

Conservation Assessment for Mountain Plover (*Charadrius montanus*) in South Park, Colorado



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**Colorado
State
University**
Knowledge to Go Places

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EXECUTIVE SUMMARY

Introduction

This Conservation Assessment for Mountain Plover (*Charadrius montanus*) in South Park, Colorado, summarizes the best available information on status, ecology, and conservation of this declining bird. It is intended to provide guidance to the Bureau of Land Management in their efforts to manage Mountain Plover on BLM lands in South Park. Research is ongoing, however, and assessments in this document should be modified as new information becomes available.

In 1999, anticipating a final listing action by the USFWS, the BLM became interested in developing more detailed site-specific information on Mountain Plover to guide their land management activities in South Park. CNHP was asked to provide supporting documentation on status, ecology, potential and occupied habitat, and potential management impacts in South Park. This report summarizes the results of that work.

Species Status

On May 3, 1993, the U.S. Fish and Wildlife Service (USFWS) listed the Mountain Plover as a Candidate Species under the Endangered Species Act of 1973, as amended. On February 16, 1999, a notice was published in the Federal Register proposing to list the Mountain Plover as a Threatened Species.

CNHP considers the Mountain Plover globally imperiled (G2/S2B). The species is listed by the U.S. Forest Service and the Bureau of Land Management as a Sensitive Species, and by the Colorado Division of Wildlife as a Species of Special Concern. In addition, Mountain Plover is on the Audubon National Watchlist. The Partners In Flight total breeding priority score is 28 for the Southern Rockies/Colorado Plateau conservation region.

Habitat Requirements

Breeding habitat for Mountain Plovers in Colorado can generally be described as flat, dry land with very short vegetation and a fairly high percentage of bare ground. However, recent research by CNHP indicates that there are also some peculiarities in South Park breeding habitat. Mountain Plovers in South Park will nest on steeper slopes (slopes of ~9-12%) than those used on the plains. Also, they will nest in comparatively thick/tall vegetation, and near habitat edges (within ~100 meters, or ~328 feet). While percent bare ground of the South Park landscape is relatively constant, height of vegetation and degree of slope vary across the geography. Still, it appears that plovers are more readily found nesting in areas that offer the gentlest slopes and the shortest vegetation. The main difference between South Park habitat and that found on the eastern plains may be in the parameters that define “most gentle slopes” and “shortest

vegetation.” In South Park, nesting areas are primarily on rolling hills and in valleys proximal to shrubs 15-30 cm. (~6-12 inches) tall.

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 Breeding Bird Surveys that show a 2.7% annual decline from 1966 to 1996) (Federal Register 1999). This decline is greater than declines shown in any other grassland endemic. The USFWS considered five factors in the proposal to list:

- present or threatened destruction, modification, or curtailment of habitat or range;
- over-utilization for commercial, recreational, scientific or educational purposes;
- disease or predation;
- inadequacy of existing regulatory mechanisms;
- other natural or manmade factors affecting continued existence.

Only over-utilization and disease/predation were not considered by the USFWS as contributing to the decline of Mountain Plovers. Of the remaining factors, the most significant seems to be destruction/modification of habitat, particularly through habitat conversion, agricultural practices, rangeland management, and decline of native burrowing mammals (Federal Register 1999).

Grazing of domestic cattle is still the primary land use within the areas of Park County that support Mountain Plover. For now, present management in much of the suitable habitat seems to be appropriate from a plover perspective. However, if water availability becomes a greater issue in the future, the number of cattle that can be supported per acre may decrease. This could result in a reduction in the amount and/or quality of grazed land. Also, Park County is one of the fastest growing counties in Colorado, with over 90% increase in population since 1990 (Park County 2000). Much of the grassland habitat is on privately owned lands, some of which have already been subdivided. It seems reasonable to assume that habitat conversion to residential and commercial development is likely to increase in the future. Ultimately, conversion of rangeland to residential development will probably prove to be the most significant impact to Mountain Plover in South Park.

Human Social and Cultural Context

Because of the fragmented nature of BLM holdings in South Park, many (if not most) land management decisions made by BLM will require coordination with local landowners and communities, as well as other government agencies. This is especially true of BLM’s land exchange program – currently one of their highest priorities. Also, anticipated growth and development in South Park will change the future amount, quality, and distribution of Mountain Plover habitat in the valley. As these changes occur, the relative importance of BLM actions will become more significant to the conservation of Mountain Plover. Furthermore, cumulative

effects analyses for any BLM project proposed within Mountain Plover habitat will need to evaluate impacts in light of other activities taking place in the park.

For these reasons, it is very important that BLM personnel understand the human social and cultural context within which they are working. If BLM staff are familiar with local communities' values and vision(s) for their future, they will be better able not only to make strategic decisions about land management (especially reconfiguration), but also to "package" their projects in ways that will be most palatable to their South Park neighbors.

Population Growth and Development

Park County is one of the fastest growing counties in Colorado, far exceeding the statewide average annual growth rate. The State Demographer projects that the county will continue to grow at very high rates for the next 10 years. By 2005, the county is expected to double the estimated 1998 population. According to the State Demographer, if population growth continues at rates close to those experienced during the 1990s, the population of Park County may reach 102,600 by the year 2020.

For the first time in 1999, more building permits were issued in the South Park area of the county than in any other area in the county. Growth in South Park is expected to represent a significant portion of the future growth in Park County.

The Ranching Industry

Between 1987 and 1997, the number of farms and ranches increased from 162 to 183, but the average size of farms and ranches has decreased by 45% over the same time period (from an average of 2,470 acres to an average 1,700 acres). Also, the total number of acres farmed or ranched in the county decreased by 90,000 acres, from 400,900 acres in 1987 to 311,182 acres in 1997. According to the county, these data demonstrate the growing tendency toward carving the large, historic ranches into smaller "ranchettes." In interviews conducted with local ranchers during the planning process, many indicated that they are having difficulty making ends meet, and most implied that their ranches would probably not continue in agricultural use indefinitely. Increasing population and development will continue to put pressure on the agricultural industry. These pressures, combined with the high prices for surface water rights and falling commodity prices, may threaten the future of agricultural land in the county.

Proposed Development Projects in South Park

Development pressures are currently being felt in two areas of South Park containing Mountain Plover habitat: Hartsel Springs and Thousand Peaks. If full build-out of these subdivisions is completed, there will be changes in the amount and distribution of Mountain Plover habitat within South Park. In addition to these current development projects, there is reason to anticipate future development proposals that could affect the amount of Mountain Plover habitat in South Park, including development of 25,000 existing plats, the potential for expansion of Antero Reservoir, and future development of additional private ranchland. Approximately 68%

of the potential Mountain Plover habitat in South Park is in private ownership. Approximately 32% has already been subdivided.

Current Conservation Initiatives

There is currently a great deal of local momentum behind the conservation of South Park's natural resources. A number of projects are underway in the area to conserve riparian and wetland resources through conservation easements. The Mountain Plover is one of the targeted species that is receiving special attention in some of these efforts. In addition, many of the state and federal agencies that own and/or manage land in the park are considering the conservation of Mountain Plover in their deliberations on how to best reconfigure public lands in South Park. Opportunities exist to work collaboratively with the Colorado State Land Board, Colorado State Parks, the Denver Water Board, and Colorado Division of Wildlife, as well as Park County, The Nature Conservancy, and Colorado Open Lands.

Conservation Opportunities for BLM

Mountain Plover habitat is fairly widespread throughout the valley of South Park, and plovers have been observed in most potential habitat. It should be noted that survey efforts have not been evenly distributed across the potential habitat, and there are a few small areas that have not been surveyed at all. However, at a meeting in March 2001, researchers, conservationists, and government representatives identified four areas as high priority for Mountain Plover conservation: the Sipal Ranch, the vicinity of Reinecker Ridge State Wildlife Area, the Thousand Peaks area, and the area north of Spinney Mountain Reservoir.

Conservation Strategies

We recommend that BLM place high priority on working with Park County, the U.S. Fish and Wildlife Service, Colorado State Land Board, Colorado Division of Wildlife, as well as landowners and other local stakeholders, to develop a coordinated conservation plan for Mountain Plover in South Park. Conservation momentum is high in the county, and there are several initiatives already underway that could serve as the foundation for coordinated, strategic conservation planning. We believe such an approach would be more effective and more efficient in making a significant, lasting contribution to the preservation of this species than will likely be achieved if each party acts in isolation.

Based on the data currently available, our recommendations on specific strategies to maximize BLM's contribution to the conservation of South Park Mountain Plover are:

- 1. Overall, construct BLM realty transactions such that there is no net loss in either quality or quantity of Mountain Plover habitat in either BLM ownership or in some other protected status** (e.g., conservation easement or other tool that achieves perpetual conservation).

2. **In designing realty projects, evaluate relationship among parcels to be sold or traded, other publicly owned lands, and subdivided private lands** (shown in Figure 9). Ideally, BLM lands should be consolidated such that large blocks of public lands are near or adjacent to large working ranches and other conservation lands, and away from subdivided land that will presumably undergo development. This would maximize BLM's (and ranchers') ability to manage rangeland to the benefit of Mountain Plover, and would also ease private ranchers' conflicts with neighboring private landowners (i.e., right to farm issues).
3. **Work with the Colorado State Land Board, the Colorado Division of Wildlife, and neighboring landowners to ensure that all lands containing high priority habitat in the Reinecker Ridge area are consolidated and managed for wildlife values (including Mountain Plover).** *We believe that this is the single best contribution the BLM can make to Mountain Plover conservation in South Park at this time.*
4. **Ensure that any BLM lands sold or traded within the Sipal Ranch are exchanged for lands containing Mountain Plover habitat elsewhere within the park. Conserve Mountain Plover habitat on the Sipal Ranch through conservation easements where appropriate.** It will also be important to work with the other relevant parties to design any realty projects so as to maximize the likelihood that the Sipal Ranch remains a working cattle ranch.
5. **Consider the area south of Spinney Mountain Reservoir for potential land consolidation, and/or ensure that continuance of grazing leases maintains grasslands in their current condition.** There is an existing bison herd there, the area is well grazed, and a fair number of Mountain Plover are reproducing well. This area is a continuation of the Sipal/Hartsel landscape complex. The future may look different depending upon how the Hartsel Springs Ranch develops. If houses are built on ridges among trees, impacts to plover habitat will be minimized. If houses are built in the grasslands between the Sipal Ranch and Spinney Mountain Reservoir, birds in these two areas will be segregated.
6. **Coordinate with other conservation practitioners working in South Park to consolidate protected lands (e.g., those with conservation easements, fee title held by conservation organization) in Mountain Plover habitat.** Support land protection projects proposed by other entities that assist in protecting high priority Mountain Plover habitat, or that assist in buffering and blocking BLM parcels.
7. **Explore the possibility of using money from the sale of BLM parcels that do not contain Mountain Plover habitat to buy other parcels in priority plover conservation areas.** If controlled use of funds is not an option, consider using non-habitat parcels strategically to trade for high-quality habitat parcels elsewhere.
8. **Consider burning in potentially suitable habitat where grazing isn't an option to increase the amount of high quality habitat available to Mountain Plover on lands managed by BLM.**

Future Research Needs for Mountain Plover in South Park

- Investigate causes of nest mortality (predator community, moisture/temperature effects, etc.).
- Investigate habitat requirements of rabbitbrush (*Chrysothamnus sp.*) in the grasslands of South Park. A better understanding of rabbitbrush biology is needed in order to better manage breeding habitat for Mountain Plover.
- Determine home range and territory size of Mountain Plovers related to productivity.
- Investigate responses of breeding plovers to changes in land use on adjacent lands.

PART 1: INTRODUCTION

This Conservation Assessment for Mountain Plover (*Charadrius montanus*) in South Park, Colorado, summarizes the best available information on status, ecology, and conservation of this declining bird. It is intended to provide guidance to the Bureau of Land Management (BLM) in their efforts to manage Mountain Plover on BLM lands in South Park. Research is ongoing, however, and assessments in this document should be updated as new information is collected.

The Assessment and Its Purpose

The BLM will be an important player in the conservation of Mountain Plover and its habitat in South Park. BLM manages approximately 13% (or 27,166 acres) of the potential habitat in the park. Although the Mountain Plover has not officially been listed by the U.S. Fish and Wildlife Service (USFWS), it is a Candidate species, and is managed as a Sensitive Species by BLM. It is BLM policy that no action should be taken that would contribute to a species becoming listed through actions funded, authorized, or implemented by BLM. As such, BLM must consider the potential effects of all land management decisions on Mountain Plover in South Park. In order to make wise decisions, several years of Mountain Plover inventory, research, and conservation planning have been initiated by BLM. The data from these efforts will contribute to the base of information needed to make management decisions in the future.

Species Status

On May 3, 1993, the USFWS listed the Mountain Plover as a Candidate Species under the Endangered Species Act of 1973, as amended. 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.” (Federal Register 1999).

CNHP considers the Mountain Plover globally imperiled (G2/S2B). The species is listed by the U.S. Forest Service and the Bureau of Land Management as a Sensitive Species, and by the Colorado Division of Wildlife as a Species of Special Concern. In addition, Mountain Plover is on the Audubon National Watchlist. The Partners In Flight total breeding priority score is 28 for the Southern Rockies/Colorado Plateau conservation region.

Study Area

Geography

South Park is a montane grassland surrounded by mountains in west-central Park County, Colorado. The park covers an area about 50 miles long and 35 miles wide, and is bounded on the west and north by the Park Range, on the east by the Tarryall Mountains and Puma Hills, and on the south by Black and Thirtynine Mile Mountains. Tributaries of the Tarryall Creek drain the northern part of the park. The South Platte River and its tributaries drain the remainder of the park. The park ranges in elevation from about 8860 feet to about 9850 feet. The vegetation is primarily grassland, much of it shortgrass or midgrass. Some shrublands exist, as well as stands of aspen, ponderosa pine, and bristlecone pine towards the higher elevations into the surrounding mountains (Spackman et al. 2001). Figure 1 shows general vegetation patterns in Park County (based on the Colorado Division of Wildlife's GAP vegetation data layer).

The climate in South Park is generally characterized by long, cold, moist winters and short, cool, dry summers. Climatic data from the town of Fairplay indicate that this area receives approximately 13 inches of precipitation per year. Average minimum and maximum temperatures are 9 degrees and 69 degrees Fahrenheit, respectively (Spackman et al. 2001).

Wildlife

Historically, large concentrations of wildlife, including bison, elk, pronghorn antelope, and beaver attracted Ute Indians and hunters, trappers, and fishermen to the park. Bison were reported as abundant in South Park prior to 1862 (Cary 1911). In the mid-1880s, the number of antelope in the park "approximated that of the buffalo" (McConnell 1966). Bison declined quickly starting in the 1860's and the last four bison in South Park were poached in 1897 (Meaney and Van Vuren 1993). Antelope are still found in the valley, although in reduced numbers. Gunnison's prairie dog was reported as "continuous over the entire park" prior to a series of plague and poisoning events in the 1940s, from which they never rebounded. However, Wyoming ground squirrel (*Spermophilus elegans*), historically absent from the park, is now abundant. Other wildlife features that are important in the park today include concentration and calving areas and migration corridors for elk, year-round deer habitat, important waterfowl nesting areas, and gold medal fisheries.

Current Human Land Use

There is a high percentage of privately owned land in South Park (see Figure 2 for ownership patterns). The largest community is Fairplay, with approximately 600 residents. Current land use in South Park includes residential, commercial, and agricultural development, but the most widespread activity is cattle grazing. Because grazing by domestic livestock maintains the vegetative structure favored by Mountain Plovers, this is the preferred land use from a plover conservation perspective. Development, especially residential, is increasing, however. Any land use changes that lead to a significant reduction in the amount, configuration, or quality of grazed land, and therefore of Mountain Plover habitat, could have serious implications for the South Park population of Mountain Plover.

Mountain Plover in South Park and Recent Inventory History

The first record of breeding Mountain Plover in South Park is from 1871 (Allen 1872). Plovers have been observed in the valley consistently since then, but were considered rare or uncommon by most observers. In 1994, the Colorado Natural Heritage Program conducted a biological inventory of a potential airport site a few miles south of Fairplay (Pague and Pague 1994). That survey confirmed the presence of plovers at the proposed airport site. In 1995, CNHP began a partnership with the BLM to study the distribution and status of Mountain Plover in South Park. A history of this survey effort can be briefly summarized as follows:

- 1995 – CNHP sampled 30% of all potential habitat in South Park;
- 1996 – Colorado Bird Observatory took lead to conduct roadside surveys;
- 1997 – CNHP continued inventory of remaining 70% potential habitat (emphasis on BLM lands);
- 1998 – CNHP continued inventory and conducted distance sampling on one 20,000 acre parcel;
- 1999 – CNHP completed inventory of potential habitat on BLM lands;
- 2000 – CNHP and USGS-BRD initiated conservation research project (e.g., density/abundance, nest monitoring);
- 2001 – CNHP and USGS continue conservation research.

Data from this multi-year inventory and research effort suggests that breeding plovers are more common in South Park than previously thought, and that birds are consistently found on BLM lands containing suitable habitat. Even so, Mountain Plover certainly cannot be considered “common” in South Park; probably the more appropriate relative qualifier is “uncommon” in suitable habitat.

Perhaps more noteworthy is not the population size, but rather that the population is apparently reproducing well. A one-year sample of 64 nests in 2000 revealed a 63% nest success rate. Preliminary data from the second year of research efforts suggest that 2001 was wetter and that reproductive success was not as high (~50%) as in 2000. Additionally, some South Park birds (recognized by color-band combination) were seen outside of South Park during the breeding season. The overall number of birds detected during the annual population sampling effort was similar in both years.

Also, although the data used to examine the population genetics of Mountain Plover in North America are preliminary, there are signs that the South Park population is both unique and genetically inclusive of all examined North American populations. It is possible that the South Park population may be serving as a genetic source for Mountain Plover range-wide. If this turns out to be the case, conservation effort in South Park will be all the more critical.

In 1999, anticipating a final listing action by the USFWS, the BLM became interested in developing more detailed site-specific information on Mountain Plover to guide their land management activities in South Park. CNHP was asked to provide supporting documentation on status, ecology, potential and occupied habitat, and potential management impacts in South Park. This report summarizes the results of that work.

Figure 1: Vegetation of Park County

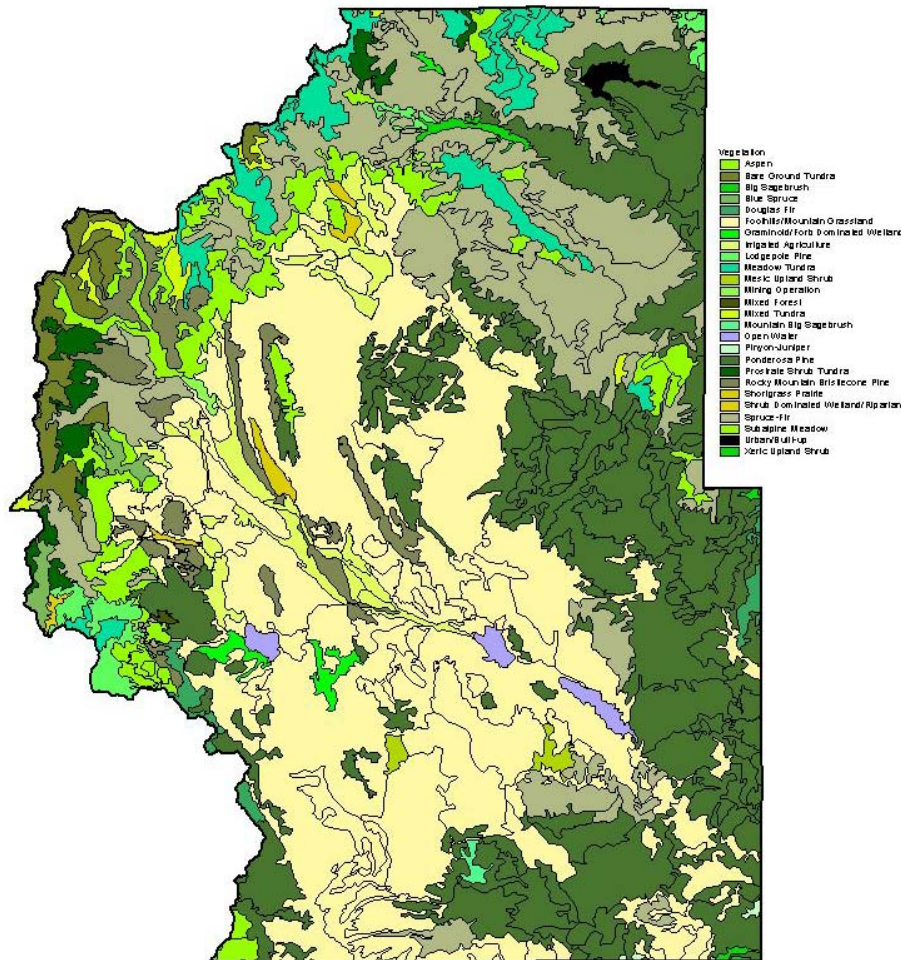
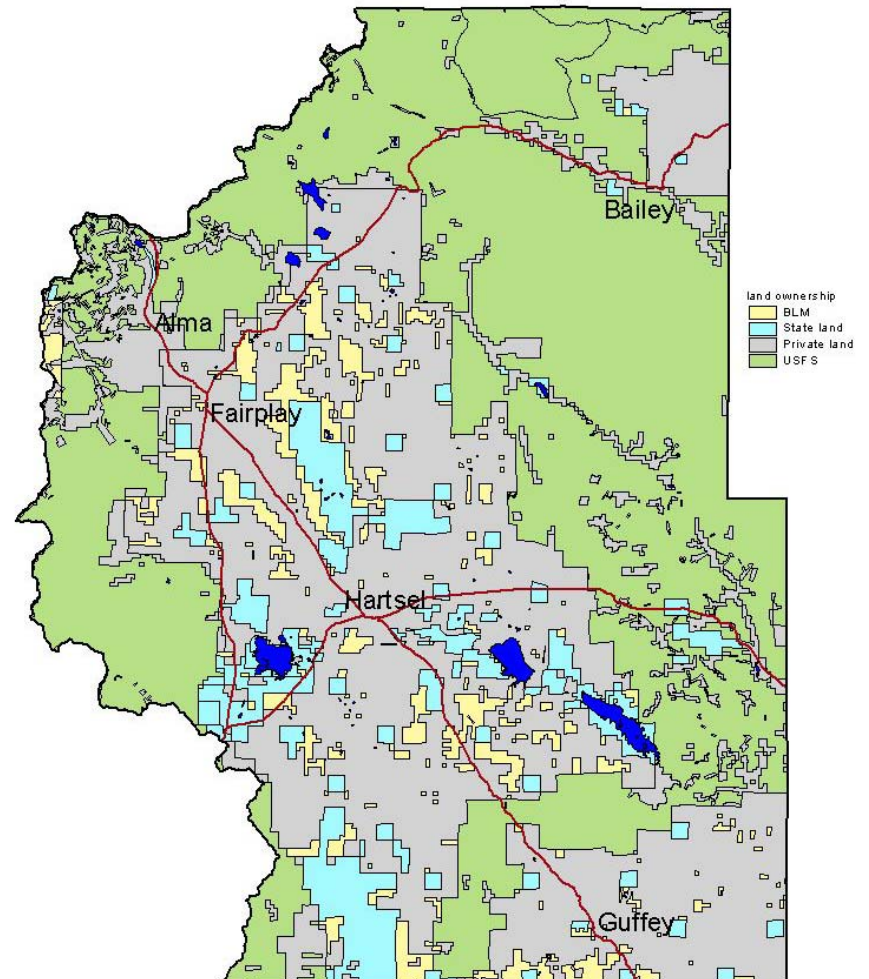


Figure 2: Land ownership in Park County



68% of the Mountain Plover habitat in South Park (largely contained within the “Foothills/Mountain grassland” vegetation type, shown on Figure 1 in pale yellow) is in private ownership.

Figures 3a and 3b. Mountain Plover chick, and adult in breeding plumage.



PART 2: MOUNTAIN PLOVER BIOLOGY AND ECOLOGY

*There is much detailed information on Mountain Plover status and distribution, life history, and habitat compiled in several documents, especially *The Birds of North America Species Account for Mountain Plover* (Knopf 1996) and the *USFWS Proposed Rule to list the Mountain Plover as a Threatened Species* (Federal Register 1999). The following sections provide a brief summary of the most pertinent information gleaned from these sources.*

Species Description

As described by the U.S. Fish and Wildlife Service, the Mountain Plover is a small bird about 7 inches tall, similar to a killdeer but lacking the breast belt common to the killdeer and other plovers (Figure 3). During the breeding season, the Mountain Plover has a distinct black cap and thin black line between eye and bill (Federal Register 1999).

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 (Graul and Webster 1976). While Mountain Plovers were once common throughout their range (Bailey and Niedrach 1965), populations have been significantly reduced in abundance and their breeding range has clearly been constricted (Graul and Webster 1976, Erlich et al. 1992). Current breeding populations are known primarily from Colorado, Montana, and Wyoming. Breeding birds also occur in fewer numbers in Oklahoma, New Mexico, Kansas, Utah, Nebraska, and Texas (Knopf 1996, Federal Register 1999) (Figure 4a). Winters are spent in central and southern California, southern Arizona, Central Texas south into northern Mexico, and southern Baja California (Root 1988).

The distribution of Mountain Plover in Colorado (Figure 4b) includes many of the shortgrass prairie counties of the eastern plains, as well as the San Luis Valley, South Park, North Park, and historically, Middle Park (Bailey and Niedrach 1965, Graul and Webster 1976, Kingery 1998).

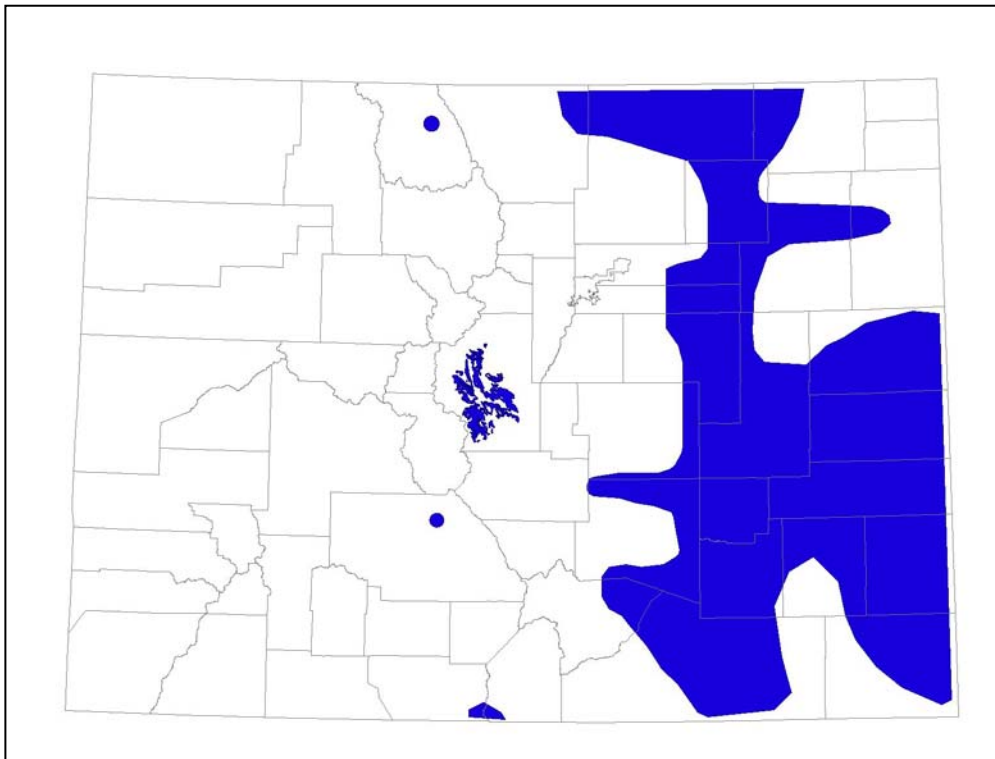
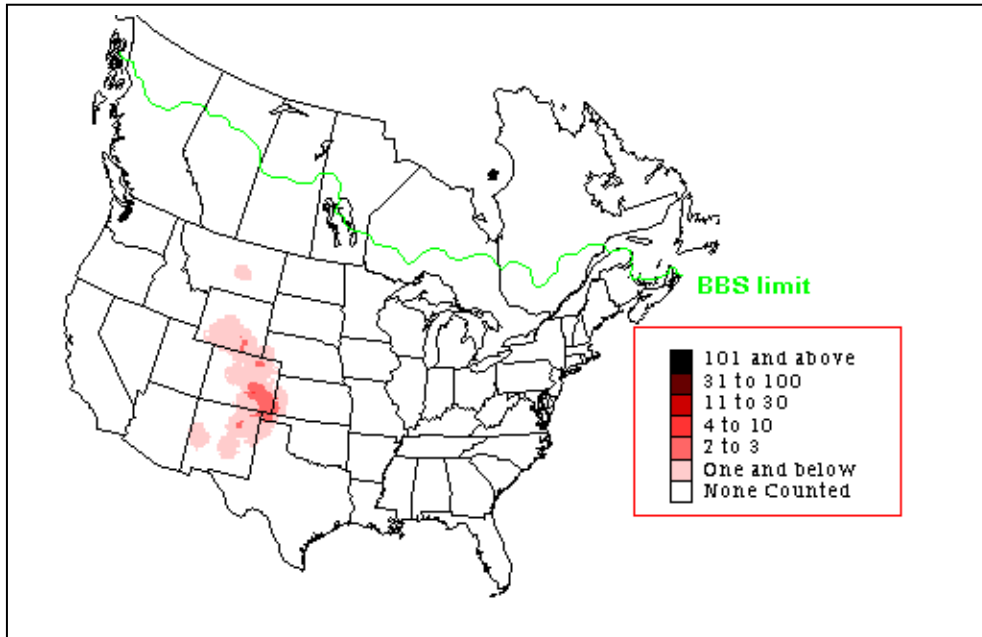
Habitat Requirements

Breeding habitat in Colorado

Breeding habitat for Mountain Plovers in Colorado can generally be described as flat, dry land with very short vegetation and a fairly high percentage of bare ground. Typical nesting habitat contains:

- **vegetation less than 3 inches in height** (most commonly blue grama / buffalo grass) (Graul 1973, Graul and Webster 1976);
- **at least 30% bare ground** (Knopf and Miller 1994);
- **a conspicuous object nearby** (e.g., manure pile, clump of forbs, rock) (Graul 1975, Knopf and Miller 1994, Olson and Edge 1985, Knowles and Knowles 1998 in Federal Register 1999);

Figures 4a and 4b: Breeding range of Mountain Plover. North American breeding range map produced by BBS and USGS (www.mbr.nbs.gov). Colorado range map produced by CNHP. Habitat in South Park supports an estimated 15-20% of the total nesting population of Mountain Plover. California appears to be the main wintering area.



- **less than 5% slope, with less than 2% optimal**¹ (Graul 1973);
- **usually heavily grazed by livestock and/or prairie dogs** (Graul 1973, Kantrud and Kologiski 1982, Knowles and Knowles 1998 *in* Federal Register 1999);
- **some taller vegetation, possibly used for shade and escape cover** (Shackford and Leslie 1995 *in* Federal Register 1999).

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., plovers may move to different nesting areas if original nests flood during spring storm events) (Leachman and Omundson 1990). There is a high degree of site fidelity. Both 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).

Breeding habitat in South Park

Figure 5 shows the distribution of potential breeding habitat in South Park. In general, characteristics of breeding habitat in South Park are consistent with those found on the eastern Colorado plains. Blue grama and buffalo grass are mostly replaced by slimstem muhly (*Muhlenbergia filiculmis*) and Arizona fescue (*Festuca arizonica*), although both blue grama and buffalograss occur in South Park (Figures 6a and 6b). Overall structure of grassland communities is similar to that found on the plains, but with more bare ground throughout. However, recent research by CNHP indicates that there are also some peculiarities in South Park breeding habitat. Mountain Plovers in South Park will nest on steeper slopes (i.e., slopes of ~9-12%) than those used on the prairie. Also, they will nest in comparatively thick, tall vegetation (~14.8 cm, or 5.8 inches), and near stark edges (within ~100 meters, or approximately 328 feet). While percent bare ground is relatively constant across the landscape in South Park, height of vegetation and degree of slope vary across the geography. Still, it appears that plovers are more readily found nesting in areas that offer the gentlest slopes and the shortest vegetation. The main difference between South Park habitat and that found on the eastern plains may be in the parameters that define “most gentle slopes” and “shortest vegetation.”

McCaffery et al. (1984) found plovers foraging in areas of taller vegetation on slopes and ridges on the Pawnee National Grassland. Knopf (1996) seemed to contradict this finding. However, Mountain Plover have also been found in supposedly “suboptimal” habitat in South Park. In South Park, nesting areas are marked as being on hills and in valleys with shrubs that are generally 15-30 centimeters (~6-12 inches) tall. The vast open short grass areas that lack shrubs are not used for nesting – they are, however, used for foraging on occasion. Current field research in South Park is looking at available food in both types of areas and using telemetry to demonstrate why the shrubs are important – possibly either for food or as cover, or both (Wunder and Knopf unpubl. data).

Also, previous observations (Hanson 1997) from South Park suggest that Mountain Plovers may be attracted to playas in the area. This does not seem to be true of breeding birds. More detailed observations indicate that playas are really only used by adults whose nests failed. Post-breeding flocks comprised of adults whose nests failed begin to form near playas in some areas. These flocks are later enlarged by the inclusion of successful adults and fledged young, but these larger flocks are found in native prairie, especially on hilltops and high benches with scattered shrubs (Wunder pers. obs.).

Table 1 shows general ownership patterns of potential breeding habitat in South Park. The majority of potential breeding habitat is in private ownership, with ownership of most of the remaining habitat shared relatively equally between BLM and the state of Colorado (primarily through the Colorado State Land Board).

Wintering habitat

“Winter habitat characteristics are very similar to those at breeding sites, i.e., Mountain Plovers are found on sites with short vegetation, bare ground, which are commonly heavily grazed...Mountain Plovers also occur on cultivated lands and sod farms. However, research in the San Joaquin Valley, California has determined that while mountain plovers are commonly seen on agricultural lands, they actually prefer the remaining natural landscapes to the agricultural lands” (USFWS 1999). In the Imperial Valley, CA, they readily use grazed alfalfa fields (especially those grazed by sheep), and also most burned fields (especially burned Bermuda grass) for foraging. Additionally, fallow fields and barren desert outside the agricultural areas are used for roosting, both at night and during the day (Wunder and Knopf unpubl. data).

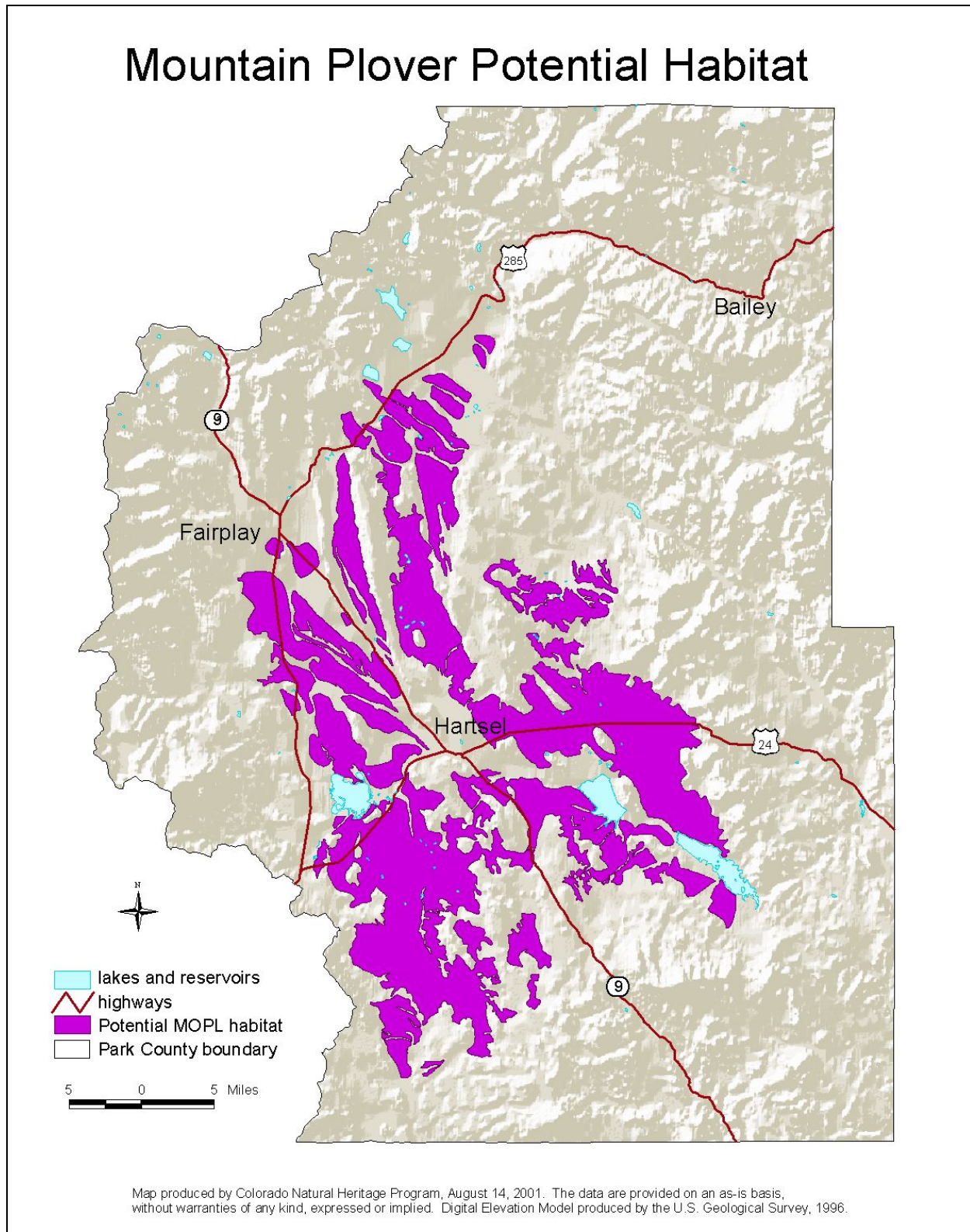
Migration habitat

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. Both dry and wet playas are used at times during migration (R. Estelle pers. comm.)

Table 1: Ownership of Mountain Plover breeding habitat in South Park.

Land Ownership	Acres of Potential Plover Habitat	Percentage of Total Potential Plover Habitat
Bureau of Land Management	approx. 27,166 acres	approx. 13%
Private Land	approx. 138,529 acres	approx. 68%
State-owned Land	approx. 35,927 acres	approx. 17.5%
U.S. Forest Service	approx. 920 acres	less than 1%

Figure 5. There are approximately 204,484 acres of potential breeding habitat for Mountain Plover in Park County.



Figures 6a and 6b. Mountain Plover habitat in South Park, Colorado. The shrub component is an important feature in South Park breeding habitat.



Life History

Reproduction

Plovers arrive on breeding grounds in northern Colorado around mid-late March (Graul 1975, Knopf and Rupert 1996), probably later at higher elevations (Knopf 1996). In 2000 and 2001, plovers 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). Birds are territorial during breeding season only. According to Knopf (1996), the territory of three males in Colorado measured roughly 16 hectares each (approximately 39.5 acres), but there was quite a bit of overlap at the boundaries.

One brood is raised per season, but a pair may have two clutches, with the male incubating the first and the female incubating the second (Graul 1973). Plovers are thought to begin breeding the first spring after hatching (Graul 1973), and every year thereafter (Knopf 1996). Egg laying begins mid-April through mid-June (May-July in South Park); 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 3 (Graul 1975, Knopf 1996). The South Park average clutch size in 2000 was 2.9 (Wunder and Knopf unpubl. data). Broods are quite mobile, moving an average of 300 meters (~984 feet) per day, with ultimate brood rearing area estimated at 28-91 hectares (69-225 acres) (Knopf and Rupert 1996). Chicks fledge approximately 33-34 days after hatching (Knopf 1996).

Graul (1975) noted a “loose colonial tendency” in nesting Mountain Plover. This tendency has also been observed in South Park every year since 1995. Wunder (unpubl. data) found tight colonies, although in different areas of the park each year. These are places where six or more nests, each about 60-80 meters (197-263 feet) from one another, have been found. Knopf describes similar observations as “passively aggregated” rather than as “behavioral colonies” (Knopf pers. comm.).

Data on lifetime reproductive success are not available. Annual reproductive success has been studied on the Pawnee National Grasslands in northeastern Colorado (Weld County), and in South Park, Colorado. Success on the Pawnee 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 range from 0.26 (Knopf and Rupert 1996) to 1.4 (Graul 1975²) chicks per nest. Given post-fledging predation, chicks surviving until migration range from 0.17 to 0.74 per nest (Knopf and Rupert 1996).

Nest success measured in South Park in 2000 was approximately 63% (40 nests out of 64). The average number of eggs laid per nest was 2.86 (± 0.04); average number of eggs hatched was 1.73 (± 0.17) for all nesting attempts combined. However, this sample is based on a single year, and probably fluctuates from year to year (2001 data for 118 nests have not yet been compiled).

² This rate based on samples that included only nests that hatched at least one egg.

These rates are nearer the rates noted from the 1970's on the Pawnee. Recent rates of nest success on the Pawnee are lower than those in South Park.

Mortality

Mountain Plovers are most vulnerable to predation as eggs and chicks; in fact, predation is the cause of most losses of eggs and chicks (Miller and Knopf 1993, Knopf and Rupert 1996). Documented predators on the breeding grounds of Colorado's eastern plains include 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 plover eggs (Knopf 1996). Predators observed taking adult birds are kit fox (*Vulpes macrotis*) on wintering grounds (Knopf and Rupert 1995) and Prairie Falcon on breeding grounds (Knopf 1996).

The predator community in South Park is somewhat different from that of the eastern plains. Notably, swift fox and bullsnake do not occur in South Park. However, other South Park species that are suspected of Mountain Plover predation (especially eggs and chicks) include: Common Raven (*Corvus corax*), American Kestrel (*Falco sparverius*), American badger (*Taxidea taxus*), Wyoming ground squirrel (*Spermophilus elegans*), and thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*). Prairie Falcon is also present in small numbers and is suspected of preying on both adults and chicks.

Causes of mortality besides predation that have been documented for 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, Graul 1975), loss of eggs because a cow stepped on the nest (only once between 1992-1994 on the Pawnee National Grasslands) (Knopf 1996), and roadkill (Pague pers. obs.). 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).

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

Of the above causes, only nest abandonment and the possibility of trampling exist for South Park birds. Overheating is not likely an issue, as summer temperatures rarely exceed 24°C (75° F) in South Park. Likewise, comparative climate data from seven stations in Weld County and six stations in Park County report seven hailstorms during the period from 1993-2000 for Park County, whereas there were 144 such storms reported from Weld. From the same period, Weld County reports ten local flood events, and none are reported from Park County.

Home Range

Adults with broods move an average of 300 meters (984 feet) per day and range over an average of 56.6 ha (~140 acres) until fledging (Knopf 1996). Telemetry data were collected in South

Park in 2001, but the data have not yet been compiled for use in estimating South Park home range size.

Migration

Mountain Plover migrate in flocks annually between breeding grounds and wintering grounds. They begin 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 birds (often all) 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 pers. obs.)

California seems to be the main wintering area for Mountain Plover (Leachman and Osmundson 1990). Migrating birds usually reach wintering grounds of California between mid-September and mid-October (Small 1994 *in* Knopf 1996). Spring migration back to breeding grounds usually begins around mid-February to early March (Knopf and Rupert 1996). It appears that migrating Mountain Plover fly non-stop over the mountains to their 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 pers. comm.).

However, there is still much uncertainty in current understanding of migration patterns. Wunder 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. Also, very little is known about migration patterns (e.g., is it a direct east-west flight, or is it a J-shaped pattern that keeps birds in suitable habitat as they move?).

Diet

Mountain Plover feed almost exclusively on invertebrates. Grasshoppers and beetles have been reported as the most common prey (Graul 1976, Wiens 1974, 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 midsummer, and consumption of grasshoppers and ants was highest during late summer. However, recent research on the diet of wintering plovers from three different locales in California indicated that the stomachs of 39 plovers 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 plovers may be more flexible in selecting food items than was previously believed, and that the Mountain Plover is an opportunistic forager, at least on wintering grounds.

Abundance

Currently, the global population is estimated at 8000-12,000 individuals (Knopf, pers. comm.). The estimate for South Park is 1500-2000 breeding adults (Wunder and Knopf unpub. data).

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 Breeding Bird Surveys that show a 2.7% annual decline from 1966 to 1996) (Federal Register 1999). This decline is greater than declines shown in any other grassland endemic. The USFWS considered five factors in the proposal to list:

- present or threatened destruction, modification, or curtailment of habitat or range;
- over-utilization for commercial, recreational, scientific or educational purposes;
- disease or predation;
- inadequacy of existing regulatory mechanisms;
- other natural or manmade factors affecting continued existence.

Only over-utilization and disease/predation were not considered by the USFWS as contributing to the decline of Mountain Plovers. Of the remaining factors, the most significant seems to be destruction/modification of habitat, particularly through habitat conversion, agricultural practices, rangeland management, and decline of native burrowing mammals (Federal Register 1999).

Habitat Conversion

Loss of habitat (both breeding and wintering) to cropland is generally considered to be the most significant threat to Mountain Plover (Dinsmore 1983, Gaul & Webster 1976, Schulenberg 1983, Knopf 1988 *in* Leachman and Osmundson 1990). Approximately 32% of the grasslands in the U.S. Great Plains have been converted to other uses (Laycock 1987 *in* Federal Register 1999, Samson and Knopf 1996). Gaul (1980) suggested that up to 45% of the buffalo-blue grama grasslands have been destroyed. Gaul and Webster (1976) also suggested that plowed shortgrass prairie allowed to revert to grasslands do not provide suitable Mountain Plover habitat because they tend to revegetate with taller grasses.

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 Mountain Plover in southern California has been replaced by residential expansion.

Because grazing is still a primary land use in South Park, loss of Mountain Plover habitat in the park has not been as much of a problem as loss of habitat from the eastern plains. However, Park County is one of the fastest growing counties in Colorado, with over 90% increase in population since 1990 (Park County 2000). Much of the grassland habitat is on privately owned lands (Table 1), some of which have already been subdivided. It seems reasonable to assume

that habitat conversion to residential and commercial development is likely to increase in the future. Ultimately, conversion of rangeland to residential development will probably prove to be the most significant impact to Mountain Plover in South Park.

Agricultural Practices

Agricultural practices *per se* are probably not posing a threat to Mountain Plover in South Park. Most of the suitable nesting habitat in the park is still rangeland. The only significant crop agriculture is hay farming, which is mostly concentrated in areas of the park that are too wet for Mountain Plover.

Conversion to cropland may have greater detrimental impacts than simple loss of habitat acreage. Plowed fields may be attractive to nesting plovers, only to subject birds to nest failure and/or mortality when tilling occurs (Knopf and Rupert 1999). This would be true whether or not the rangeland was originally suitable nesting habitat prior to conversion.

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 plover are 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 Mountain Plover may be directly threatened by pesticides is not completely understood (Federal Register 1999).

Concerns also exist regarding grasshopper control on breeding grounds. According to Fair et al. (1995 in Federal Register 1999), grasshopper control can reduce abundance of grasshoppers by greater than 90%, and can reduce abundance in non-target insects as well. As grasshoppers represent one of the primary food sources for Mountain Plover, severe reductions in availability of grasshoppers could influence plover productivity (Graul 1973, Knopf 1996, Knopf and Rupert 1996).

Rangeland Management

Mountain Plover occupy habitat that was historically adapted to grazing disturbance. However, in present times, there are significant differences in both herbivore communities as well as in 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 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. Increasing vegetation height and decreasing bare ground reduces suitability for use by Mountain Plover.

Grazing of domestic cattle is still the primary land use within the areas of South Park that support Mountain Plover. Rangeland management could be detrimental to Mountain Plover to the extent that rangeland practices were to favor taller grasses and less bare ground. For now, present management in much of the suitable habitat seems to be appropriate from a plover perspective. However, if water availability becomes a greater issue in the future, the number of cattle that can be supported per acre may decrease. This could result in a reduction in the amount and/or quality of grazed land. Thus, adverse impacts to Mountain Plover in South Park would be expected.

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, especially in Montana (Federal Register 1999). There is general agreement that prairie dogs have experienced significant reductions in both range and abundance, primarily from eradication efforts, habitat conversion, and sylvatic and bubonic plagues. Absence of active prairie dog towns could pose a significant threat to Mountain Plover in some parts of the breeding range (Federal Register 1999).

Gunnison's prairie dogs were plentiful in South Park until a series of plague episodes and poisoning efforts in the 1940s. They have not re-colonized to any great degree in South Park, and do not currently constitute an important factor in Mountain Plover habitat in the park. Three towns were observed during research in 2000 and 2001. Two towns near Spinney Mountain Reservoir are each less than 10 acres in size. One town less than 40 acres in size was observed just southeast of Bald Hill. These towns may not grow much larger as Gunnison's prairie dog towns are typically much smaller and more widely distributed than the black-tailed towns on the plains. Also, in South Park Gunnison's are in hibernation for six months each year, and consequently do not have the same effect on the local vegetation of the towns as black-tailed prairie dogs. Therefore, concerns regarding the reduction in prairie dog towns elsewhere in the breeding range may not apply as significantly to South Park. Potential effects of community vigilance and warning sounds present in prairie dog colonies on the nesting success of Mountain Plover using these towns is unknown.

PART 3: HUMAN SOCIAL AND CULTURAL CONTEXT

Because of the fragmented nature of BLM holdings in South Park, many (if not most) land management decisions made by BLM will require coordination with local landowners, communities, as well as other government agencies. This is especially true of BLM's land exchange program – currently one of their highest priorities. Also, anticipated growth and development in South Park will change the future amount, quality, and distribution of Mountain Plover habitat in the valley. Thus, the relative importance of BLM actions, as well as those of other public land management agencies, will become more significant to the conservation of

Mountain Plover in the future. Furthermore, cumulative effects analyses for any project will need to evaluate the impacts of BLM actions in light of other activities taking place in the park.

For these reasons, it is very important that BLM personnel understand the human social and cultural context within which they are working. If BLM staff are familiar with local communities' values and vision(s) for their future, they will be better able not only to make strategic decisions about land management (especially reconfiguration), but also to "package" their projects in ways that will be most palatable to their South Park neighbors. (This, in part, was the purpose for undertaking the Park County Public Lands Planning Project referenced later in this document, in which BLM was a participant and signatory on the MOU.)

Human Land Use In South Park

Historic Land Use

The cultural heritage of South Park has been nicely chronicled in a couple of sources that are readily available. Most notable are Bayou Salado: The Story of South Park, by Virginia McConnell (published by Sage Books, Denver, in 1966) and the "South Park Heritage Resource Area Study" compiled by Shapins Associates, Inc. in 1996. Following is a very brief summary of recent patterns of human settlement in South Park taken from these two sources (unless cited otherwise). Interested readers may also reference "South Park Contexts," a detailed account of Park County history prepared by Front Range Research Associates for the Park County Tourism and Community Development Office in 1999.

Prior to exploration and settlement by Europeans, Native Americans camped and hunted in the South Park area. Large game was abundant, with vast herds of bison and antelope in the park. Small game included rabbits, prairie dogs, squirrel, fish, ducks and geese, quail, and wild turkey, as well as beaver, muskrat, otter and mink. Surrounding forests contained grizzly bear, bighorn sheep, wolf, deer, elk, and mountain lion. South Park was primarily within the territory of the Ute Indians, although other tribes also moved through the area. Ultimately, however, the Utes were removed to reservations, and by 1880 the park was dominated by white settlers.

Although European explorers began moving through the area in the 1700s, the earliest white occupants of South Park were the trappers, whose influx began in earnest in 1821. However, by the mid-1800s beaver pelts were no longer fashionable and trapping activity declined. The 1859 discovery of gold in the park initiated the rise of the mining culture, which was the original source of many towns existing in South Park today. Gold mining began to decline by the 1860s, but silver was discovered in 1871. As late as the 1980's, mining was a mainstay of the local Park County economy (Clarion Associates of Colorado 2000). Although mining is a very small industry in the park today, mining claims comprise much of the land in the Mosquito Range and Alma area.

By the end of the 19th Century ranching and hay production had become a significant business in the park. By 1870, the valley of South Park was open range for cattle (estimated at about 6,000 head), horses (about 700 head), and some sheep (McConnell 1966). By 1883, there were nearly 50,000 head of cattle, 5,000 head of horses, and 10,000 sheep in the park (McConnell 1966). By 1880, most of the desirable rangeland [i.e., near water] in the park had been settled. Many of the

historic ranches that are currently targeted for preservation in South Park were originally settled during this time. Ranching remains the dominant land use in the valley today, and is the most important contributor to maintaining Mountain Plover habitat in the park.

Ranchers were given rights to appropriate and divert stream water in the 1860s. By 1907, water rights from South Park were already being sold to Denver and other Front Range communities. The completion of Antero Reservoir in 1913 removed 45% of the original water rights from South Park. Spinney Mountain Reservoir and the Elevenmile Canyon reservoir also store water for Front Range communities. Today, less than 10 of the large, historic ranches have retained their original water rights. The availability of water is an important factor in the ability of ranchers to maintain land in active production. If land cannot be grazed sufficiently due to lack of water, the quality and/or quantity of suitable Mountain Plover habitat will be reduced.

Some of this information may seem a bit extraneous from a Mountain Plover perspective. However, there is a very strong sentiment for historic preservation in South Park, and much of this sentiment is attributable to the mining and ranching cultures that gave rise to the human communities that exist in South Park today. This community interest in preservation may be very important to the future persistence of Mountain Plover in the park, especially as related to protection of historic ranches.

Modern Population Growth and Development

Park County has recently undergone an extensive, countywide planning process for development of a strategic master plan. In support of the master plan development, Clarion and Associates of Colorado prepared a "Demographic and Economic Reconnaissance Report" for the county dated March 2000. This report is the source of all the following information unless cited otherwise.

Estimates of the 1998 population of Park County vary from 13,331 people to between 18,000 – 20,000. There seems to be some question as to the validity of the 1990 census count for Park County, which was the original basis for these estimates. However, there is no doubt that Park County is one of the fastest growing counties in Colorado, far exceeding the statewide average annual growth rate. The State Demographer projects that the county will continue to grow at very high rates for the next 10 years. By 2005, the county is expected to double its estimated 1998 population. According to the State Demographer, if population growth continues at rates close to those experienced during the 1990s, the population of Park County may reach 102,600 by the year 2020.

To date, the majority of the development in Park County has been concentrated in the Platte Canyon area (around Bailey). This is largely due to the relatively close proximity of employment opportunities in Denver. As of April 1990, there were approximately 7,247 housing units in the county, almost half of which were in the Bailey/Shawnee/Pine Junction area. Of the 2,840 residential building permits issued between 1991 and 1999, almost half of these were in the general vicinity of Bailey.

However, *for the first time in 1999, there were more building permits issued in the South Park area of the county than in any other area in the county.* Growth in South Park is expected to

represent a significant portion of the future growth in Park County for two reasons: the Fairplay/Alma/Hartsel area is relatively convenient and affordable as a housing area for employees of nearby Summit County resorts; and the majority of land in the county that is unplatted and undeveloped is in South Park. According to Park County, the Platte Canyon area is approaching build-out faster than any other area in the county. In fact, recent information from Gary Nichols, Director of Park County Tourism and Community Development, indicates that build-out in the Platte Canyon area has already occurred (Nichols pers. comm.).

The Ranching Industry

Between 1987 and 1997, the number of farms and ranches increased from 162 to 183, but the average size of farms and ranches decreased by 45% over the same time period (from an average of 2,470 acres to an average 1,700 acres). Also, the total number of acres farmed or ranched in the county decreased by 90,000 acres, from 400,900 acres in 1987 to 311,182 acres in 1997. According to the county, these data demonstrate the growing tendency toward carving the large, historic ranches into smaller “ranchettes.” In interviews conducted with local ranchers during the master-planning process, many indicated that they are having difficulty making ends meet, and most implied that their ranches would probably not continue in agricultural use indefinitely. Increasing population and development will continue to put pressure on the agricultural industry. These pressures combined with the high prices for surface water rights and falling commodity prices may threaten the future of agricultural land in the county.

In 1997, the 311,182 acres of farm and ranch land in Park County represented 22% of the total land area of the county (total acreage for Park County = 1,413,692 acres). In that same year, agriculture accounted for only 1.4% (or 31 people employed at 11 establishments) of the jobs available in the county, and represented less than two tenths of one percent of both the total sales revenue and the total tax revenue for the county³. In other words, although agriculture represents a sizeable percentage of the land use in the county, it represents only a tiny part of the county’s economic picture. There is no reason to think that this trend will reverse in the near future. If Mountain Plover habitat is to be protected in South Park, it will be very important to encourage motivations other than (or at least in addition to) economics for keeping ranching a viable industry in South Park.

Local Community Values

As part of the 1999-2000 countywide master-planning process, RRC Associates conducted a survey of county residents and landowners to gauge public opinion on a variety of topics. A total of 2,032 responses were received; 674 of these responses were from the planning subareas of

³ According to Gary Nichols in Park County, two or three big ranches turned over in the 1996-1997 time period, and were out of production for part or all of 1997. This could explain the low agriculture revenues for that year. Looking at data for the entire 1990 decade, sales revenues for agriculture were less than 1% of the total county revenue for the years 1990-1992, then jumped up to roughly 2% for 1993-1996 before falling below 1% again in 1997 and 1998. Even so, the highest percentages over the past 10 years are still quite low.

Alma/Fairplay and Hartsel (the subareas that contain Mountain Plover habitat)⁴. Following is a summary of responses on topics related to conservation of Mountain Plover. These responses represent countywide totals; results that would represent only respondents of Alma/Fairplay and Hartsel were not available.

- **59% thought that current rates of residential growth are “too fast.”** 33% thought rates were “about right” and 2% thought rates were “too slow.” The results were opposite regarding commercial development rates: 40% thought “too slow”, 42% thought “about right”, and 9% thought “too fast.”
- **When asked what types of economic development they would support or oppose, ratings for ranching/agriculture were second highest, at 56% “strongly support”** and 2% “strongly oppose.” Non-motorized recreation received the highest percent of “strongly support” at 64%. Least popular types of development were motorized recreation (38% opposed, 15% supported); real estate development (39% opposed, 4% supported); resource extraction (50% opposed, 4% supported); and heavy industrial (69% opposed, 4% supported).
- **When asked to select two sectors of the economy that they would like to emphasize both countywide and also “in their area”, ranching/agriculture was rated third countywide at 23%** (behind retail at 40%, and non-motorized outdoor recreation at 37%) and fourth (at 21%) for “their area” (behind retail, non-motorized outdoor recreation, and small home-based business). Least popular development options both countywide and “in your area” were heavy industrial (3%), real estate development (3%), and resource extraction (2%).
- **When asked about balancing environmental protection and economic development, 51% favored “environmental protection” even if it required compromise on economic development;** 41% favored a balance between the two; 8% favored economic development even if it required compromise on environmental protection.
- **When asked about their level of support or opposition to potential land use policies or regulations, the highest level of support was given to “establishment of guidelines to protect wildlife and wetlands,” with 68% “strongly support”** and 3% “strongly oppose.” Other interesting results: 57% strongly support preservation of open space through PDRs [purchase of development rights] and easements; 53% strongly support incentives for ranchers to keep lands in agricultural production.
- **When asked to prioritize efforts to protect the natural environment, “wildlife habitat” came in fourth (out of 10), with 63% rating “high priority.”** The top three priorities were water quality (83%), water supply (80%), and scenic/visual quality (67%). Open lands came in 5th at 62%.

⁴ Two percent of the respondents indicated that their primary source of personal income was from agriculture or ranching.

- **When asked to prioritize types of open space protection, “river/stream corridors and wetlands” and “wildlife habitat” tied for highest priority (out of seven), with 67% rating these as “high priority.”**
- Questions about willingness to finance open space purchases yielded these results: “private donations” was supported by 91% and opposed by 9%; “impact fees on new development” was supported by 87% and opposed by 13%; “sales tax” was supported by 63% and opposed by 37%. “Property tax” and “other tax” were both opposed by the majority of respondents (73% and 61%, respectively).
- **In terms of prioritizing community services, “protection of wildlife habitat” was ranked highest out of 18 services, with 56% rating “very important.”** When asked which of these services they would support through tax increases, only four services would be supported: “road improvements” supported by 63%, “protection of wildlife habitat” at 55%, “open space acquisition/protection” at 53%, and “purchase of water rights” at 50%.

There seems to be some inconsistency in responses across questions. While 53% of the people surveyed indicated that they would support a tax increase for open space protection, write-in comments summarized by RRC indicate “strong disdain” for tax increase-based open space protection. However, when asked to allocate *existing* funds, “purchase open space” came in second out of 16 expenditure types in terms of dollars allocated. It seems that there is a sentiment in favor of protecting open space in Park County, but some disagreement about how it should be paid for. (Responses about tax increases were also strongly negative for road improvements, schools, and law enforcement.)

Complementary Planning Efforts

Park County Strategic Master Plan

In the spring of 2001, Park County adopted a new Strategic Master Plan. Implementation of the plan will require development of land use regulations that support the plan’s recommendations. Development of these regulations will require at least two years. Currently public sentiment and the commissioners’ political sentiment are in support of the plan. It is uncertain whether or not the political climate will change once difficulties in implementation begin to arise.

In the overview of the preferred development scenario, the plan recommends that strategies focus on limiting small-lot development and confining higher density and intensity development to designated growth areas. One of the key tools suggested would be to prevent the re-zoning of Agricultural land to Residential outside the designated growth areas. In addition to directing new growth, the county would consider limiting the annual rate of growth as well as the overall build-out to reduce the total projected population.

This plan makes several recommendations that could, depending on how they were implemented, be beneficial to Mountain Plover in South Park. These recommendations include:

- Designation of “growth boundaries” and possibly the institution of a county-wide growth cap.
- Limit the parcelization of large tracts of open space and ranchland and the build-out of existing small or substandard lot subdivisions.
- Consolidation of undeveloped plats. There are currently approximately 25,000 undeveloped plats in South Park, many of which are not big enough to support necessary septic systems, etc. The proposal is to consolidate as many of these as possible (i.e., the ones that are contiguous and under single ownership), and then transfer development rights from outliers to the designated growth areas. (The majority of these plats are in the Hartsel area.)
- Creation of a county-based land trust, and development of a comprehensive open space (and trails) masterplan.
- Creation of a digital database to create countywide maps of critical natural resources and areas.
- Supplementation of the county’s 1041 regulations during development review and annexation to require identification of wildlife habitat and protection by setting these areas aside to satisfy open space requirements.
- Re-zoning of unincorporated rural areas to prevent scattered, small-lot development.
- Preserve historic ranches “to the greatest extent possible,” including adoption of restrictions that make it more difficult to change the zoning from agriculture to other uses, and encouragement of alternative sources of income for ranches (e.g., some recreational use for tourism purposes, “pay for access” for hunting and fishing).
- Concentration of development (especially residential development greater than 1 unit/5 acres, as well as commercial and industrial development) in designated “growth areas.” These growth areas have not been delineated, but they include Fairplay and Hartsel.

Concentration of development in the Hartsel area could be either beneficial to the Mountain Plover, or detrimental, depending on how it was done. According to data currently available, the town of Hartsel is relatively central to the largest concentrations of Mountain Plover in the park.

South Park Heritage Resource Area Study

In 1994, local citizens and public agencies developed a partnership to “preserve the heritage of South Park and build a stronger economic base.” In 1996, the South Park Heritage Resource Area Board commissioned a study of the “key resources that express South Park’s heritage through time.” Historic ranches were among the heritage resources targeted in this study. Although the study area didn’t include all of the Mountain Plover habitat in South Park, two of the ranches that the report identified as being of the highest priority for preservation have occurrences of Mountain Plover.

The Park County Strategic Master Plan recommends implementation of the strategies presented in the South Park Heritage Resource Area report. At this point, existing conservation projects in Park County are largely focused on wetland and riparian protection via conservation easements. Many of these projects are somewhat reactionary, in that they are being developed in response to opportunities presented by interested landowners. However, the South Park Heritage Resource Area does have an ex officio director in Gary Nichols, who would be a logical partner in efforts to protect Mountain Plover through preservation of historic ranches.

Park County Public Lands Planning Process

There is a substantial amount of public land in South Park, much of it owned and/or managed by state and federal governments. Many of these government agencies are interested in consolidating their holdings, and trading or selling some lands to ease management difficulties or to achieve some other goal. Many of these lands are important to the cultural, historic, and natural heritage of Park County. In order to promote strategic decisions regarding land disposition, and to ensure that the county's interests were considered in governmental land deals, the county and its consultants coordinated a county-wide planning effort in 1999. Of the 10 focus areas (called "bubble areas" in the project), six contain documented occurrences of Mountain Plover. In fact, three of these areas comprise the bulk of highest quality Mountain Plover habitat in South Park.

Through a year-long series of meetings, agreement about the best way to configure public land in each of the bubbles was reached among all affected stakeholders. In relation to the Mountain Plover, the most significant recommendations from this project were:

- Consolidation of lands in the Reinecker Ridge area under management of Colorado Division of Wildlife as a State Wildlife Area;
- Establishment of a conservation easement on BLM lands traded to the Sipal Ranch, and continuance of the Sipal Ranch as a ranching operation;
- Consolidation of BLM land in the Fourmile Creek area to facilitate conservation of Mountain Plover habitat there.

Proposed Development Projects in South Park

Development pressures are currently being felt in two areas of South Park containing Mountain Plover habitat. If full build-out of these subdivisions is completed, there will be changes in the amount and distribution of Mountain Plover habitat within South Park. Furthermore, as real estate values continue to rise in relation to commodity prices, pressures toward conversion of private ranchlands to other uses will increase. As plover habitat on private land is lost or degraded, management on BLM lands will become increasingly important. Anticipated changes in the availability of Mountain Plover habitat should be evaluated by BLM as part of their cumulative effects analyses for any BLM projects proposed for lands containing plover habitat within the park, and also in BLM's land reconfiguration plans.

Hartsel Springs/Badger Basin

The Hartsel Springs/Badger Basin project is a relatively large-scale planned-development proposal currently under consideration by Park County that occurs within Mountain Plover habitat. The conceptual plan has already been approved. The Hartsel Springs/Badger Basin proposal calls for two Planned Unit Developments in the Hartsel area. These developments anticipate including a fishing camp, an equestrian center, and approximately 1500 housing units (Nichols pers. comm.), as well as large tracts of land for wildlife habitat and livestock grazing. Potential impacts to Mountain Plover will be dependent upon how these developments are designed. If houses are built on ridges among trees, as is currently planned, impacts to Mountain Plover habitat will be minimized. If grasslands are converted to built uses, impacts will be much greater to Mountain Plover habitat, but less to deer and elk.

Thousand Peaks

The area north of Antero Reservoir known as Thousand Peaks has been subdivided into approximately 350 parcels of varying sizes (mostly 35-40 acres). Most of the parcels are under separate ownership. This is not a planned, phased development project. Rather, development is occurring on a parcel-by-parcel basis. Some roads and homes are currently in place, but how or when complete build-out will occur is unknown. Once this area is built-out, however, we presume that much of the area will no longer be suitable for Mountain Plover.

Other Potential Development Projects

In addition to these current development projects, there are other reasons to anticipate future development proposals that could affect the amount of Mountain Plover habitat in South Park. There are 25,000 undeveloped plats in South Park, mostly in the Hartsel area⁵. Although the county has placed some emphasis on the idea of consolidating as many of these plats as possible, it seems reasonable to expect that eventually many of them will be built out. How this build-out occurs could have direct implications for plovers in the park.

Also, the Denver Water Board owns, or is interested in acquiring, lands around Antero Reservoir. Some of these lands contain habitat for the Mountain Plover. According to the Park County Public Lands Planning Process, one of the potential future goals of Denver Water may be to expand Antero Reservoir. Such a project would probably result in the inundation of some plover habitat. What effects this might have on the plover population are unknown.

Finally, according to Park County, there is a private developer proposal to subdivide and develop a private ranch near Como. A conceptual plan has been submitted for consideration by the county, but they do not expect any development activity for at least a year. This area represents the northernmost occurrence of Mountain Plover in the park. According to the information currently available, birds do not occur in great numbers in this area and the habitat is not optimal. Consequently, this portion of the valley is not considered a high priority for plover conservation.

⁵ This number includes the Thousand Peaks development, but not Hartsel Springs/Badger Basin.

Depending upon how this plan is designed (e.g., density), it is possible that this project would not have any appreciable impact on South Park plovers. Nonetheless, land conversion would presumably reduce the total amount of potential habitat by some amount. Also, if development does occur in this area, there could be impacts to BLM lands nearby.

Current Conservation Initiatives

There is currently a great deal of local momentum behind the conservation of South Park's natural resources. A number of projects are underway in the area to conserve riparian and wetland resources through conservation easements. The County is actively engaged in eight such projects (Gary Nichols pers. comm.). The Nature Conservancy, Colorado Open Lands, and numerous landowners and concerned citizens are coordinating to develop new strategies for protecting natural systems, plants, and animals in the valley. The Mountain Plover is one of the targeted species that is receiving special attention in some of these efforts.

In addition, many of the state and federal agencies that own and/or manage land in the park are considering the conservation of Mountain Plover in their deliberations on how to best reconfigure public lands in South Park. Opportunities exist to work collaboratively with the Colorado State Land Board, Colorado State Parks, the Denver Water Board, and Colorado Division of Wildlife.

Finally, all available resources indicate that one of the best economic strategies for Park County is development of a resource-based tourism industry. Historic ranches are high priorities for preservation under this scenario. All local efforts toward historic preservation of ranchland would likely constitute effective conservation action for the Mountain Plover as well. Two of the ranches identified as priorities in the 2000 Park County Historic Preservation Plan contain Mountain Plover habitat. According to the plan, "Ranching was selected as first priority for study not only because of heritage tourism potential and owner interest, but also because there is a high level of threat due to sale of water rights and subdivision. Continuing ranching as a way of life, especially without water rights, is seldom economically feasible. Colorado Open Lands, the Division of Wildlife, and other organizations [including The Nature Conservancy] are working to develop conservation purchases, leases, and easements that will preserve open space and wildlife habitat, while allowing continued use of the land for agricultural purposes" (Nichols pers. comm.).

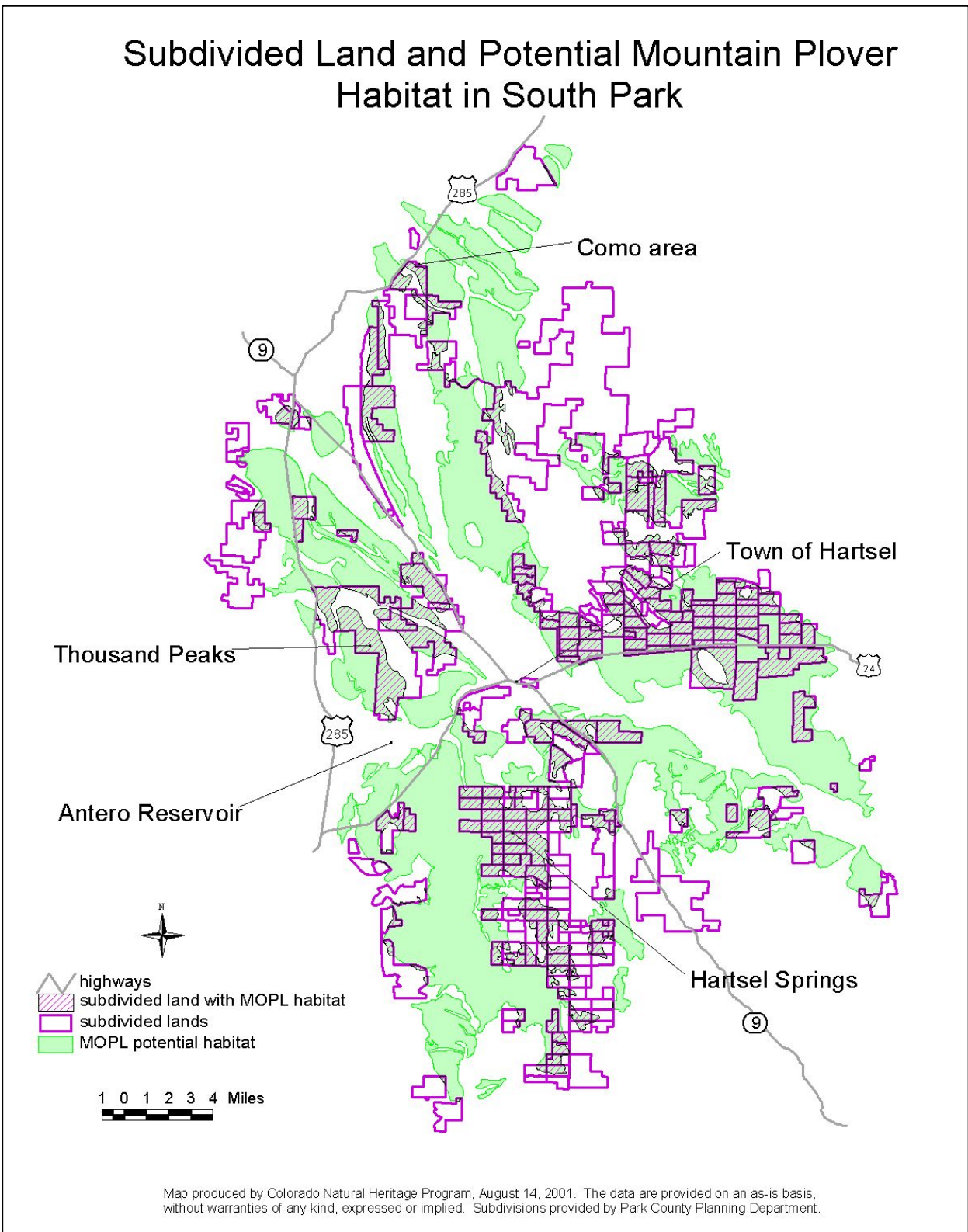
Figure 7 shows the relationship of existing subdivided private lands and potential Mountain Plover habitat in South Park. The subdivision data layer was provided by the Park County Planning Department. The potential habitat data layer was created jointly by CNHP and BLM. This layer was originally based on aerial photography, and has since been ground-truthed and refined during field inventories over the past four years. Much of the subdivided land is, so far, subdivided on paper only. In reality, most of this area is still open landscape in (relatively) natural condition.

It is not known how or when development will actually occur on these subdivided lands. Direct and indirect impacts to Mountain Plover habitat and to the birds themselves would presumably be different depending upon how ultimate build-out of these lands occurs. For example, we would expect low-density clustered development surrounded by open space to have fewer impacts and maintain more suitable habitat, than would low-density development scattered across the landscape, with each parcel having its own road, or than high-density development. The worst-case scenario would be development of all of these subdivided lands to the point that Mountain Plover habitat was completely converted, and occupation by the birds was precluded entirely. We expect the final scenario will be somewhat less than worst case. However, if all the habitat on these subdivided lands was lost, the total amount of potential habitat currently available to Mountain Plover in South Park would be reduced by approximately 32% (based on approx. 204,484 acres of total suitable habitat; 65,426 acres of which are subdivided).

In addition, there may be some level of indirect impact from development on adjacent habitat. The scope and severity of indirect impacts would also presumably be somewhat dependent upon the density and design of development. Possible examples include disturbance by people and domestic pets, alteration of the predator community, habitat degradation through the spread of weeds, increased difficulty in managing neighboring rangeland through grazing and controlled burns, and possible impacts to surrounding habitat from alterations to local hydrologic regimes. We do not have data to demonstrate how Mountain Plover might respond to some of these changes. All these questions need to be investigated.

Finally, it may be that most of the suitable habitat in South Park is already occupied by Mountain Plover. Birds have been found in nearly every site with suitable nesting habitat that we have sampled. Preliminary data on density and abundance of Mountain Plover suggest that some of the best habitat (e.g., the Sipal Ranch) may be at or near capacity. If this is true, then there would not be much suitable but unoccupied habitat available to displaced birds. A significant reduction in total habitat available would also preclude the ability of birds to move around in response to local conditions in any given year. There are some potentially suitable lands that have appropriate landform where management could be employed to create appropriate vegetative structure for Mountain Plover. However, this alternative would likely be more costly, less efficient, and have lower probability of success than maintaining high-quality habitat where it currently exists.

Figure 7. Potential future development in relation to Mountain Plover habitat.
Approximately 32% of the potential plover habitat in South Park has been subdivided.



PART 4: MANAGEMENT AND CONSERVATION IMPLICATIONS FOR BLM

Potential Impacts from BLM Projects

The following information is based on currently available literature. As much of the published research has focused on the eastern plains of Colorado, many of the following statements are based on that ecosystem. We have noted where the impacts would likely be different for South Park. In terms of existing standards and guidelines for federal land management, the only available information is from evaluations conducted on the Pawnee National Grasslands (PNG) in northeastern Colorado. Some of the management suggestions presented here are based on the standards and guidelines implemented by the Pawnee in their Mountain Plover management strategy. We assume these standards and guidelines would also be applicable to BLM lands in South Park except where noted.

Range Management

By all accounts, grazing is considered not only beneficial to the maintenance of Mountain Plover habitat, but essential. Season-long grazing during the summer is reported to maintain nesting habitat for plover (USDA Forest Service 1994a). Light intensity grazing combined with burning results in vegetative structure similar to that which results from heavy grazing alone (Wershler 1989). Thus, moderate to heavy grazing, or light intensity grazing combined with burning, will likely be the most effective management approaches for maintaining Mountain Plover habitat. Winter grazing on short-grass generally leaves vegetation over three inches long in early spring, thereby reducing the effectiveness of habitat for nesting (USDA Forest Service 1994a). Deferred grazing systems also result in vegetation that is not suitable for plover nesting (Brockway 1992).

On the eastern plains of Colorado, heavy season-long grazing that results in concentration of grazers may lead to formation of mats of warm season grasses through “heavy tillering and rhizome development.” If this happens, the amount of bare ground in an area would decrease. In other words, total basal cover and plant density are increased. Therefore, “season-long heavy grazing may not produce the desired habitat for mountain plover nesting” (USDA Forest Service 1994a) on Colorado’s eastern plains. However, in South Park, this result would not be expected to occur with heavy grazing because the grass species that dominate Mountain Plover habitat in the Park do not tend to sod under grazing pressure.

Existing livestock grazing guidelines employed by the BLM in South Park are compatible with maintaining Mountain Plover habitat. The extent of bare ground available on the range is an important variable for Mountain Plover (Knopf and Miller 1994). In 2000, Wunder examined percentage of bare ground at nest sites and compared these with randomly selected sites that were not used by nesting plovers. There was no significant difference in the extent of bare ground found across the landscape in South Park. That is, all sites (both grazed and ungrazed as well as both nest sites and non-nest sites) offered about 50% bare ground. Management may have little or no effect on the amount of bare ground available to nesting Mountain Plovers. However, monitoring the percentage of bare ground available would help to proactively identify needed changes if and when the amount of bare ground dropped below 30% (the apparent minimum for nesting Mountain Plover) (Knopf and Miller 1994).

Range management projects such as pitting to increase soil moisture retention, seeding with exotic species, watershed improvement projects, and fire suppression encourage development of taller vegetation and reduce suitable nesting habitat for plover (Graul and Webster 1976, Knowles and Knowles 1993 *in* Federal Register 1999).

Mountain Plover feed strictly on insects, especially grasshoppers and beetles. Mountain Plover productivity could be influenced by reduction in prey abundance due to grasshopper control (USDA Animal and Plant Health Inspection Service 1987, Graul 1973, Knopf 1996, Knopf and Rupert 1996 *in* Federal Register 1999). This factor should be taken into account when planning and executing pest management activities.

On the Pawnee National Grassland (PNG), range management (e.g., new water developments, fence replacements) requires a plover clearance survey between April 10 and July 10. Utilization standards leave 300 pounds of forage per acre on sites within suitable nesting habitat (USDA Forest Service 1994b). Appropriate clearance dates for range improvement projects in South Park would be between June 1 and July 31.

Lands and Realty

Loss of habitat in both winter and summer range is generally agreed upon as the most likely cause for long-term Mountain Plover declines (USDA Forest Service 1994a, Federal Register 1999). The specific problem mentioned most consistently is conversion to cropland, but conversion to other developed or rural uses are considered threats as well. In Park County, building permits for land containing plover habitat tripled between 1991 and 1997 (Federal Register 1999). Removing land containing plover habitat from BLM ownership would not be desirable if the subsequent use involved habitat conversion. Specific suggestions on how land acquisitions and disposals should be evaluated for impacts to Mountain Plover are outlined in the “Conservation Strategies” section of this report.

Lands and Realty projects involving surface disturbance (e.g., Right-of-Way projects such as road construction and maintenance, pipeline or powerline construction) that are planned for May 15 through July 15 should have clearance surveys for Mountain Plover conducted prior to commencement. These are the dates during which the majority of breeding activity occurs in South Park. If evidence of breeding Mountain Plover is detected within 200 meters⁶ (approximately 200 yards, or 650 feet) of the proposed project site, delaying the project by 30 days would allow for hatching and dispersal from the nest site(s). After 30 days, a second clearance survey would be desirable to detect possible new nesting attempts. Once projects are complete, construction sites should be re-vegetated with native species.

We suspect that placement of powerlines in areas where they bisect open grasslands could influence predation on plover by raptors using the powerlines for perching, and could also influence nest site selection. Although there is currently no citable evidence to support this

⁶ This is the furthest distance from humans that disturbance of plovers has been observed (USDA Forest Service 1994a).

theory, a conservative approach would be to avoid placement of powerlines through Mountain Plover habitat.

Recreation

In an ecological evaluation of Mountain Plover on the PNG, Brockway (1992) suggested that long-term recreational development that increases human access into plover habitat may result in reduced reproductive success and increased mortality. These impacts may result from increased predation along roads and trails, traffic mortality, direct crushing of nest sites, and greater stress on both young and adults when flushed from nests. Potential impacts from existing dispersed recreation on the PNG was not found to be significant. On the PNG, OHV areas in plover nesting habitat are closed from April 10 until October 31 to eliminate disturbance to plover and cattle, and to recover the vegetation (USDA Forest Service 1994b).

In South Park, the majority of recreation on federal lands is concentrated on U.S. Forest Service lands. BLM lands in South Park do not currently receive much pressure from recreation, but there could be permits granted for ATV use, mountain biking, horseback riding, and hiking. BLM lands with nesting Mountain Plover should be closed to ATV use between May 1 and August 15. Mountain biking is more likely to occur on single-track trails than on open grasslands, and would therefore not be expected to affect nesting Mountain Plover. Horseback riding and hiking have some potential to affect nesting Mountain Plover (e.g., flushing birds from nests, disturbing broods). Closures for these activities are probably not necessary given current levels of use, but directing these activities toward areas that are not occupied by Mountain Plover would be desirable. Educational materials and signage would be helpful in directing users how to avoid or minimize impacts. Horseback riders should watch for plovers flying up in the face of horses, and should alter their route if they encounter plovers. Hikers should also be aware of the potential for nesting birds, watch carefully where they walk, and alter their route if birds are encountered. If the level of recreational use on BLM land increases in the future, additional restrictions may become necessary.

Minerals

Available information on potential impacts from mining deals primarily with oil and gas development on the Pawnee National Grasslands in northeastern Colorado. The Final Environmental Impact Statement (USDA Forest Service 1994a) for the PNG's Mountain Plover management strategy identifies a 200-meter (~200 yards, or 650 feet) radius as a disturbance buffer. This is considered a conservative estimate of "how close human activity may be to plover before the species is disturbed."

On the PNG, the highest known density of plover was on the "same quarter section which had supported one operational oil well and associated production facilities for approximately 15 years." A banding study showed that at least 50% of plover returned to nest at the same site the following year. The PNG inferred that low density wells and facilities "typical of the exploration phase" was a compatible management practice, but did not expand this inference to large scale, high density development (USDA Forest Service 1994a).

The primary period for protecting plover on the PNG is April 10 – July 10 (the time during which 90% of the breeding activity occurs). Stipulations for oil and gas development on the PNG include:

- “Drilling, construction of production facilities, and plugging and abandonment of wells during April 10 – July 10 is prohibited.
- Production facilities will be collocated on previously constructed roads, where feasible, to minimize disturbance to the plover and loss of habitat from construction of roads.
- Vibroseis exploration and other prospecting will not be authorized during April 10 – July 10” (USDA Forest Service 1994b).

Stipulations adopted by the PNG for oil/gas development would also be appropriate for oil/gas development and seismic exploration in South Park, except that closure dates for South Park should be from May 1 through August 15. Road grading and construction should be minimized between May 15 and July 15 (during the most active nesting period).

Clearance surveys for Mountain Plover should be conducted prior to any sand and gravel mining projects on BLM lands in South Park between May 15 and July 15. If evidence of breeding Mountain Plovers is found within 200 meters (approximately 200 yards, or 650 feet) of the proposed project site, delaying the project by 30 days would allow for hatching and dispersal from the nest site(s). After 30 days, a second clearance survey would be desirable to detect possible new nesting attempts. Once projects are complete, construction sites should be re-vegetated with native species.

Fire Management

Fire combined with lighter intensity grazing achieves a vegetative structure similar to that produced by heavy grazing alone (Wershler 1989). In 1996 and 1997, the PNG burned 640 acres prior to plover arrival. The burns attracted plover, with 15-40 birds observed in each section burned prior to nesting. Higher nesting densities were recorded after the burns than had previously been recorded on the same sites, but was still lower than densities reported from burns on the Comanche and Cimarron National Grasslands in southeast Colorado and western Kansas (Ball 1997).

In South Park, BLM burned 475 acres on April 18, 2001. Four plovers were observed in the burned area by that same afternoon. Twelve birds were seen in the burn area on the following day. Ten Mountain Plover nests were located in this burned pasture during the 2001 breeding season, and no fewer than two additional broods (from nests that were not found) were also observed. Of those nests found, 70% were successful in hatching at least one young (compared to 50% nest success for South Park in general in 2001). In 2000, prior to the burn, two nests were found in the same pasture, one of which hatched at least one young. The burn was used most obviously in the evenings for foraging. Up to ten adults were commonly observed foraging in loose flocks at dusk during active nesting. Distance sampling in this area in 2000 yielded 13 detections, whereas the same area (now burned) in 2001 yielded 32 detections.

Whether or not the long-term effects of fire on vegetation would be the same as the short-term effects seen in one year is unknown. Additional research and long-term monitoring are warranted.

In South Park, prescribed burning should be done after snowmelt, but before April 20 if possible. Burns are more effective in areas larger than 100 acres.

Wunder modeled the probability of habitat suitability based on local landforms using field-captured presence-absence data (Appendix A). The values contained in the modeled surface represent the probability of a given location providing a landscape setting suitable for plovers. It can be used to maximize effectiveness of burn-site selection (this model was used to select the site for the 2001 burn). A digital version of this model is provided to BLM in ArcINFO GRID format along with this report.

General Disturbance

In general, plover seem 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 during the first few weeks after hatching” (USDA Forest Service 1994a). Disturbance that keeps birds either off the nest or separated from young chicks for longer than approximately 10 minutes may result in egg or chick death (USDA Forest Service 1994a). On the eastern plains, chicks less than 2 weeks old may die if left without shade for longer than 15 minutes in temperatures over approximately 81 degrees F. This is probably not a concern in South Park as summer temperatures are not as hot. Adults may abandon eggs if disturbed while on the nest, and may die from stress (Graul 1975).

In general, plover are tolerant of vehicles at close distances, but show changes in behavior if people get out of the vehicles. The furthest distance at which behavioral change was observed on the PNG was 200 meters (approximately 200 yards or 650 feet) (USDA Forest Service 1994a).

Roads

Some studies have suggested that Mountain Plover may be attracted to roads, especially at night. Other studies indicate that plover are widespread throughout their habitat, and may use roads but do not concentrate on them. There is speculation that roads may serve as predator traps by concentrating plover (USDA Forest Service 1994a).

On the PNG, some birds were found to use graveled county roads. Godbey (1992) speculated that the temperature difference (the roads are 2 degrees warmer than surrounding prairie at night) may be attractive to brooding birds. Mortality from traffic was thought to be a potential issue, especially “during the first two weeks following hatching when response to threat is to freeze instead of running.” Birds were not found to use 2-track or ungraveled roads (USDA Forest Service 1994a).

According to the PNG's FEIS Mountain Plover Strategy (USDA Forest Service 1994a), both Walt Graul and Fritz Knopf believe that there is no evidence to suggest that roads contribute to fragmentation of plover habitat, that road mortality is currently a negligible problem, and that roads do not create predator traps. These comments are based on currently existing roads on the PNG. However, if enough additional roads are built, at some point there would be a negative effect. Data are not available to determine where that threshold may be.

Conservation Opportunities for BLM

Mountain Plover habitat is fairly widespread throughout the valley of South Park, and plovers have been observed in most potential habitat. It should be noted that survey efforts have not been evenly distributed across the potential habitat, and there are a few small areas that have not been surveyed at all. However, at a meeting in March 2001, researchers, conservationists, and government representatives identified four areas as high priority for Mountain Plover conservation: the Sipal Ranch, the vicinity of Reinecker Ridge State Wildlife Area, the Thousand Peaks area, and the area north of Spinney Mountain Reservoir (Figure 8). Note that the relative priority of some of these areas may need to be re-evaluated based on additional information collected during the 2001 field season.

Sipal Ranch and Reinecker Ridge State Wildlife Area

According to the data currently available, it appears that the highest densities and best reproductive success of Mountain Plover in South Park occur on the Sipal Ranch and in the vicinity of Reinecker Ridge State Wildlife Area. Both of these areas are relatively large, unbroken landscapes with simple ownership patterns. Most of the land in and around the Reinecker Ridge State Wildlife Area is already under public ownership (primarily through BLM and the Colorado State Land Board). There are on-going discussions about realty projects in both these areas as government agencies and landowners attempt to consolidate their holdings. Retaining as much active cattle grazing (or elk grazing in combination with controlled burns) as possible in these areas will be an important step in conserving South Park Mountain Plover.

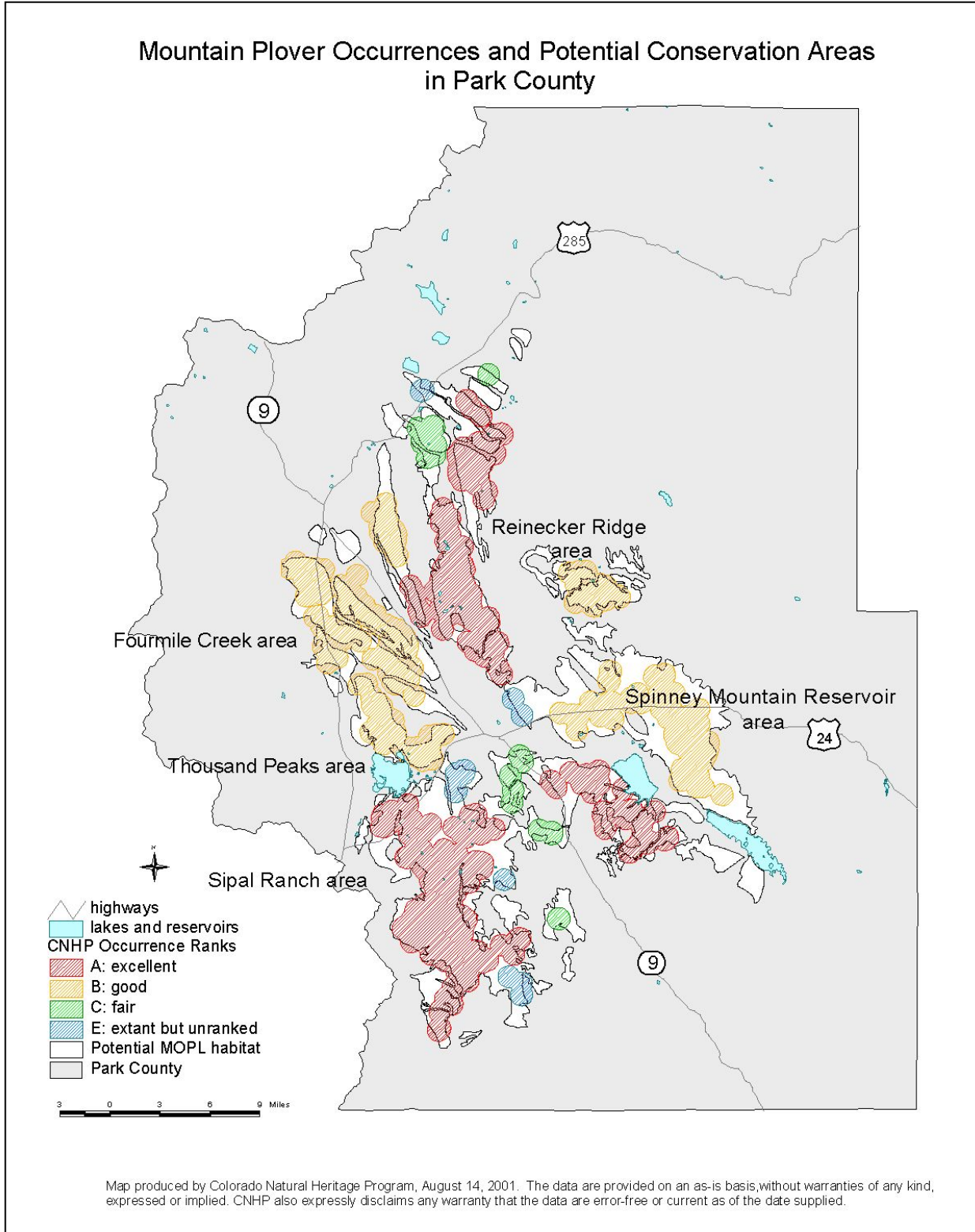
Thousand Peaks

This area currently contains good Mountain Plover habitat and documented nesting birds. However, the area has been subdivided under multiple ownership, and development is already occurring in a piece-meal fashion. If habitat in this area is not protected before a significant number of parcels are built, the future viability of plover in this area is uncertain.

Spinney Mountain Reservoir

The area north of Spinney Mountain Reservoir was originally highlighted as a priority area not so much because it was known to be important, but more because it ranked highly on a potentially suitable habitat model. Field observations in 2001 indicate that there is indeed high quality habitat in this area, and also in the area south of Spinney Mountain Reservoir. The lands north of Highway 24 have been subdivided. If full build-out occurs, the future viability of

Figure 8. Highest priorities for Mountain Plover conservation are in the Reinecker Ridge area and on the Sipal Ranch. CNHP occurrences are based on observation points buffered by home range.



Mountain Plover north of Highway 24 is questionable. However, the area south of the reservoir is part of a large, unbroken landscape that contains some of the best plover habitat in the park. (Note that this may change in the future depending on how the Hartsel Springs Ranch develops.)

Fourmile Creek

Research on reproductive biology during the summer of 2001 indicates that Fourmile Creek is the least productive area of those we studied in 2000 and 2001 (Wunder and Knopf unpubl. data). Nest success on 13 nests discovered in this area was 30%, compared with 52% for the rest of the nests in the park (Wunder and Knopf unpubl. data). Also, much of the Fourmile Creek area lacks the shrub component that is found throughout most of the suitable nesting habitat in the park. Known plover nesting in the Fourmile Creek area is confined to the two distinct locales where rabbitbrush occurs. The cumulative acreage in these two areas is approximately 400 acres. If Mountain Plover conservation is planned for this area, management needs to be directed to promote shrub growth. It is not currently known whether or not these shrubs increase with grazing, or if these shrubs need relatively more water. The soil in this area is quite rocky and porous, and conducive to quick drainage. Increasing the moisture levels to promote shrub growth may not be feasible. Additional research, especially on rabbitbrush biology, is needed prior to expending large resources on conservation in this area.

Conservation Strategies

Consolidation of land holdings is one of BLM's primary management goals for South Park in the near future. In fact, how BLM approaches land reconfiguration will probably have greater impact on conservation of Mountain Plover in South Park than any single other land management activity that BLM might undertake, except possibly range management. Of course, grazing in BLM allotments within Mountain Plover habitat should be managed to maintain vegetation height, bare ground, and shrub components suitable for breeding Mountain Plover. Fire management will likely be a useful tool for maintaining Mountain Plover habitat as well. At this time, significant pressures from recreation, travel management, and mineral exploration are not being realized on BLM lands in South Park; nor are undue pressures from these activities anticipated in the foreseeable future. Therefore, the suggested conservation strategies listed below largely focus on possible approaches to realty transactions.

It is apparent from discussions with BLM and the U.S. Fish and Wildlife Service that the overall approach BLM takes to land reconfiguration will be important from both regulatory and conservation perspectives. One approach would be to evaluate potential realty transactions on a parcel-by-parcel basis by comparing numbers of documented nests, numbers of birds, etc. This type of evaluation at some scale will be useful, and in fact, will probably be unavoidable given regulatory restrictions on incidental take. However, we caution against relying solely on parcel-specific evaluations of realty projects for these reasons:

- Although in general Mountain Plover are known to nest in the same areas from year to year, it is not necessarily true that *most* birds will re-nest on the *exact* same sites used in previous years. Nesting birds need the ability to move around within the general vicinity from year to

year, depending on local conditions. Therefore, the number of nests documented on any given parcel one year will not necessarily be the same in subsequent years. Also the number of nesting attempts on a particular parcel may not be directly correlated with nesting success in any given year.

- While data certainly exist to document where nesting has occurred during the past few years, inventory efforts have not been evenly distributed across potential habitat. The absence of data documenting nesting birds on a particular parcel does not necessarily mean that birds aren't there.
- Realty transactions undertaken by BLM will not be conducted in a vacuum. Development in South Park is expected to proceed at high rates over the next 10-20 years. Each land deal in the valley will have some impact on the quantity, quality, and distribution of Mountain Plover habitat. So, while it is possible to make some judgments about which BLM parcels are more significant to Mountain Plovers than others today, these judgments may change as surrounding land use changes. In addition, BLM must also look at other resource values in South Park when acquiring lands - i.e., riparian values, the existence of fens, public access issues, range and wildlife habitat management considerations, and the consolidation of public lands into manageable blocks.
- Protection of habitat based on land ownership may not be sufficient without abatement of threats at a landscape scale. Conservation of birds only on BLM lands will not protect South Park Mountain Plover. If the goal is conservation of the *population*, then regional issues such as the future of the grazing industry in South Park, impacts from water development projects, and countywide patterns of residential and commercial development (including the myriad of associated indirect impacts) will need to be addressed in a comprehensive way.

Therefore, we recommend that BLM place high priority on working with Park County, the U.S. Fish and Wildlife Service, Colorado State Land Board, Colorado Division of Wildlife, as well as landowners and other local stakeholders, to develop a coordinated conservation plan for Mountain Plover in South Park. Momentum for conservation is high in the county, and there are several initiatives already underway that could serve as the foundation for coordinated, strategic conservation planning. We believe such an approach would be more effective and more efficient in making a significant, lasting contribution to the preservation of this species than will likely be achieved if each party acts in isolation.

Based on the data currently available, our recommendations on specific strategies to maximize BLM's contribution to the conservation of South Park Mountain Plover are:

1. **Overall, construct BLM realty transactions such that there is no net loss in either quality or quantity of Mountain Plover habitat in either BLM ownership or in some other protected status** (e.g., conservation easement or other tool that achieves perpetual conservation).
2. **In designing realty projects, evaluate relationship among parcels to be sold or traded, other publicly owned lands, and subdivided private lands** (shown in Figure 9). Ideally, BLM lands should be consolidated such that large blocks of public lands are near or adjacent to large working ranches and other conservation lands, and away from subdivided land that will presumably undergo development. This would maximize BLM's (and ranchers') ability

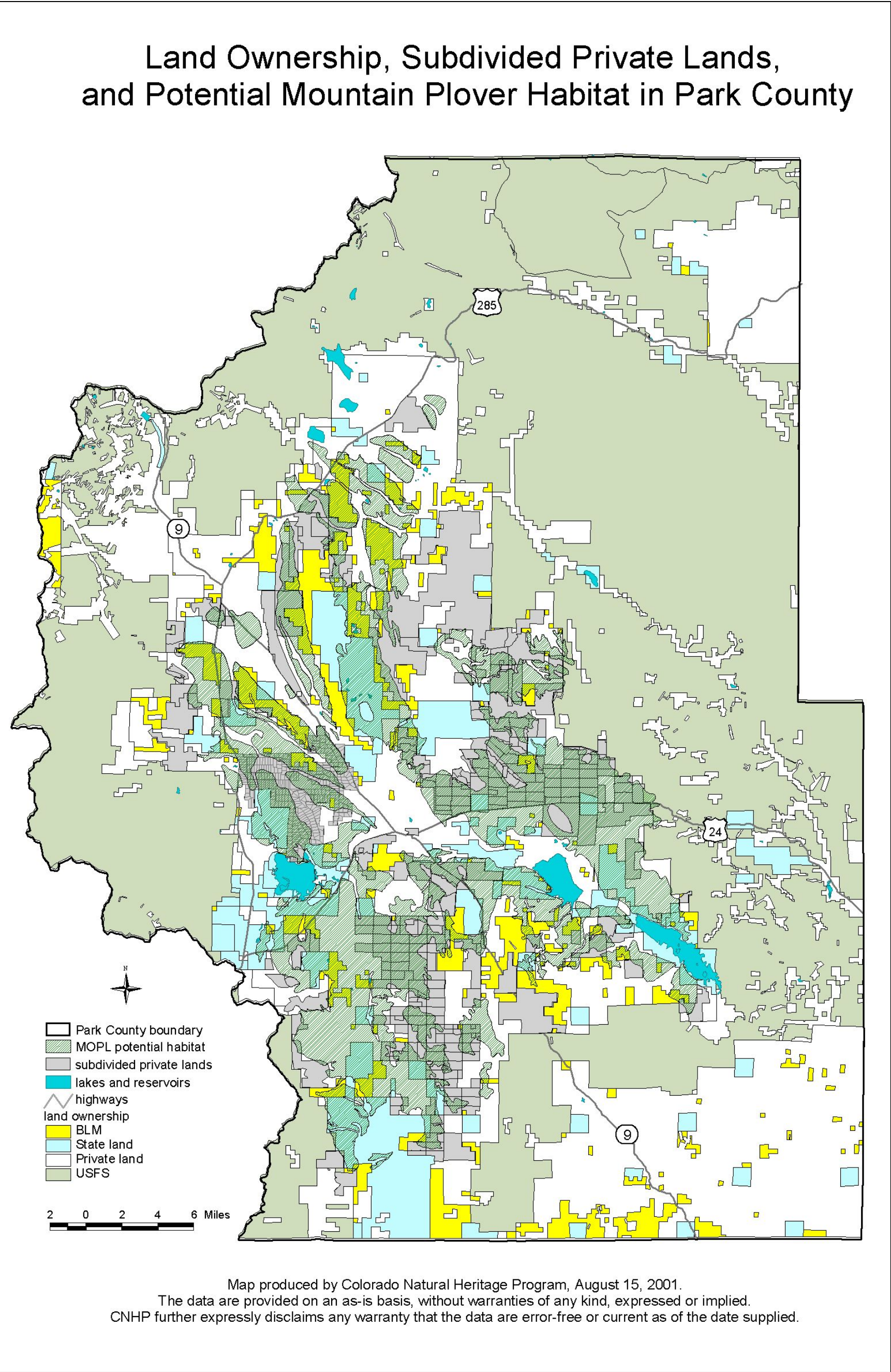
to manage rangeland to the benefit of Mountain Plover, and would also ease private ranchers' conflicts with neighboring private landowners (i.e., right to farm issues).

3. **Work with the Colorado State Land Board, the Colorado Division of Wildlife, and neighboring landowners to ensure that all lands containing high priority habitat in the Reinecker Ridge area are consolidated and managed for wildlife values (including Mountain Plover).** We believe that this is the single best contribution the BLM can make to Mountain Plover conservation in South Park at this time.
4. **Ensure that any BLM lands sold or traded within the Sipal Ranch are exchanged for lands containing Mountain Plover habitat elsewhere in the park. Conserve Mountain Plover habitat on the Sipal Ranch through conservation easements where appropriate.** It will also be important to work with the other relevant parties to design any realty projects so as to maximize the likelihood that the Sipal Ranch remains a working cattle ranch.
5. **Consider the area south of Spinney Mountain Reservoir for potential land consolidation, and/or ensure that continuance of grazing leases maintains grasslands in their current condition.** There is an existing bison herd there, the area is well grazed, and a fair number of Mountain Plover are doing well reproductively. This area is a continuation of the Sipal/Hartsel landscape complex. The future may look different depending upon how the Hartsel Springs Ranch develops. If houses are built on ridges among trees, impacts to plover habitat will be minimized. If houses are built in the grasslands between the Sipal Ranch and Spinney Mountain Reservoir, birds in these two areas will be segregated.
6. **Coordinate with other conservation practitioners working in South Park to consolidate protected lands (e.g., those under conservation easement, fee title held by conservation organization) in Mountain Plover habitat.** Support land protection projects proposed by other entities that assist in protecting high priority Mountain Plover habitat, or that assist in buffering and blocking BLM parcels.
7. **Explore the possibility of using money from the sale of BLM parcels in Park County that do not contain Mountain Plover habitat to buy other parcels in priority plover conservation areas.** If controlled use of funds is not an option, consider using non-habitat parcels strategically to trade for high-quality habitat parcels elsewhere in Park County.
8. **Consider burning in potentially suitable habitat where grazing isn't an option to increase the amount of high quality habitat available to Mountain Plover on lands managed by BLM.**

Future Research Needs for Mountain Plover in South Park

- Investigate causes of nest mortality (predator community, moisture/temperature effects, etc.).
- Investigate habitat requirements of rabbitbrush (*Chrysothamnus sp.*) in the grasslands of South Park. A better understanding of rabbitbrush biology is needed in order to better manage breeding habitat for Mountain Plover.
- Determine home range and territory size as related to productivity.
- Investigate responses of breeding plovers to changes in land use on adjacent lands.

Figure 9. Evaluation of disposal parcels should consider Mountain Plover habitat, as well as proximity to subdivided lands and other public or conservation lands.



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APPENDIX A

Landform-based spatial probability modeling for Mountain Plover in South Park, CO (Figure 10)

Michael Wunder, Colorado Natural Heritage Program
May, 2001

MODEL TECHNIQUES

These data were modeled using field-captured survey and observation data in a presence-absence stepwise logistic regression model. I first converted plover observations and survey routes from 1995 and 1998 field efforts into a GRID format at 30-meter resolution (to match the resolution of the digital elevation model). Points representing observed plovers were buffered to 422 meters. This distance represents the radius of the reported average home range (56 hectares) for mountain plover. These “home ranges” were then incorporated as “presence data” into the driving data set. Transects were buffered to 120 meters. Program DISTANCE provided this range as the optimum detection distance (Effective Strip Width) for plovers observed in 1995 and 1998. Transects that intersected observations of plovers were then deleted from the data set. The remaining transects were those on which no plovers were observed. These remaining buffered transects then represented “absence data” for incorporation into the model. This resultant presence-absence data set represented the dependent variable.

I then extracted slope, aspect, and elevation from a standard 30-meter resolution digital elevation model. These were the independent variables. I did not use any vegetation model as an independent variable since sampling was stratified based upon vegetation class (short-grass), and because geomorphic attributes can be used to approximate potential vegetation.

I then spatially sampled all the independent variables using (a randomly selected) 25% of the presence-absence data and analyzed the data using SAS (Statistical Analysis Software). Fitting the data into a stepwise logistic regression revealed parameter estimates for the intercept and all independent variables to be significant at alpha levels from 0.0001 to 0.02.

Using the Spatial Analyst extension for ArcView, the resultant parameter estimates were then back transformed from the logit scale and integrated with the independent variable grids. I masked this analysis using a grid derived from potential habitat and thematically mapped short-grass vegetation (from satellite imagery). The potential habitat map was digitized at 1:24000 and was delineated using aerial photography to determine areas of short-grass and using 7.5 minute topographical maps to determine areas of gentle ($<10^\circ$) slopes.

This produced a continuous surface (model) of probability of suitable habitat for the study area. I then used another random sample of the remaining 75% of the original data as well as observation data from years other than 1995 and 1998 to validate the model. A comparison of positive data from 1995 and 1998 (that were not used to derive the model) with positive data from other years yielded no significant differences ($t=0.533$, $p=0.5945$ $df=798$). That is, the model effectively predicted the probabilities of new positive data. Further, when I compared the predicted probabilities of positive data from 1995 and 1998 (not used to derive the model) with predicted probabilities of negative data from 1995 and 1998 (again, not used to derive the model), I found that the model predicted significantly lower probabilities for the negative data than for the positive data ($t=4.064$, $p<0.0001$ $df=792$).

In summary, the model will show the user the probability of suitable habitat potential for any given area within South Park. The estimate is derived from field observations and examines physical characters of the landscape (landforms). By using this model in conjunction with knowledge of the local vegetation, management activities can be guided to promote more suitable vegetation in areas where local landform provides for suitable landscape settings.

SUGGESTED USES

Areas of interest can be spatially identified in a GIS and then used as a basis for comparison amongst each other using the values of the model. That is, average (or median, or modal) values can be obtained from the model for each parcel of interest. This will assign a relative “significance” value for each parcel. However, I would not suggest using this alone, since the size of parcels will have bearing on the comparative value of interest. When we find situations where we have large parcels, but the entire parcel is not known as occupied, interpretation problems arise. Specifically, if values are weighted based on area of the parcel (equal area option in AV), then we over-rate the parcel, whereas if we use the data distributions themselves (natural breaks option in AV), we under-rate the parcel. If the intent is to obtain categorical values for the range in values from the model, my advice is to obtain a value for each parcel of interest and then to use that value in conjunction with the observation and nest data, such that sub-parcel areas of actual significance are recognized, and a complementary value for the remainder of the parcel is assigned for relative comparisons. Otherwise, it might be just as easy to look at the observed data to get sub-parcel areas of significance, and then be able to look at the full range of values for the predicted probability of use from continuous data (the model un-grouped).

Finally, the model may prove useful for the identification of areas suitable for management action. This tool may help select areas that offer the greatest probability of success in vegetation-altering management activities (grazing, burning, etc.). Since the model is based on landform only, one might test the notion that the limiting factor then for any parcel is vegetation height or density. This would be a relatively straightforward test and can be done on relative scales. That is, parcels can be experimentally treated and then the relative response can be measured and compared with the relative probability from the model.

Figure 10. This model can be used to identify areas where management tools such as fire could improve plover habitat.

