of seedlings/container stock and new introductions of weed species. Controlled livestock grazing may be appropriate following establishment of native species; however, this must be closely managed to avoid degradation of the habitat.

## IV. REFERENCES

Colorado Division of Wildlife. 2008a. *Strategic Plan for the Wetland Wildlife Conservation Program*. Unpublished technical document. Colorado Division of Wildlife. 17 pp.

Colorado Division of Wildlife. 2008b. *Recommended Survey Protocol and Actions to Protect nesting Burrowing Owls*. Unpublished technical document. Colorado Division of Wildlife. 3pp.

Colorado Partners in Flight (CPF). 2000. *Physiographic Region 36: Central Shortgrass Prairie*. Retrieved from CPF website: <http://www.rmbo.org/pif/bcp/phy36/36.htm>

COE (U.S. Army Corps of Engineers). 2008. *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region*, ed. J.S. Wakeley, R.W. Lichvar, and C.V. noble. ERDC/EL TR-08-12. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Elphick, C., J. Dunning, and D. Sibley, eds. 2001. *The Sibley Guide to Bird Life and Behavior*. Alfred A. Knopf. New York. 587 pages.

Johnson, Dan. 2007. *Fish of Colorado Field Guide*. Adventure Publications Inc. Cambridge, MN. 176 pages.

Kentula, Mary E. Restoration, Creation, and Recovery of Wetlands. Wetland Restoration. Retrieved from U.S. Environmental Protection Agency website: <http://water.usgs.gov/nwsum/WSP2425/restoration.html>

- Klapproth, J.C. and Johnson, J.E. 2009. *Understanding the Science Behind Riparian Forest Buffers: Benefits to Communities and Landowner*. Natural Resources, Maryland Cooperative Extension and , College of Natural Resources, Virginia Tech; 420-153.
- Law, B.S. and Dickman, C.R. 1998. *The use of habitat mosaics by terrestrial vertebrate fauna: implications for conservation and management*. Biodiversity and Conservation 7, 323±333.
- Natural Diversity Information Source, Colorado Division of Wildlife. 2009. *Wildlife Species Page*. Retrieved from Natural Diversity Information Source website:  
<http://ndis.nrel.colostate.edu/wildlife.asp>
- The Nature Conservancy. 2005. *Colorado's Grasslands Draw Mongolian Conservationists*. Retrieved from the Nature Conservancy website:  
<http://www.nature.org/wherewework/northamerica/states/colorado/press/press2109.html>
- OtterTail Environmental, Inc. 2009a. *Literature Review and Historical Data Survey for Cache la Poudre River General Investigation Study Flood Control/Environmental Restoration Project*. Unpublished technical report prepared for the U.S. Army Corps of Engineers, Omaha District. 19 pages plus appendices.
- OtterTail Environmental, Inc. 2009b. *Plant Communities and Species List for Cache la Poudre River General Investigation Study Flood Control/Environmental Restoration Project*. Unpublished technical report prepared for the U.S. Army Corps of Engineers, Omaha District. 7 pages plus appendices.
- OtterTail Environmental, Inc. 2009c. *Wildlife Inventory and Map for Cache la Poudre River General Investigation Study Flood Control/Environmental Restoration Project*. Unpublished technical report prepared for the U.S. Army Corps of Engineers, Omaha District. 8 pages plus appendices.
- OtterTail Environmental, Inc. 2009d. *Habitat Types and Wetland/ Riparian Habitat Restoration Potential for the Cache la Poudre River General Investigation Study Flood Control/Environmental Restoration Project*. Unpublished technical report prepared for the U.S. Army Corps of Engineers, Omaha District. 24 pages plus appendices.
- Sibley, David A. 2000. *The National Audubon Society The Sibley Guide to Birds*. Alfred A. Knopf. New York. 544 pages.
- South Platte Wetland Focus Area Committee and Centennial Land Trust. 2002. *South Platte River, Colorado Wetland Focus Area Strategy*. Unpublished technical document. South Platte Wetland Focus Area Committee. 46pp.
- Stebbins, Robert C. 1985. *A Field Guide to Western Reptiles and Amphibians, Peterson Field Guides*. Houghton Mifflin Company. New York, New York. 336 pages.
- Terres, John K. 1996. *The Audubon Society Encyclopedia of North American Birds*. Wings Books. Avenel, New Jersey. 1,009 pages.

Trainor, A.M., T.M. Shenk, and K.R. Wilson. 2007. Microhabitat characteristics of Preble's meadow jumping mouse high-use areas. *The Journal of Wildlife Management*. Vol. 71. No. 2. Pp. 469-477

Wheeler, Brian K. 2003. *Raptors of Western North America*. Princeton University Press. Princeton, New Jersey. 544 pages.

Whitaker, John O. 1995. *National Audubon Society Field Guide to North American Mammals*. Alfred A. Knopf. New York. 745 pages.