

APPENDIX C
SPECIES ACCOUNT: MOUNTAIN PLOVER

MOUNTAIN PLOVER (*Charadrius montanus*)

Species Status

On May 3, 1993, the USFWS listed the Mountain Plover as a Candidate Species under the ESA. On February 16, 1999, a notice was published in the Federal Register proposing to list the Mountain Plover as a Threatened Species. In summarizing reasons for the proposed listing, the USFWS stated:

“Breeding Bird Survey trends analyzed for the period 1966 through 1996 document a continuous decline of 2.7 percent annually for this species, the highest of all endemic grassland species. Between 1966 and 1991, the continental population of the Mountain Plover declined an estimated 63 percent. The current total population is estimated to be between 8,000 and 10,000 individuals. Conversion of grassland habitat, agricultural practices, management of domestic livestock and decline of native herbivores are factors that likely have contributed to the Mountain Plover’s decline” (USFWS 1999).

On December 5, 2002, the USFWS reopened the comment period on the proposal to list the Mountain Plover, and proposed a special 4(d) rule that would exempt incidental take of the Mountain Plover during certain routine farming practices until research has been completed in 2004.

The Mountain Plover is listed as threatened in Canada and in Mexico (Commission for Environmental Cooperation 2000). U.S. states in which the Mountain Plover has recognized conservation status are: Colorado (species of special concern), Nebraska (listed threatened), Montana, Oklahoma, and California (species of special interest or concern), and Kansas (species in need of conservation).

The Commission for 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 U.S. Shorebird Conservation Plan has ranked the Mountain Plover in its highest conservation category (category 5) (USFWS 2002). Partners in Flight (PIF) ranks the Mountain Plover a “species of management concern” in Colorado, Kansas, Montana, Nebraska, New Mexico and Oklahoma (total PIF breeding priority score for the Southern Rockies/Colorado Plateau conservation region is 28). The Mountain Plover is listed as a sensitive species by the U.S. Forest Service and the Bureau of Land Management. The Colorado Natural Heritage Program ranks the Mountain Plover G2/S2B-SZN (imperiled globally because of extreme rarity; breeding season imperiled in Colorado) (CNHP 2003). In addition, the Mountain Plover is on the Audubon National Watchlist.

The USFWS (1999) interpreted BBS data for 1966-1991 as suggesting a decline of 2.7% annually. Breeding Bird Survey data presented in Sauer et al. (2001), however, are inconclusive; BBS data for the Mountain Plover should be interpreted with caution. These birds are inconspicuous and easily overlooked, and much of the data are based on low abundance and small sample sizes. Of the 12 regions for which BBS data are reported, five have a red credibility rating (important deficiency in the data), and seven (including Colorado) have a yellow rating (deficiency in the data) (Sauer et al. 2001).

Description and Taxonomy

The Mountain Plover is a comparatively large plover, approximately 9 in long (National Geographic Society 1987) and 8 in tall (Gillihan and Hutchings 2000). It is similar in size and appearance to a killdeer, but lacks the breast bands typical of the killdeer and other plovers (National Geographic Society 1987). Summer coloration is light brown on the back and along the side of the neck and chest, with bright white forehead, throat, breast and underwings (Knopf

1996). Breeding birds have a distinct black cap and thin black line between the eye and bill (Knopf 1996).

John K. Townsend described the Mountain Plover in 1837 from birds collected in Fremont County, Wyoming (Coues 1874; Luan 1957; Leachman and Osmundson 1990; Knopf 1996). Over the years, the Mountain Plover was known by eight different scientific names – *Charadrius montanus*, *Aegialitis montanus*, *Podascoys montanus*, *Charadrius* (Podascoys) *montanus*, *Aegialitis asiaticus* var. *montanus*, *Eudromias montanus*, *Aegialites montana*, and *Eupoda montana* (Leachman and Osmundson 1990). Other common names used or suggested included Rocky Mountain Plover (Bent 1929), Prairie Plover (Luan 1957), Bullhead Snipe (Grinnell et al. 1918), and Field Snipe (Shackford 1987). The American Ornithological Union Committee on Classification and Nomenclature officially adopted the scientific name *Charadrius montanus* in 1983 (AOU 1983). No subspecies are recognized (Oberholser 1974; Johnsgard 1981; Knopf 1996). According to the American Ornithological Union (1983), Mountain Plover, Oriental Plover (*C. Veredus*), and Caspian Plover (*C. asiaticus*) appear to constitute a superspecies.

Historical and Current Distribution

The historic breeding range of Mountain Plover included the shortgrass prairie of the western Great Plains from Saskatchewan and Alberta south to New Mexico and western Texas, and extended eastward into the Dakotas and Kansas (Graul and Webster 1976). While the Mountain Plover was once common throughout its range (Bailey and Niedrach 1965), populations have been significantly reduced in abundance and breeding range has clearly been constricted (Graul and Webster 1976; Ehrlich et al. 1992), particularly in the eastern portion (Knopf 1996). Current breeding populations are known primarily from Colorado, Montana and Wyoming, though birds are no longer found in three Montana counties where they once occurred (USFWS 2002). Breeding birds also occur in fewer numbers in Oklahoma, New Mexico, Kansas, Utah, Nebraska and Texas (Knopf 1996; USFWS 1999). In addition, nesting has been reported in Canada and confirmed in Mexico (USFWS 2002).

Historic winter distribution included California (including some coastal islands), Arizona, Texas and Nevada, as well as northern Mexico and Baja (Strecker 1912; Swarth 1914; Alcorn 1946; Jurek 1973; Russell and Lamb 1978; Garrett and Dunn 1981; USFWS 1999). Current winter distribution is primarily the Imperial and Central Valleys of California, but a few birds winter in southern Arizona and southern Texas (USFWS 2002). An unknown proportion of the Mountain Plover population winters in northern Mexico (AOU 1983; Knopf 1996).

The distribution of the Mountain Plover in Colorado once included many of the shortgrass prairie counties of the eastern plains, as well as the San Luis Valley, South Park, Middle Park (Bailey and Niedrach 1965; Graul and Webster 1976; Leachman and Osmundson 1990; Andrews and Righter 1992; Kuenning and Kingery 1998), North Park (one record) (Andrews and Righter 1992) and some western valleys (Davis 1969; Leachman and Osmundson 1990; Andrews and Righter 1992). Graul and Webster (1976) noted that Mountain Plover was no longer found in the front range counties surrounding Denver. More recently, Kuenning and Kingery (1998) reported the majority of breeding Mountain Plovers on the eastern plains and in South Park, with a few blocks represented in the San Luis Valley and one block in North Park. The PNG in Weld County, Colorado – formerly considered a stronghold for the breeding population – currently supports fewer than 100 birds (USFWS 2002; F. Knopf, pers. comm.). This decline from 1991 numbers (estimated by Knopf to be 1,280 birds) is attributed, at least in part, to unusually cold, wet weather during several years, which has altered the vegetation (USFWS 2002). On the other hand, recent data suggest that South Park (Park County) may be a more important breeding location than was previously thought, with the current population estimated at 1,500 to 2,000 breeding adults (Wunder et al. 2003 submitted; Grunau and Wunder 2001).

Life History and Habitat

Breeding habitat

The Mountain Plover nests in flat, dry landscapes characterized by very short, sparse vegetation (preferably less than 3 in), with at least 30% bare ground and a slope less than 5 degrees (less than 2 degrees optimal) (Graul 1973; Knowles et al. 1982; Leachman and Osmundson 1990; Parrish et al. 1993; Knopf and Miller 1994; Knowles 1996). A conspicuous object (e.g., manure pile, clump of vegetation, rock) is usually found near nest sites (Graul 1975; Knopf and Miller 1994; Olson and Edge 1985; USFWS 1999). In Colorado, the Mountain Plover is commonly associated with heavily grazed blue grama (*Bouteloua gracilis*) or buffalograss (*Buchloe dactyloides*) (Giezentanner 1970; Graul 1973, 1975; Graul and Webster 1976) on the eastern plains, but is also found in montane grasslands, sparse shrublands, and other heavily grazed grasslands in Colorado's mountain parks (e.g., South Park, San Luis Valley, Cochetopa Park).

Although nests are not established next to tall vegetation (Bradbury 1918; Graul 1975), areas of taller vegetation or other objects (e.g., fence posts, telephone poles) nearby may be necessary to provide shade (Graul 1975; Parrish 1988; McCaffery et al. 1984; USFWS 1999). Graul (1975) reported that chicks less than 2 weeks old can die if left without shade for 15 minutes in temperatures of approximately 81 degrees.

Use of Prairie Dog Towns

The Mountain Plover is strongly associated with black-tailed prairie dog towns in some parts of its breeding range (Tyler 1968; Knowles et al. 1982; Knowles and Knowles 1984; Parrish 1988; Shackford 1991; Knopf 1996; USFWS 2002). This is particularly true of Montana, where the Mountain Plover is believed to be dependent upon prairie dogs (Olson 1984; Olson and Edge 1985; Knowles 1996; Dechant et al. 2001; USFWS 2002).

The relationship between the Mountain Plover and prairie dogs in Colorado is less clear. Early research papers on the Mountain Plover in Colorado do not mention prairie dog colonies in descriptions of habitat (Graul 1973; Graul 1975; Graul and Webster 1976). Leachman and Osmundson (1990) noted that the Mountain Plover in northeastern Colorado used prairie dog towns for feeding and courtship, but not for nesting. In documents that summarize existing data on the Mountain Plover (i.e., Leachman and Osmundson 1990; Knopf 1996; USFWS 1999; Dechant et al. 2001), citations used to support statements relating nesting Mountain Plover and prairie dogs are all based on research from other states (including the adjacent states of Wyoming and Oklahoma). Information from the PNG in Colorado suggest there were relatively few prairie dogs in the area at a time when Mountain Plover populations were at a peak there (late 1960s – early 1970s), but that there are currently ~1,000 acres of prairie dogs present on the PNG, while Mountain Plover populations are still very low. Other recent observations in Colorado, however, suggest that the Mountain Plover may be more commonly associated with black-tailed prairie dogs (F. Knopf, pers. comm.; C. Pague, pers. comm.). In 1995, black-tailed prairie dogs were successful in maintaining Mountain Plover habitat on the PNG in northeastern Colorado after record rainfall, while similar sites without black-tailed prairie dogs became unsuitable (USFWS 1999). In 2001, McCoy (V. Dreitz, pers. comm.) found slightly higher nest success on rangeland sites with black-tailed prairie dogs than on sites without black-tailed prairie dogs. Additional research is needed to determine the level of association between the Mountain Plover and black-tailed prairie dogs in Colorado. Researchers studying the relationship between the Mountain Plover and agricultural practices in 2003 plan to investigate Mountain Plover use of black-tailed prairie dog colonies as well (F. Knopf, pers. comm.).

In areas where the Mountain Plover does nest on prairie dog colonies, the size of the colony may be important. In Montana, the Mountain Plover occurs at higher densities on larger towns (6-50 ha) compared to smaller towns (Knowles et al. 1982; Olson 1984; Olson-Edge and Edge 1987;

Dechant et al. 2001). Nest sites within prairie dog towns had shorter vegetation, more bare ground, and higher forb density (Olson 1984; Olson and Edge 1985; Dechant et al. 2001). The Mountain Plover has also been found on white-tailed prairie dog (*Cynomys leucurus*) towns, on Gunnison's prairie dog (*C. Gunnisoni*) towns in New Mexico, and on prairie dog towns in Mexico (USFWS 2002). In Montana, Knowles et al. (1982) found that the Mountain Plover used only active prairie dog towns that were also grazed by cattle.

Use of Cultivated Fields

Breeding Mountain Plover adults, nests, and chicks have been observed on cultivated fields in Colorado, Kansas, Nebraska, Oklahoma and Wyoming (Shackford et al. 1999). Contribution of cultivated fields to population productivity, however, is unclear. Knopf (1996) suggested that if fields left barren until after the Mountain Plover has begun nesting are then plowed and planted or tilled for weed control, later in the season nests, eggs and young can be destroyed by farm machinery. Knopf (1996) further suggested that even if the Mountain Plover re-nests after plowing, it might abandon the nest once vegetation grows taller than approximately two in. Shackford et al. (1999) found that 31 of 46 nests on cultivated fields failed; 22 of these nest failures were due to farm machinery. The success of the remaining 15 nests was unknown, but there were no successes documented (Shackford et al. 1999). In new field research into the effects of farming practices on the Mountain Plover in eastern Colorado, however, preliminary data suggest that nest success on cropland in eastern Colorado was not significantly different from success on rangeland in 2001 and 2002 (V. Dreitz, pers. comm.). Although nest success was similar in rangeland and cropland, the causes of mortality were different, with predation being the primary cause of nest failure on rangeland and agricultural practices being the primary cause of nest failure on cropland (T. McCoy unpubl. data; V. Dreitz, pers. comm.). The effect of drought in 2002 on the preliminary findings of McCoy and Dreitz is unclear. Final results of this research will be presented in 2004.

Wintering habitat

Winter habitat is very similar to breeding habitat – flat areas with short vegetation and bare ground, usually heavily grazed. Wintering sites include alkali flats, plowed or burned fields, heavily grazed grasslands and prairie dog colonies (Oberholser 1974; Knopf and Rupert 1995; Knopf 1996). Although wintering Mountain Plovers occur on cultivated lands and sod farms, research in the San Joaquin Valley, California, determined that birds preferred the remaining natural landscapes to the agricultural lands (Knopf and Rupert 1995). In the Imperial Valley, California, the Mountain Plover foraged in grazed alfalfa fields (especially those grazed by sheep), and also most burned fields (especially burned Bermuda grass) (Knopf and Rupert 1995). In fact, according to Wunder and Knopf (2003), irrigated fields and grazed alfalfa fields are now the predominant winter habitat in the Imperial Valley, due to the lack of natural habitat. Not all cultivated fields are considered suitable winter habitat for the Mountain Plover, however. Important characteristics are thought to include insect availability, depth of furrows, dirt clod size and vegetation of contiguous parcels (USFWS 2002). Additionally, fallow fields and barren desert outside the agricultural areas are used for roosting at night and during the day (Wunder and Knopf unpubl. data).

Migration habitat

Habitat used during migration is similar to that occupied during breeding and wintering seasons (e.g., grasslands, tilled fields, sod farms). Also noteworthy is the use of old buffalo wallows (playas) in southeastern Colorado during migration. Dry and wet playas are used at times during migration (R. Estelle, pers. comm.). Birds are also predictably seen in late summer foraging in tilled fields and roosting in flocks on alkaline or mud flats in southeastern Colorado, and are commonly observed on commercial sod farms in New Mexico (Knopf 1996).

Reproduction

The Mountain Plover arrives on breeding grounds in northern Colorado around mid-late March (Graul 1975; Knopf and Rupert 1996) and somewhat later at higher elevations (Knopf 1996). Peak breeding season in Weld County is mid-April to mid-July (Ball 1996; Dechant et al. 2001). In 2000 and 2001, the Mountain Plover arrived in South Park in mid-April, although in 2001, all areas were not occupied until mid-late May (Wunder unpubl. data). Males begin digging nest scrapes soon after arriving on breeding grounds (Knopf 1996) and are territorial during breeding season only. According to Knopf (1996), the territory of three males in Colorado measured roughly 16 ha each (approximately 39.5 acres), but there was abundant overlap at the boundaries.

One brood is raised per season per adult, with the male incubating the first clutch and the female incubating the second (Graul 1973). The second clutch may be produced with a different male (Graul 1975; Johnsgard 1979; Kuenning and Kingery 1998). The Mountain Plover is thought to begin breeding the first spring after hatching (Graul 1973) and continue every year thereafter (Knopf 1996). Egg laying begins mid-April through mid-June (May-July in South Park) and incubation is around 29 days (Graul 1975). If the first clutch or brood is lost before early June, the adult may re-nest (Knopf 1996). Typical clutch size is three (Graul 1975; Knopf 1996). Broods are quite mobile, moving an average of 300 m per day (Knopf and Rupert 1996), with necessary brood rearing area estimated at 28-91 ha (Knopf and Rupert 1996) to 147.9 ha (Dreitz et al., pers. comm.). Chicks fledge approximately 33-34 days after hatching (Knopf 1996).

Graul (1975) noted a "loose colonial tendency" in the nesting Mountain Plover in eastern Colorado. Plover nests are often found grouped in localized areas (Graul 1975) that may change in location from year to year. This shift in locations may be attributed to local weather patterns (e.g., birds may move to different nesting areas if original nests flood during spring storm events) (Leachman and Osmundson 1990). There is a high degree of site fidelity. Males and females have been documented to return to nest within several hundred meters of the previous year's nest site, and banded chicks have returned to their natal areas (Graul 1973b, Knopf 1996). The colonial tendency has also been observed in South Park every year since 1995. Wunder (unpubl. data) found areas of nest aggregation, although in different areas of South Park, each year. These are places where six or more nests, each about 60-80 m (197-263 ft) from one another, have been found. Knopf describes similar observations as passively aggregated rather than as behavioral colonies (Knopf 1996).

Data on lifetime reproductive success are not available. The Mountain Plover is known to live and breed at eight years old (Dinsmore 2001; USFWS 2002). However, recent data suggest that the mean lifespan of the Mountain Plover is 1.92 years starting at 14 days post-hatch (Dinsmore 2001; USFWS 2002). If birds begin breeding at one year of age (Knopf 1996), then a life span of less than two years would suggest that an individual bird may have only one opportunity (one breeding season, up to two clutches) to contribute to population recruitment (USFWS 2002). Therefore, loss of nest(s), eggs, or young could greatly reduce or entirely negate an individual's contribution to the population (USFWS 2002). This mean value for lifespan, however, does not take into account pre- and post-fledging mortality, and should be interpreted with caution.

Annual reproductive success has been studied on the PNG in northeastern Colorado (Weld County), and in South Park, Colorado. Success on the PNG seems to be quite variable from year to year, ranging from a low of 26% (Knopf and Rupert 1996) to a high of 65% (Graul 1975) for nests hatching at least one egg. Successful nests hatched an average of between 2.1 (McCaffery et al. 1984) and 2.7 (Graul 1975) eggs per nest. Fledging rates ranged from 0.26 (Knopf and Rupert 1996) to 1.4 (Graul 1975¹) chicks per nest. Given post-fledging predation, chicks surviving until migration ranged from 0.17 to 0.74 per nest (Knopf and Rupert 1996). The

¹ This rate based on samples that included only nests that hatched at least one egg.

PNG, however, experienced unusually cold, wet weather into June for several consecutive years beginning in 1995, which resulted in taller, more dense vegetation. Successful nesting Mountain Plovers on the PNG declined from 77 in 1990 to only two in 2001 (Knopf in litt. 2001 cited in USFWS 2002). In 2002 (a drought year), Knopf's preliminary data from the PNG suggest that 13 nests on native prairie had a 69% success rate, and 50 nests on experimental burns had a 54% success rate (Knopf in litt. 2001 cited in USFWS 2002). Apparent nest success in South Park was approximately 63% (n=64 nests) in 2000, 50% (n=117 nests) in 2001, and 90% (n=68 nests) in 2002 (Wunder unpubl. data).

Mortality

The Mountain Plover is most vulnerable to predation as eggs and chicks, predation being the cause of most losses (Miller and Knopf 1993; Knopf and Rupert 1996). Adults are rarely killed by predators (USFWS 1999). Documented predators on the breeding grounds of Colorado's eastern plains include the swift fox (*Vulpes velox*), coyote (*Canis latrans*), thirteen-lined ground squirrel (*Spermophilus* sp.), Swainson's Hawk (*Buteo swainsonii*), Prairie Falcon (*Falco mexicanus*) and Loggerhead Shrike (*Lanius ludocivianus*) (Sutton and Van Tyne 1937; Graul 1973; Graul 1975; Miller and Knopf 1993; Knopf and Rupert 1996). In addition, bullsnake (*Pituophis melanoleucus*) may be a predator of Mountain Plover eggs (Knopf 1996). Predators observed taking adult birds are the kit fox (*Vulpes macrotis*) on wintering grounds (Knopf and Rupert 1995) and Prairie Falcon on breeding grounds (Knopf 1996). Data from the PNG from 1969 to 1994 indicate that rates of nest predation range from 15% to 74% (Graul 1975; Miller and Knopf 1993; Knopf and Rupert 1996; USFWS 1999). High rates of predation in 1993 and 1994 were attributed to the swift fox, but Knopf and Rupert (1996) believed this was related to a temporary reduction in prey. They did not believe that long-term declines in the Mountain Plover population were related to swift fox predation.

Causes of mortality besides predation documented for the Mountain Plover are: nest abandonment (Miller and Knopf 1993; Knopf and Rupert 1996); death of chicks by overheating in the sun (Graul 1973); death of eggs from flooding after spring storms (Knopf 1996); eggs or adults killed by hail (Graul 1973, 1975) loss of eggs because a cow stepped on the nest (only once between 1992-1994 on the PNG) (Knopf 1996); and being struck by aircraft (Knopf 1996). Some nests are abandoned each year, sometimes owing to infertile eggs, but not always for known reasons. In 2001, three nests in South Park were abandoned. Infertile eggs were the cause in each of these cases (Wunder unpubl. data). Nest abandonment and mortality on cultivated fields often occurs after fields are plowed or tilled (Knopf 1996).

There are no data to suggest that disease is a significant cause of mortality in the Mountain Plover.

Home Range

Knopf and Rupert (1996) found that adults with broods move an average of 300 m (984 ft) per day and range over an average of 56.6 ha (~140 acres). Dreitz et al. (unpubl. data; pers. comm.) found average daily movement of 369 m per day – similar to the findings of Knopf and Rupert (1996) – but estimated home range at 147.9 ha, almost twice the home range estimated by Knopf and Rupert. The larger home range estimate may reflect the effect of drought on food abundance during the chick-rearing period (V. Dreitz, pers. comm.). Wunder (unpublished data) estimated a home range size of 83.96 ha (± 7.64 ha) for adults with broods of chicks in South Park.

Migration

The Mountain Plover migrates in flocks annually between breeding grounds and wintering grounds. It begins arriving on breeding grounds in Colorado between early March and mid-April (Knopf 1996). Adults and juveniles begin forming fall flocks in mid-June, and start leaving the breeding grounds around early July in Colorado. By early August, most (often all) birds will have

left the area (Knopf and Rupert 1996). In South Park, post-breeding flocks begin forming in July, peak in August and leave by early September (Wunder, unpublished data.)

The Imperial Valley and the Central Valley in California are the main wintering areas for the Mountain Plover (Wunder and Knopf 2003). Migrating birds usually reach wintering grounds of California between mid-September and mid-October (Small 1994; Knopf 1996). Spring migration back to breeding grounds usually begins around mid-February to early March (Knopf and Rupert 1996).

It appears that the Mountain Plover migrates non-stop over the mountains to its breeding areas (Knopf and Rupert 1995), but may also exhibit a J-shaped pattern of movement flying south through Mexico and back north along the western high plains (Wunder and Knopf 2003). There is still much uncertainty, however, in current understanding of migration patterns. Wunder (unpublished data) observed two South Park birds in California's Imperial Valley, and one of the 65 birds banded in the Imperial Valley during the winter of 2000-2001 attempted to nest in South Park in June 2001. Very little is known about Mexican populations.

Diet

The Mountain Plover feeds almost exclusively on invertebrates. Grasshoppers and beetles have been reported as the most common prey (Wiens 1974; Graul 1976; Olson 1985). A study in Colorado by Baldwin (1971) looking at stomach contents of 13 birds (8 adult; 5 immature) revealed a diet of 99.7% invertebrates and 0.3% seeds. The most important prey items were beetles (60%), grasshoppers and crickets (24.5%), and ants (6.6%). Baldwin further noted that consumption of beetles was highest from late spring through mid-summer and consumption of grasshoppers and ants was highest during late summer. Research on the diet of the wintering Mountain Plover from three different locales in California indicated that the stomachs of 39 birds contained 2,092 different invertebrate food items (including representatives from 13 orders and at least 16 families) (Knopf 1998). The proportions of invertebrate orders represented varied among the three locales. Knopf (1998) concluded that the Mountain Plover may be more flexible in selecting food items than was previously believed and that it is an opportunistic forager, at least on wintering grounds.

Abundance

Currently, the global population is estimated at 8000-12,000 individuals (Knopf, pers. comm.; USFWS 1999, 2002). An estimated 7,000 Mountain Plovers breed in Colorado (Kuenning and Kingery 1998; USFWS 2002), of which an estimated 1,500-2,000 breeding adults occur in South Park (Wunder et al. 2003 submitted), with the majority of the remainder found on the eastern plains. The total populations for Montana and Wyoming are estimated to be fewer than 1,500 birds each (USFWS 2002). There are substantially fewer birds in other states where the Mountain Plover breeds. The status of the breeding population in Mexico is unknown.

Reasons for Decline

According to the USFWS proposed rule to list the Mountain Plover as a threatened species, there has been an estimated 63% decline in the continental population of Mountain Plover since 1966 (based on BBS showing a 2.7% annual decline from 1966 to 1996) (USFWS 1999). This decline is greater than declines shown in any other grassland species.

Habitat Conversion

Loss of habitat (both breeding and wintering) to cropland has generally been considered the most significant factor in the decline of the Mountain Plover (Dinsmore 1983; Graul & Webster 1976; Schulenberg 1983; Knopf 1988; Leachman and Osmundson 1990). Approximately 32% of the grasslands in the U.S. Great Plains have been converted to other uses (Samson and Knopf 1996;

USFWS 1999). Graul (1980) suggested that up to 45% of the buffalo-blue grama grasslands have been destroyed. Graul and Webster (1976) also suggested that plowed shortgrass prairie allowed to revert to grasslands do not provide suitable Mountain Plover habitat because these areas tend to revegetate with taller grasses.

An estimated 572,000 acres of native Colorado grassland were plowed during the 1970's and 1980's (USFWS 1999). Using NRCS data from 1982-1992, the USFWS concluded that 466,200 acres of Colorado rangeland believed to be currently or historically occupied by the Mountain Plover was converted to other uses (either cropland, development, or other rural land use) (USFWS 1999). Data were not available for all pertinent counties in Montana, but decreases in other states where the Mountain Plover breed ranged from 18,400 acres converted in Nebraska to 33,000 acres converted in Oklahoma (Fed Register 1999). According to NRCS data covering the period 1992 to 1997, conversion of rangeland continues, including a decrease of another 70,500 acres in Colorado, though it is unknown how much of this land was Mountain Plover habitat (USFWS 2002). Specific information on exactly how much of Colorado's Mountain Plover habitat has been lost to date, and the degree to which habitat conversion may continue to occur, are lacking. Conversion of native habitats to residential and commercial development will continue to occur in urban areas, especially along the front range of Colorado. The degree of future threat from conversion of the remaining habitat to cropland is uncertain (EDAW 2000). Economics and government programs can have a sizeable impact on the degree of future conversion of rangeland to cropland. Economic and government programs currently operating in Colorado do not favor additional cultivation, but this is highly unpredictable and could easily change (Dr. D. Hoag, Professor of Agriculture and Resource Economics, CSU, pers. comm.).

Habitat conversion to urban uses such as residential development is also of concern, especially on wintering grounds. According to Dinsmore (1983), most former wintering habitat for the Mountain Plover in southern California has been replaced by residential expansion.

Agricultural Practices

Conversion to cropland may have greater detrimental impacts than simple loss of habitat acreage. Plowed fields may be attractive to the nesting Mountain Plover, only to subject birds to nest failure or mortality when tilling or crop growth occurs (Knopf and Rupert 1999). This would be true whether the rangeland was originally suitable nesting habitat prior to conversion (i.e., even if the original grassland was not suitable for the Mountain Plover, the plowed field may attract breeding birds, which could then become subject to nest failure or mortality from farming practices). Preliminary results from current research in Colorado, however, suggest that nest success on native rangeland and on cropland are not significantly different (V. Dreitz, pers. comm.). Final results from this research are expected in 2004. Meanwhile, the USFWS believes that agricultural practices conflict with the nesting Mountain Plover, and may constitute a threat to reproduction (USFWS 2002).

Another potential threat related to agricultural activities involves the use of pesticides. Knopf (1996) noted pesticide application on plowed fields in California during the months that the Mountain Plover is present on wintering grounds. It appears that concentrations of pesticide chemicals are probably not affecting reproduction, but may pose threats to individual birds. The degree to which the Mountain Plover may be directly threatened by pesticides is not completely understood (USFWS 1999).

Concerns also exist regarding grasshopper control on breeding grounds. Grasshopper control can reduce abundance of grasshoppers by greater than 90%, and can reduce abundance in non-target insects as well (USFWS 1999). As grasshoppers represent one of the primary food sources for the Mountain Plover, severe reductions in availability of grasshoppers could influence productivity (Graul 1973; Knopf 1996; Knopf and Rupert 1996).

Rangeland Management

Grazing is not merely a compatible activity – it is an *essential* activity in maintaining Mountain Plover habitat (USDA Forest Service 1994). The Mountain Plover occupies habitat that was historically adapted to grazing disturbance, and is strongly associated with heavy grazing pressure (Knopf and Miller 1994; Warner 1994; Knopf 1996b). However, in present times, there are significant differences in herbivore communities as well as the spatial and temporal distribution of grazing pressure.

Historically, the primary fauna that influenced Mountain Plover habitat were bison, elk and pronghorn, as well as burrowing rodents (especially the prairie dog). Today, there are no remaining wild bison herds; elk have largely moved to foothills and mountain habitats; and pronghorn and prairie dogs are greatly reduced in numbers.

Currently, the dominant herbivores sustaining Mountain Plover habitat are the domestic cow and the black-tailed prairie dog. Whereas historic grazers such as bison were very nomadic, domestic cattle (and even domestic bison) are usually fenced within pasture allotments. This basic difference has caused a shift from a more heterogeneous mosaic of habitat types shifting in time and space to a more homogenous cover. In addition, modern grazing practices favor taller vegetation and less bare ground than was typical of historic landscapes. For example, introduction of exotic grasses, pitting to increase soil moisture retention, water improvement projects and fire suppression all encourage habitat that is less favorable to the Mountain Plover (Graul 1980; USFWS 1999). Although heavy grazing is considered necessary in maintaining Mountain Plover habitat, season-long heavy grazing may actually degrade Mountain Plover habitat if grasses increase tillering and rhizome production (i.e., form mats) in response, and thereby decrease the amount of desired bare ground (USDA Forest Service 1994).

Decline of Burrowing Mammals

The presence of prairie dog towns is an important component of Mountain Plover habitat in many parts of the breeding range (USFWS 1999). There is general agreement that the black-tailed prairie dog has experienced significant reductions in range and abundance (possibly up to 98% across their range), primarily from eradication efforts, habitat conversion, and sylvatic plague (USFWS 1999). Habitat conversion on private land continues, and prairie dog control is ongoing on public and private lands across the breeding range of the Mountain Plover. In addition, there are currently no measures available to counteract the adverse impact of plague on black-tailed prairie dog colonies (USFWS 1999). Absence of active black-tailed prairie dog towns could pose a significant threat to Mountain Plover in some parts of the breeding range (USFWS 1999).

Other Factors Contributing to the Decline of the Mountain Plover

Development of oil, gas and minerals is common across the breeding range of the Mountain Plover and could adversely affect the species. Access roads may attract adults and chicks for foraging and travel, thereby increasing the possibility of direct mortality from vehicles (USDA Forest Service 1994; USFWS 1999). In addition, disturbance from the presence of humans could lead to stress-related death in adults or increased vulnerability of chicks to overheating and other stresses (Graul 1975; USFWS 1999). On the other hand, NFS biologists on the PNG found highest Mountain Plover nesting densities on the same quarter-section that had an operational oil well and associated facilities for 15 years, and 50% of banded birds returned to this site the following year (USDA Forest Service 1994). Researchers on the PNG noted that these data were from only one study site and may not be representative, but concluded that low-density development was probably not incompatible with the Mountain Plover (USDA Forest Service 1994).

In general, the Mountain Plover seems to be relatively tolerant of disturbance, although response varies for individual birds. Incubation and brooding times are the most critical. Birds become

more sensitive to disturbance as eggs near hatching and for a few weeks afterward (USDA Forest Service 1994). Adults may abandon eggs if disturbed on the nest and may die from stress (Graul 1975; USFWS 1999). The Mountain Plover is generally tolerant of vehicles at close distances, but shows changes in behavior if people get out of vehicles. The furthest distance at which behavioral disturbance was observed was 200 m (USDA Forest Service 1994). Use of Mountain Plover habitat by off-highway vehicles, bikers and hikers could prove to be locally detrimental, but these activities do not occur at significant levels across Mountain Plover habitat on the eastern plains of Colorado.

According to the USDA Forest Service (1994), some studies have suggested that the Mountain Plover may be attracted to roads, especially at night. The possibility that roads may serve as predator traps by concentrating the Mountain Plover has been suggested. Other studies indicate that the Mountain Plover is widespread throughout its habitat, and may use roads but does not congregate on them. On the PNG, some birds were found to use graveled county roads, possibly suggesting that the temperature difference (the roads were 2 degrees warmer than surrounding prairie at night) may be attractive to brooding birds (Godbey 1992). Mortality from traffic was thought to be a potential conservation issue, especially just after hatching, when the response of chicks to a threat is to freeze rather than to run. Birds were not found to use two-track or ungraveled roads.

LITERATURE CITED

- Alcorn, H.R. 1946. The Birds of Lahontan Valley, Nevada. *Condor* 48:129-138.
- American Ornithologists' Union. 1983. Checklist of North American birds. 6th edition. American Ornithologists' Union, Washington, D.C.
- Andrews, J.N. and R. Righter. 1992. Colorado Birds: A Reference to Their Distribution and Habitat. Denver Museum of Natural History, Denver, Colorado. 442pp.
- Bailey, A.M. and R.J. Niedrach. 1965. Birds of Colorado. Denver Museum of Natural History. 2 vols. 895pp.
- Baldwin, P.H. 1971. Diet of the Mountain Plover at the Pawnee National Grassland, 1970-71. U.S. Int. Biol. Program, Grassland Biome Prog. Rep. 134, Fort Collins, CO.
- Ball, M. 1996. Impacts of grassland uses and management practices. Pp. 28-29 in D.P. Coffin, ed. Summary report – shortgrass prairie/Mountain Plover workshop. Denver Audubon Society, Aurora, Colorado.
- Bent, A.C. 1929. Life histories of North American shorebirds. U.S. National Museum Bulletin 146, Part 2:263-269.
- Bradbury, W.C. 1918. Notes on the nesting of the Mountain Plover. *Condor* 20:157-163.
- Colorado Natural Heritage Program. 2003. Biological and Conservation Datasystem. Element Tracking Database. Colorado State University, Fort Collins.
- Commission for Environmental Cooperation. 2000. Biodiversity conservation: conservation of migratory and transboundary species (2.2.4). Species of common conservation concern in North America – working draft of the Commission for Environmental Cooperation.
- Coues, E. 1874. Birds of the northwest: a hand-book of the ornithology of the region drained by the Missouri River and its tributaries. U.S. Govt. Printing Office, Washington, D.C. (Reprinted 1974 by Arno Press, New York.)
- Davis, W.A. 1969. Birds in western Colorado. *Colorado Field Ornithologists*. 15pp.
- Dechant, J.A., M.L. Sondreal, D.H. Johnson, L.D. Igl, C.M. Goldade, M.P. Nenneman, and B.R. Euliss. 2001. Effects of management practices on grassland birds: Mountain Plover. Northern Prairie Wildlife Research Center, Jamestown, North Dakota. Northern Prairie Wildlife Research Center Home Page. <http://www.npwrc.usgs.gov/resource/literatr/grasbird/mtnplove/mtnplov.htm>.
- Dinsmore, J.J. 1983. Mountain Plover (*Charadrius montanus*). Pp. 185-196 in Impacts of coal surface mining on 25 migratory birds of high federal interest. Editor: J.S. Armbruster. U.S. Fish and Wildlife Service. FWS/OBS-83/35.
- Dinsmore, S.J. 2001. Population biology of Mountain Plovers in southern Phillips County, Montana. Ph.D. Dissertation, Colorado State University, Fort Collins, Colorado.
- Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1992. Birds in Jeopardy. Stanford University Press, Stanford. 259 pp.
- Garrett, K. and J. Dunn. 1981. Birds of Southern California – Status and Distribution. Los Angeles Audubon Publishers. 408pp.

- Giezentanner, J.B. 1970. Avian distribution and population fluctuations on the shortgrass prairie of north central Colorado. M.S. Thesis, Colorado State University, Fort Collins. 113pp.
- Gillihan, S.C. and S.W. Hutchings. 2000. Best management practices for shortgrass prairie birds: a landowner's guide. Rocky Mountain Bird Observatory, Brighton, Colorado. 33pp.
- Godbey, Jerry L. 1992. A Survey of the Mountain Plover on the Pawnee National Grassland. Unpublished report submitted to the Pawnee National Grassland.
- Graul, W.D. 1973. Adaptive aspects of the Mountain Plover social system. *Living Bird* 12:69-94.
- Graul, W.D. 1973b. Breeding adaptations of the Mountain Plover (*Charadrius montanus*). Ph.D. Dissertation, University of Minnesota, St. Paul.
- Graul, W.D. 1975. Breeding biology of the Mountain Plover. *Wilson Bull.* 87:6-31.
- Graul, W.D. 1976. Food fluctuations and multiple clutches in the Mountain Plover. *Auk* 93:166-167.
- Graul, W.D. 1980. Grassland management practices and bird communities. Pp. 38-47 *in* Management of Western Forests and Grasslands for Nongame Birds. Tech. Coord.: R.M. DeGraff. U.S. Forest Service. GTR INT-86.
- Graul, W.D. and L.E. Webster. 1976. Breeding status of the Mountain Plover. *Condor* 78:265-267.
- Grinnell, J., H.C. Bryant, and T.I. Storer. 1918. The Game Birds of California. University of California Press, Berkeley. 642pp.
- Grunau, L. and M. Wunder. 2001. Conservation assessment for Mountain Plover (*Charadrius montanus*) in South Park, Colorado. Unpublished report prepared for the Bureau of Land Management, Canon City, Colorado. 58pp.
- Johnsgard, P.A. 1979. Birds of the Great Plains. University of Nebraska Press, Lincoln. 539pp.
- Johnsgard, P.A. 1981. The Plovers, Sandpipers, and Snipes of the World. University of Nebraska Press, Lincoln. 493pp.
- Jurek, R.M. 1973. California shorebird study: accelerated research program for shore and upland migratory game birds. Project final report. California Department of Fish and Game, Sacramento. 233pp.
- Kuenning, R.R. and H.E. Kingery. 1998. Mountain Plover. Pp. 170-171 *in* H.E. Kingery, ed. Colorado Breeding Bird Atlas. Colorado Bird Atlas Partnership and Colorado Division of Wildlife, Denver, Colorado. 636pp.
- Knopf, F.L. 1988. Conservation of steppe birds in North America. ICBP Technical Publication 7:27-41.
- Knopf, F.L. 1996. Mountain Plover (*Charadrius montanus*). *In* A. Poole and F. Gill, eds. The Birds of North America, No. 211. The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

- Knopf, F.L. 1996b. Prairie legacies – birds. Pp. 135-148 in F.B. Samson and F.L. Knopf, eds. *Prairie Conservation – Preserving North America’s Most Endangered Ecosystem*. Island Press, Washington, D.C. and Covelo, California. 340pp.
- Knopf, F.L. 1998. Foods of Mountain Plovers wintering in California. *Condor* 100:382-384.
- Knopf, F.L. and B.J. Miller. 1994. *Charadrius montanus* – montane, grassland, or bare-ground plover? *Auk* 111:504-506.
- Knopf, F.L. and J.R. Rupert. 1995. Habits and habitats of Mountain Plovers in California. *Condor* 97:743-751.
- Knopf, F.L. and J.R. Rupert. 1996. Productivity and movements of Mountain Plovers breeding in Colorado. *Wilson Bull.* 108:28-35.
- Knopf, F.L. and J.R. Rupert. 1999. The use of crop fields by breeding Mountain Plovers. *Studies in Avian Biology* 19:81-86.
- Knowles, C.J. 1996. Studies and observations of Mountain Plover in Montana. Pp. 30-31 in D.P. Coffin, ed. *Summary report – shortgrass prairie/Mountain Plover workshop*. Denver Audubon Society, Aurora, Colorado.
- Knowles, C.J. and P.R. Knowles. 1984. Additional records of Mountain Plovers using prairie dog towns in Montana. *Prairie Naturalist* 16:183-186.
- Knowles, C.J., C.J. Stoner, and S.P. Gieb. 1982. Selective use of black-tailed prairie dog towns by Mountain Plovers. *Condor* 84:71-74.
- Leachman, B. and B. Omundson. 1990. Status of the Mountain Plover: a literature review. U.S. Fish and Wildlife Service. Golden, CO.
- Luan, H.C. 1957. A life history study of the Mountain Plover, *Eupoda montana*, Townsend on the Laramie Plains, Albany County, Wyoming. M.S. Thesis, University of Wyoming, Laramie.
- McCaffery, B.J., T.A. Sordahl, and P. Zahler. 1984. Behavioral ecology of the Mountain Plover in northeastern Colorado. *Wader Study Group Bull.* 40:18-21.
- Miller, B.J. and F.L. Knopf. 1993. Growth and survival of Mountain Plovers. *J. Field Ornithol.* 64:500-506.
- National Geographic Society. 1987. *Field Guide to the Birds of North America*. Second edition. Washington, D.C. 464pp.
- Oberholser, H.C. 1974. *The bird life of Texas*. E.B. Kincaid, Jr., ed. University of Texas Press, Austin. 530pp.
- Olson, S.L. 1984. Density and distribution, nest site selection, and activity of the Mountain Plover on the Charles M. Russell National Wildlife Refuge. M.S. Thesis, University of Montana, Missoula. 62pp.
- Olson, S.L. 1985. Mountain Plover food items on and adjacent to a prairie dog town. *Prairie Naturalist* 17:83-90.
- Olson, S.L. and W.D. Edge. 1985. Nest site selection by Mountain Plovers in northcentral Montana. *Journal of Range Management* 38:280-282.

- Olson-Edge, S.L. and W.D. Edge. 1987. Density and distribution of the Mountain Plover on the Charles M. Russell National Wildlife Refuge. *Prairie Naturalist* 19:233-238.
- Parrish, T.L. 1988. Mountain Plover habitat selection in the Power River Basin, Wyoming. M.S. Thesis, University of Wyoming, Laramie. 60pp.
- Parrish, T.L., S.H. Anderson, and W.F. Oelklaus. 1993. Mountain Plover habitat selection in the Powder River Basin, Wyoming. *Prairie Naturalist* 25:219-226.
- Russell, S.M. and D.W. Lamm. 1978. Notes on the distribution of birds in Sonora, Mexico. *Wilson Bull.* 90: 123-131.
- Samson, F.B. and F.L. Knopf, eds. 1996. *Prairie Conservation: preserving North America's most endangered ecosystem.* Island Press. Covelo, California.
- Sauer, J.R., J.E. Hines, and J. Fallon. 2001. The North American Breeding Bird Survey, Results and Analysis 1966-2000. Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, Maryland. <http://www.mbr-pwrc.usgs.gov/bbs/bbs.html>.
- Schulenberg, J.H. 1983. Status of the Mountain Plover reintroduction in Kansas. Unpublished Report. Kansas Fish and Game Dept. Pratt. 17pp.
- Shackford, J.S. 1987. Nesting distribution and population census of golden eagles, prairie falcons, Mountain Plovers, and long-billed curlews in Cimarron County, Oklahoma. George Miksch Sutton Avian Research Center, Inc., Bartlesville. 28pp.
- Shackford, J.S. 1991. Breeding ecology of the Mountain Plover in Oklahoma. *Oklahoma Ornithological Society* 24:9-13.
- Shackford, J.S., D.M. Leslie, Jr., and W.D. Harden. 1999. Range-wide use of cultivated fields by Mountain Plovers during the breeding season. *Journal of Field Ornithology* 70:114-120.
- Small, A. 1994. *California birds: their status and distribution.* Ibis Publishing Co., Vista, California.
- Strecker, J.K. 1912. The birds of Texas: an annotated checklist. *Bull. Baylor University* 15:23.
- Sutton, G.M. and J. Van Tyne. 1937. *The birds of Brewster County, Texas.* University of Michigan Press, Ann Arbor.
- Swarth, H.S. 1914. A distributional list of the birds of Arizona. *Pacific Coast Avifauna* 10. Cooper Ornithol. Club, Berkeley, California. 133pp.
- Tyler, J.D. 1968. Distribution and vertebrate associates of the black-tailed prairie dog in Oklahoma. Ph.D. Dissertation, University of Oklahoma, Norman.
- U.S. Fish and Wildlife Service. 1999. Proposed Threatened Status for the Mountain Plover. Pp. 7587-7601 *in* Federal Register Volume 64, Number 30, February 16, 1999.
- U.S. Fish and Wildlife Service. 1999b. Mountain Plover fact sheet. <http://www.r6.fws.gov/mtnplover/factsheet.htm>
- U.S. Fish and Wildlife Service. 2002. Threatened status and special regulation for the Mountain Plover. Proposed rule: notice of new information and reopening of the comment period. Pp. 72396-72401 *in* Federal Register Volume 67, Number 234, December 5, 2002.

- U.S.D.A. Forest Service. 1994. Final Environmental Impact Statement for Management Strategy for Mountain Plover. Pawnee National Grassland, Greeley, Colorado. 279pp.
- Warner, R.E. 1994. Agriculture land use and grassland habitat in Illinois: future shock for midwestern birds? *Conservation Biology* 8:147-156.
- Wiens, J.A. 1974. Climatic instability and the "ecological saturation" of bird communities in North American grasslands. *Condor* 76:385-400.
- Wunder, M.B. and F.L. Knopf. 2003. The Imperial Valley of California is critical to wintering Mountain Plovers. *Journal of Field Ornithology* 74:74-80.
- Wunder, M.B., F.L. Knopf, and C.A. Pague. 2003. The high-elevation population of Mountain Plovers in Colorado. Submitted.