SPECIES ASSESSMENT FOR MOUNTAIN PLOVER (*CHARADRIUS MONTANUS*) IN WYOMING

prepared by

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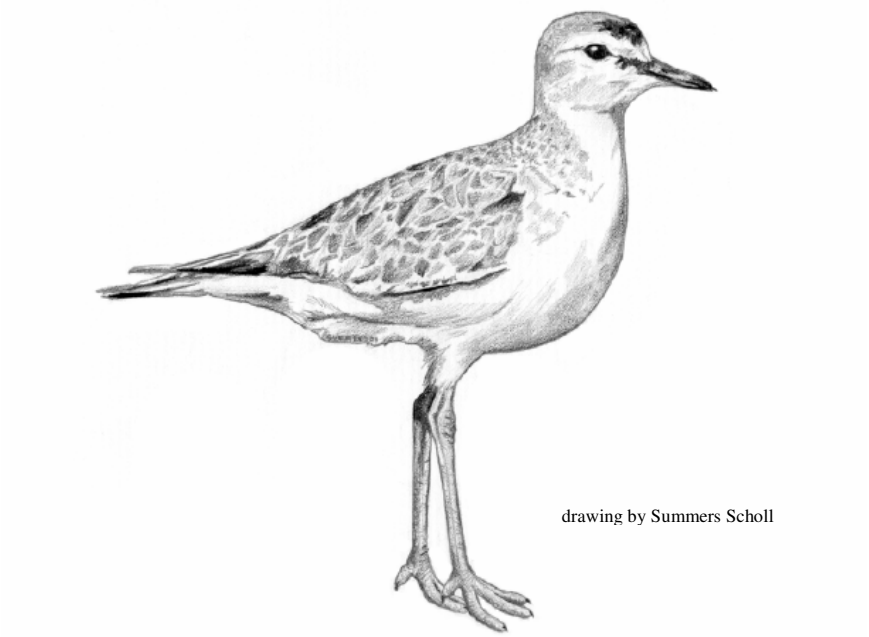

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Introduction

The Mountain Plover (*Charadrius montanus*) is and endemic shorebird species which breeds in grassland and shrubsteppe habitats of the western Great Plains and Colorado Plateau. Occurrences of this species in Wyoming are constrained to breeding and migration seasons. First described in 1837 by J. K. Townsend, from the tablelands of the Rocky Mountains in the region of the Sweetwater River, Wyoming (AOU 1983), this species is locally common and has been detected in every county of Wyoming. The Mountain Plover was proposed for listing as threatened under the Endangered Species Act by the U. S. Fish and Wildlife Service in 1999. The proposal for listing was withdrawn in 2003, as perceived threats to the species and available habitat were deemed not as serious as perceived at the time of the petition, and do not pose an imminent threat to the survival of this is species in all or a significant portion of its range. Recent research has identified five Mountain Plover breeding areas of noteworthy concentrations in the Laramie, Shirley, Washakie, Great Divide, and Big Horn Basins. The species occurs regularly elsewhere at lower densities, yet breeding hot spots may remain to be found. Wyoming is host to roughly 25 percent of the North American breeding population of 8,000 to 10,000 birds. The Wyoming Partners In Flight Wyoming Bird Conservation Plan (2003) lists the Mountain Plover as a species of highest conservation priority, a species in immediate need of conservation attention. Habitat loss, fragmentation, and alteration of historic grazing and disturbance regimes have resulted in a significant, long-term decline of this species. Conservation of this species in Wyoming must focus on protection of suitable habitat, improved species inventory and monitoring, and vigilant ongoing assessment of impacts from landscape changes associated with natural resource development.

Natural History

Morphological Description

The Mountain Plover is a rare endemic shorebird found in upland habitats of the western Great Plains. Once coined as the "Prairie Ghost", this species can blend seamlessly into the prairie landscape, a tactic often employed to avoid detection (Plumb 2004). The plumage can be quite cryptic, lacking the distinct black breast bands commonly seen in congeners such as the Killdeer (*Charadrius vociferus*). Like Killdeer, the Mountain Plover is often found far from water yet is distinguished by upright posture, longer legs and a comparatively shorter tail (Knopf 1996, Sibley 2000). On average it is 21 centimeters (8 inches) in length, similar in size to the Killdeer. Mountain Plovers are monomorphic, and unless supported by behavioral cues, cannot reliably be classified to sex in the field (Dinsmore 2003).

The alternate or breeding plumage of adult Mountain Plovers is attained almost entirely in the first spring after hatching (Figure 1). First year birds retain some scapulars and upper-winged coverts from Juvenal plumage, noted for pale edges and dark subterminal bands, lending a scalloped appearance to dorsal feathers (Knopf 1996). Breeding birds experience partial Prealternate molt in spring prior to departing from the wintering grounds. Distinctive head and facial features include white forehead, and supercilium, fading into buffy hindneck and side of face. Black feathers form a broad forecrown bar and loral stripe. Black feathers in the lores connect the dark eye, and black bill in a distinctive line. Mantle, upper breast and flanks have a buffy orange hue contrasting the all-white belly and under wing. Ventrally, drab-brown feathers of the back and upper wing contrast against a dark, subterminal tail patch. Dark flight feathers which lighten towards a white base in the primaries and secondaries, give the impression of a faint, white wingstripe. Legs are pale brown.

Wintering adult birds attain Definitive Basic plumage prior to migration, between mid-June (CO) and mid-August (Knopf 1996), it is retained through mid-February. The basic plumage is similar to the alternate plumage, without the distinctive patterning of dark feathers on the forehead and lores, and lacking the buff color in the body.

Taxonomy and Distribution

The species *Charadrius montanus* (Order Charadriiformes: Family Charadriidae) is a North American shorebird, first described in 1837 by J. K. Townsend, from the tablelands of the Rocky Mountains in the region of the Sweetwater River, Wyoming (AOU 1983). Relationships between the families of the order Charadriiformes have not been fully resolved. The traditional alignment of this order includes the Shorebirds, Gulls, Auks, and Allies. The Family Charadriidae consists of the Lapwings and Plovers. Dinsmore (2003) reports that the closest relatives of the Mountain Plover are the Caspian Plover (*Charadrius asiaticus*), and the Eurasian Dotteral (*Eudromias morinellus*). In the Check-list of North American Birds (AOU 1983) it is noted that the Mountain, Caspian, and Oriental Plover (*Charadrius veredus*) appear to constitute a superspecies. There are no recognized subspecies of the Mountain Plover.

The Mountain Plover is one of twelve endemic birds of the western Great Plains (Mengel 1970). As a short to mid-distance migrant it has very distinct breeding and wintering grounds. The Mountain Plover's breeding range includes short-grass prairie characteristic of the western Great Plains and tablelands of the Rocky Mountains. The core of the breeding area occurs in east central and central Colorado, central Wyoming, and eastern Montana. Mountain Plovers are less common and breed locally in northern Mexico, the Davis Mountains of West Texas, Arizona, northern New Mexico, western Oklahoma, southwestern Kansas and southwestern Nebraska, west through

Colorado to northeastern Utah. On the periphery of the species range; Mexico, Texas, Utah and extreme southern Alberta, the Mountain Plover is very scarce (Dinsmore 2003).

In Wyoming, Mountain Plovers have been documented in every county. They are suspected or confirmed to breed in 19 of 28 latilongs by Dorn and Dorn (Figure 2, 1999). Nests, or young dependent upon parental birds, have been confirmed in 18 of 28 latilongs, with breeding suspected in an additional two, according to the Wyoming Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (Figure 3, Cerovski et al. 2004). In conducting research on Mountain Plovers in Wyoming, Plumb (2004) visited all known breeding locales in the state and identified five areas of bird concentration in the Laramie, Shirley, Washakie, Great Divide, and Big Horn Basins. Given the threats on a regional scale to plover habitat, the lesser extent of cultivation and urbanization in Wyoming will play a significant roll in the future conservation of this species.

Habitat Requirements

General

Many attributes of Mountain Plover habitat recall landscapes of an earlier era. This species nests in a region historically impacted by a variety of herbivores, including prairie dogs (*Cynomys* spp.), bison (*Bison bison*), and pronghorn (*Antilocapra americana*), wherein heavily grazed or similarly disturbed landscapes met nesting habitat requirements. Across the species' range, Mountain Plovers occupy sites in vegetation shorter than that of the surrounding area. Another characteristic of suitable habitat is flat topography, open expanses with exceptional horizontal visibility. These conditions are met on flat tablelands, prairie-dog colonies, alkali flats, agricultural fields, or heavily grazed sites, especially in regions where taller grasses dominate. Habitat in the western periphery of the breeding range of the Mountain Plover is found in xeric, shrubland communities of mostly bare ground, saltbush (*Atriplex* spp.) and sagebrush (*Artemisia* spp.). Such

habitats are often occupied by white-tailed prairie dogs (*Cynomys leucurus*; Ellison-Manning and White *in* Dinsmore 2003).

Habitats often reflect some measure of disturbance, be it through fire, presence of digging or burrowing mammals (prairie dog towns on the breeding grounds, kangaroo rat (*Dipodomys* sp.) precints or Califoria ground squirrel (*Spermophilus beecheyi*) colonies on the wintering grounds), or anthropogenic factors. It has been suggested that in the principle nesting habitats of the native short- and mixed-grass prairies, heavy grazing by cattle or sheep is a similar landscape-level surface disturbance conducive to plover breeding.

Breeding

Widely dispersed, free-ranging herbivores in conjunction with landscape-scale ecological drivers, including drought and fire, shaped pre-settlement breeding habitat of the Mountain Plover. Today, native grasslands with substantial areas of bare ground are habitat for breeding plovers, yet vary in availability across the species range. The consistent variable across breeding habitats is flat expanses of available bare ground, the suggested minimum for most sites being 30% (Knopf and Miller 1994). Minimal slope is an important factor as well, as plovers seek habitats of slope ideally ≤ 5 degrees (Parrish et al. 1993). Further north, greater horizontal visibility and shorter vegetation found on prairie dog towns, appear to be "islands" of suitable habitat in an otherwise unsuitable area (Olson and Edge 1985). In areas where native habitat has been converted to croplands Mountain Plovers will nest on tilled or fallow fields with little or no vegetative cover (Knopf and Rupert 1999, Shackford et al. 1999).

The nesting microhabitat in short-grass prairie ecosystems is generally composed of blue grama grass (*Bouteloua gracilis*), sometimes mixed with buffalo grass (*Buchloe dactyloides*) or western wheat grass (*Agropyron smithii*; Knopf 1996). Disturbed or sparsely vegetated sites can

include sod farms or cultivated fields. Semi-desert or shrub-steppe habitats are characterized by taller vegetation on the landscape scale, such as saltbush and sagebrush, with little or no understory. In xeric shrublands, nesting plovers always select nest sites with shorter vegetation than surrounding habitat (Dinsmore 2003). Surface water or wet soils are rarely found in the vicinity of nesting plovers.

Several studies advance the hypothesis that Mountain Plovers may select nest sites in close proximity to conspicuous objects. Nesting near such prominent objects on otherwise flat expanses may make nests less conspicuous to predators. Availability Graul (1975) first documented this phenomenon, reporting that 55% of observed nests were located within 30 cm of a manure pile. Knopf and Miller (1994) observed 49% of plover nests were placed near a manure pile or rock, and Olson and Edge (1985) reported nests on prairie dog towns in Montana were near a rock 8 cm or more in diameter. In Wyoming Parrish et al. (1993) found a significant correlation between plover nest sites and proximity to vehicle and animal tracks. An unusual corollary to this behavior, noted by Knopf and Miller (1994) is that Mountain Plovers will select nest sites with fewer prickly pear cactus (*Opuntia polyacantha*) in the immediate vicinity, relative to the surrounding landscape.

Breeding in Wyoming

This section is based primarily on the M.S. thesis research of Plumb (2004), chapters of which are in preparation for publication. This work summarizes a two year effort to locate as many Mountain Plover breeding territories as possible, and therein improve knowledge of the ecology of this species in the state. Previously, the breeding population was assumed to be somewhere between 500 and 1,500. This study provides evidence that there may be greater than 3,000 breeding birds in the state.

Concentrations of breeding plovers in Wyoming were located in both grassland and desert-shrub habitats. Grazing was pervasive, evident at all grassland sites and most desert sites, predominantly by domestic cattle and sheep, and less regularly by pronghorn and wild horses. Habitat in the immediate vicinity of nests (n=55), showed that on average cover was 53% bare ground, greater in xeric landscapes. Previous work in the southern Powder River Basin (Campbell, Converse, and Weston Counties of Wyoming) by Parrish et al. (1993) reported even greater bare ground cover (72%) at nest sites. A noteworthy landscape feature reported in the Plumb (2004) thesis was that 62% of nest sites were located on elevated plateaus, at least 100 meters higher in elevation than the surrounding area.

Affinity for nesting on prairie dog towns appears to be most common in mixed grass prairies of Montana, where horizontal visibility and amount of bare ground areas were much greater (Knowles et al. 1982). Parrish et al. (1993) located one out of fifteen nests in the Powder River basin on a black tailed prairie dog town. The Plumb (2004) study shared similar findings, noting that there was less affinity for nest site selection on prairie dog towns in Wyoming as compared to Montana. Black-tailed prairie dogs were present on 17 of 32 (53%) grassland sites and white-tailed prairie dogs were present at 3 of 23 (13%) desert sites.

Winter

The vast majority of wintering Mountain Plovers are found in the interior lowlands of southern and central California. Currently the majority of birds winter in the Sacramento, San Joaquin, and Imperial Valleys; however there has been a noticeable shift in distribution of wintering plovers away from urbanized coastal habitats to inland agricultural landscapes. Winter habitat in the Imperial Valley appears to be agricultural fields under various phases of cultivation. Wunder and Knopf (2003) found that during a January survey for Mountain Plovers, grazed alfalfa fields and

crops such as Bermuda grass and asparagus, burned after harvest, were the areas most heavily used. Plovers will not occupy any landscape in winter where cover height exceeds 20 centimeters (Wunder and Knopf 2003). Mountain Plovers are now only rare visitors to historic, coastal wintering grounds throughout the dry plains west of Los Angeles (Wunder and Knopf 2003). Distribution outside of California in winter is poorly known; however, similar wintering habitat is reported from Texas including coastal prairies, alkaline flats, plowed fields, and Bermuda grass fields (Knopf 1996).

Area Requirements

Home Range

Home range for breeding Mountain Plovers is influenced by the precocial nature of hatchlings. Chicks are capable of rapid movement away from the nest soon after hatching (Graul 1975), and have regularly been found up to 2 km away from the nest site within two to three days of hatching (Knopf and Rupert 1996). Adult plovers, which have raised a brood to fledging, have an average home range of 56.6 ± 21.5 ha (range 28-91), often moving in excess of 300 m/day (Knopf and Rupert 1996). It is concluded that the minimum-area requirement for plover broods, based on this study, is 28 ha (Dinsmore 2003).

Density Estimates

Assessments of Mountain Plover area requirements are based on research in areas of known concentration. Across the species range populations tend to be scattered and localized, and species densities are highly variable. In South Park, Colorado, a discrete population of Mountain Plovers, distributed over approximately 80,000 ha of relatively intact, high elevation prairie exists. This landscape experiences moderate to heavy grazing, condition which is assumed to be relatively unchanged since the 1860's. Density of Mountain Plovers over three years of surveys was 7.9 ± 0.9 (SE) breeding adults km^{-2}. Current estimates of plover densities tend to be slightly lower in

eastern Colorado, and northern states of the plover's range. Knopf (1996) reports densities of 1.3 to 6.8 plovers km^{-2} in habitat associated with black tailed prairie dog towns of Montana, and 4.7 birds km^{-2} on the Pawnee National Grassland in Colorado, prior to more recent declines.

In Wyoming, Plumb (2004) calculated a global density estimate of 4.47 ± 0.55 birds km^{-2}, by averaging 12 explanatory models based on areas of relatively high concentrations of plovers. In predominantly grassland habitats, average density of plovers was 5.17 birds km^{-2}. Density was slightly lower in desert-shrub habitats, 4.23 birds km^{-2}. During this study many areas of low plover density were encountered; hence, it requires further research to determine correlations between landscape and variation in density across the state-wide breeding distribution of the species.

Landscape Pattern

Physiographic attributes of Mountain Plover habitat are met in a wide range of settings, and across a broad elevational gradient. The native habitat occurs from 640 m in eastern Montana to in excess of 2,500 m in south-central Colorado (Knopf 1996). Landscape pattern is more evident where it can be tied closely to the presence of burrowing mammals, such as in Montana, where suitable nesting habitat is scarce and it is believed Mountain Plovers are almost entirely dependent upon prairie dog towns (Olsen-Edge and Edge 1987, Dinsmore 2001). In semi-desert sites, where habitats are dominated by scattered shrubs, such as those of the genera *Atriplex* or *Artemisia*, breeding plovers are more likely associated with presence of burrowing mammals than in the core of the breeding range. Plumb (2004) reports that 34 of 55 nest sites in Wyoming were located on elevated plateaus at least 100 meters higher than surrounding habitats. The remaining 21 nests were in either broad basins or on high plains.

The habitat patterns (*see* Habitat Requirements; General, Breeding) vary in terms of cover type, yet remain consistent in terms of slope, % area of bare ground, and reduced cover height of

native grasses, either through grazing or other forms of disturbance. Such parameters in the native ecosystems of the Mountain Plover were historically impacted by drought, fire and grazing by native herbivores. The homogenization of the natural variability throughout the shortgrass prairie and shrub-steppe has invariably changed the historic landscape pattern around Mountain Plover breeding habitat (Samson et al. 2004). Beyond general habitat associations and minimum area requirements, optimal spatial arrangement of suitable plover habitat across the landscape is unknown (Dinsmore 2003).

Movement and Activity Patterns

Daily Activity

The early morning hours are when foraging activity is highest (Knopf 1996). Much of what is reported about daily activity, otherwise, has been reported in terms of adult time investment during nesting and brood rearing. Detailed observations by Graul (1975) show an increase in attentiveness to the nest until hatching. While laying, adults appeared to attend to the unfinished clutch in the event of rain or extreme direct sun. Overall average of daylight time spent on the nest ranged from 42.3% - 57.7%, low in comparison to the other Charadriidae (Graul 1975). Prior to fledging, chicks are brooded in the early morning hours. During the heat of the day, adults and chicks of all ages seek means of shading, at which time adults will shade chicks if other sources of shade are lacking. As the afternoon heat subsides birds will leave protection of shade and commence foraging (Graul 1975).

Broad-scale movement patterns

Mountain Plovers are mobile during the brood rearing phase of reproduction, estimated home range of an adult, bringing at least one chick to fledging, is 56.6 ± 21.5 ha (Knopf and Rupert 1996). The large estimated home range during brood rearing is a function of high mobility of

precocial chicks, as illustrated in daily movement of broods, which can vary from <100 m/day to >1000 m/day, $\bar{x}$ = 337 ± 46.5 m/day (1993) and 298 ± 41.9 m/day (1994; Knopf and Rupert 1996). It is not uncharacteristic of broods to move between native prairie grasslands and cultivated fields during this period (Knopf and Rupert 1999).

The Mountain Plover undergoes annual short to mid-distance migration. In summer, as young of the year approach fledging, birds begin to coalesce into small flocks, seen as early as mid-June in Colorado (Graul 1975), but growing in size until mid-August. The mode of migration is much different between autumn and spring. The southbound migration is a prolonged flight, in contrast to the direct, possibly non-stop return flight to breeding grounds in the spring (Knopf and Rupert 1996). There is latitudinal variation in departure date, as birds in the northern extent of the range exit north-central Montana by late September, Wyoming and the central part of the range by mid-October, and breeders from the southern extent of the range exit by late October (Dinsmore 2003). Migration routes of the Mountain Plover are poorly known, yet flocks frequent landscapes similar to those used during breeding and wintering (Knopf 1996).

In winter birds are highly mobile (Knopf 1996). On the wintering grounds, distribution across habitats is influenced by precipitation patterns and cover height. Wintering flocks range from 2 to > 1,100 individuals throughout the winter. These assemblages are considered loosely organized, with birds arriving and departing freely, as no two birds captured together were ever relocated together (Knopf and Rupert 1995). There is no evidence of spatial constraints on movements between areas of suitable habitat during winter. There is evidence that some wintering birds are capable of long distance movements (>90 km), yet, the majority of wintering plovers displayed nominal local movements (of 44birds, mean movement of 38 birds equaled ≤ 1.6 km/day (Knopf

and Rupert 1995). Departure from the wintering grounds of California is nearly complete by early March, from which birds are assumed to make direct flights to breeding grounds.

Reproduction and Survivorship

Breeding Behavior

There is evidence that a loosely colonial behavior is expressed by Mountain Plovers. Graul (1975) observed that the spatial relationship between nests on the landscape in northern Weld Co. (CO) were not random. Similarly, some nesting birds in South Park, CO were observed to be "passively aggregated", although not truly exhibiting colonial behavior (Knopf 1996). There also appears to be "clumping" of nests on prairie dog colonies in Montana (Dinsmore 2003).

In early courtship, territorial males react aggressively towards other males, and females will chase other females (Graul 1973). Although territories were not mutually exclusive, Graul (1973) observed males (n=3) defending territories of approximately 16 ha. Mountain Plovers are exceptionally territorial against nest area intruders. Researchers were unable to flush territorial adults from black tailed prairie dog towns on the Charles M. Russell National Wildlife Refuge, Montana (Olsen and Edge 1985).

Graul (1973) conducted extensive observations of the Mountain Plover social system. There is a diverse array of territorial or agonistic behaviors, courtship rituals, and predator defense postures. Males defend territories from intruders or even a mate by horizontal threat display. A slow, gliding motion in a squat posture, with wings drawn in, tail flattened, and head pulled back. If pursuit results in an aerial chase, males often return by floating back to the ground, wings in a deep V, in the falling lead display. Territory boundaries are defended or contested between males in parallel run displays or upright threat displays. Neighboring birds commonly engage in parallel

runs, at ± 1 meter distance, often for > 10 minutes. During runs, birds will abruptly stop, and face on another in an upright position for 10 to 15 seconds.

Breeding Phenology

Courtship

Males will display scraping behavior on territory. Numerous nest bowls are created in a methodic pushing of soil with the legs, while the breast is pressed to the ground while alternating position in the scrape, the male signals with his tale. Additional courtship displays include bowing, tilting, rapid throwing of nest material along the side of the body, and scrape exchanges wherein one individual is replaced at the empty scrape by the other.

Pair Formation

Although some Mountain Plovers may be paired upon arrival to the breeding grounds, arriving flocks tend to break up into breeding pairs within a few days of arrival (Knopf 1996). Regionally, loose flocks of birds arrive on the breeding grounds in Wyoming in April and early May (Plumb 2004). Birds arrive earlier at lower elevations and further south, such as northern Colorado, where migrant flocks arrive on the breeding grounds in mid- to late March (Graul 1975, Knopf and Rupert 1996). Pair bonds appear to be somewhat weak in comparison to other plovers, as copulation is less frequent and agonistic behavior does occur between mates (Graul 1973). Generally considered monogamous, there is recent evidence that polyandry occurs among Mountain Plovers (Dinsmore 2003). Graul (1973 *in* Dinsmore 2003) described the only known instance of polyandry. Commonly, the male will incubate a first clutch, and the second will be incubated by the female, in a breeding system described as rapid multiple-clutch, although it is unknown what percentage of pairs will produce two broods. If a pair produces two broods, each adult will tend a single nest, and remain with the brood through fledging (Dinsmore 2003). Graul (1976) suggests the production of multiple clutches may be a response to food fluctuations, or

overall beneficial ecological conditions. McCaffery et al. (1984) suggest that elements of both polyandry and polygyny could be incorporated in the rapid multiple-clutch mating system, as males of a pair may court or mate with alternate females prior to incubation of the first clutch. Polygyny, however, has not been reported from Mountain Plovers to date.

Nest-building

During courtship males excavate several nest scrapes. Scraping is a common courtship display (Graul 1973). After the clutch is complete, the otherwise fully exposed nest is lined until eggs are nearly half buried (Figure 4). Lining materials include lichens, plant matter, and dry chips of cow manure (Graul 1973). A nest phenology study in Wyoming by Plumb (2004) reported discovering nests from 22 May through 10 July. Plovers will re-nest, and those nests found later in the nesting cycle may represent re-nesting efforts (Dinsmore 2003).

Fecundity and Survivorship

Mean lifespan of Mountain Plovers reported by Dinsmore (2001) was 1.94 years, and maximum known age for a breeding individual is eight years old. Lifetime reproductive success is unknown (Colorado Division of Wildlife 2003). Males and females are thought to breed after their first winter; hence, a mean lifetime breeding effort by an individual would be expected to be 2 – 4 nest attempts. Common clutch size is three eggs, although the reported range is 1-6 eggs (Knopf 1996).

Survivability of chicks from hatching to migration ranges from 0.17 – 0.74 per nest (Knopf and Rupert 1996). Nest success (nests hatching at least one egg) appears to be variable. On the Pawnee National Grasslands, Weld County, Colorado, nest success varied from 26% (Knopf and Rupert 1996) to 65% (Graul 1975). Plumb (2004) recorded 64% nest success in Wyoming. Further north, on the Charles M. Russell National Wildlife Refuge, Dinsmore et al. (2003) report 58% of

600 observed nests hatching at least one egg successfully. A summary of demographic parameters is included in Table 1, as provided in Dinsmore (2003).

Population Demographics

Historically, Mountain Plovers were widely distributed across the Great Plains region and tablelands of the eastern Rocky Mountains. Breeding Mountain Plovers were characterized as locally rare to abundant. Presently, the range of the species is reduced, especially across the eastern portion of the range (NE, OK, KS, ND, SD, SK), where numbers have declined precipitously. Population estimates vary, from 8,000-10,000 birds (Knopf 1996) to a more recent estimate range of 5,000-11,000 (USFWS 2002). Both estimates are based on short duration, high effort counts of wintering plovers in California.

Wyoming Population

Currently, there is no evidence of recent changes in the status of Mountain Plovers in the state of Wyoming. Knopf (1996) cites a 1902 account by W.C. Night, which described Mountain Plovers having bred in vast numbers statewide. The best available estimate of current numbers of breeding plovers in Wyoming in 2,000-5,000 birds (USFWS 2002). Assuming an average home range size of 56.6 ha (Knopf and Rupert 1996) the minimum population estimate as calculated by Plumb (2004) for the known occupied range in the state of Wyoming is 3,393 birds. The state lacks any systematic census or monitoring program for Mountain Plovers; hence, it is impossible to determine whether the population is increasing, stable, or decreasing.

Metapopulation Dynamics

Presently it is unknown whether metapopulation theory may explain the population dynamics of Mountain Plovers (Dinsmore 2003). What is known about immigration and philopatry suggests

that there may be a high level of site fidelity in this species, in both adults and young of the year, and that there may be limited dispersal capabilities.

Genetic Concerns

Preliminary results of a study of the genetic diversity of Mountain Plovers across the breeding range find considerable mixing between populations and high variability within populations (S. Oyler-McCance, pers. comm.2002. *in* Dinsmore 2003) According to these results, this sample of the North American population of Mountain Plovers is a single, undifferentiated genetic unit. This suggests there are no imminent threats to this species from a population genetics standpoint.

Food Habits

Food items

The Mountain Plover is insectivorous, foraging opportunistically on ground dwelling or perched invertebrates (Knopf 1996). There is no information on plover diet in Wyoming, however, in Colorado stomach contents analysis (n=13) revealed a diet composed almost exclusively of invertebrates (Baldwin 1971 *in* Knopf 1996). Stomach contents included 90 invertebrate taxa, 60% of which were beetles (Coleoptera), and 24.5% crickets and grasshoppers (Orthoptera). Ants (Hymenoptera) were also important prey items. The results suggesting a vast diversity in Mountain Plover diet was supported in an analysis of stomach contents from 39 birds on the wintering grounds of California. Knopf (1998) described stomach contents of Mountain Plovers to be invertebrate prey, which was composed of species from 13 orders and at least 16 families. Mountain Plovers appear to satisfy water requirements through. Mountain Plovers appear to satisfy all water requirements through water content in prey items (Knopf 1996).

Foraging Strategy

Mountain Plovers are ground-foraging insectivores. Foraging technique involves repeated runs of approximately one meter. If prey is detected, a rapid run will ensue to secure the prey as prey is not taken in flight (Dinsmore 2003). All prey items are consumed immediately. Foraging activity is typically highest in the early morning hours, presumably to take advantage of cooler temperatures (Knopf 1996). It has been observed that upon arrival to the breeding grounds foraging only takes up a small percentage of daily activities, suggesting birds are not energetically stressed after migration (McCaffery et al. 1984). Wintering Mountain Plovers exhibit a foraging behavior, common among several congeners, in which they tap the ground with one foot or "patter" to flush prey (Knopf 1996).

Community Ecology

Predators and Competitors

Mountain Plovers are almost continuously vigilant, selecting habitats which prevent undetected approach by predators, and regularly scanning the sky for approaching birds of prey (Graul 1975). In addition this species has a suite of adaptive behavioral and developmental traits which predispose it to more successful predator defense. There is some evidence that this species is most vulnerable to predation just shortly after hatching (Graul 1975); however, contrasting results suggest that chicks are equally susceptible to predation throughout the brood rearing period (McCaffery et al. 1984, Miller and Knopf 1993). The limited estimates of survival rates for adults appear to be quite high, on the breeding ground 100% (n=24, Miller and Knopf 1993) and on the wintering ground 95% (n=44, Knopf and Rupert 1995), therefore it is not likely that predation of adults constitutes a significant depletion of the population.

There has been no detailed study of the predator guild (Dinsmore 2003), yet a summary of known incidences of predation is provided in Knopf (1996). Egg and chick predators include

thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), swift fox (*Vulpes velox*), and coyote (*Canis latrans*). Chicks are also taken by Swainson's Hawk (*Buteo swainsonii*), Prairie Falcon (*Falco mexicanus*), and Loggerhead Shrike (*Lanius ludovicianus)*. Bullsnake (*Pituophis melanoleucus*) was strongly suspected of depredating eggs during mammalian predator exclosure efforts at nests (Knopf 1996). Two incidences of adult depredation of wintering birds by kit fox (*Vulpes macrotis*) have been reported, and a Prairie Falcon (*Falco mexicanus*) took an adult plover on the breeding grounds. It is likely that habitat in close proximity to urban/suburban development would experience increased predation rates by such subsidized predators as house cats (*Felis catus*) and raccoons (*Procyon lotor*) or impacts from landscape changes such as tree planting which could affect raptor numbers (Dinsmore 2003).

Competition

Much of the interspecific interactions which might suggest competition, may also result from natural territorial or anti-predator defense. It is not uncommon for Mountain Plovers to exhibit agonistic displays (horizontal threat, tail-down rush) towards thirteen-lined ground squirrels, McCown's Longspurs (*Calcarius mccownii*), Horned Larks (*Eremophila alpestris*) and large herbivores in the vicinity of a nest (Knopf 1996). There is no research that suggests resource partitioning or direct interspecific competition with Mountain Plovers (Dinsmore 2003).

Parasites and Disease

There has been no research to date on diseases or parasitism of Mountain Plovers. Dinsmore (2003) has observed feather mites on most individuals, especially in the secondaries and retrices.

Symbiotic and Mutualistic Interactions

There is no information currently available to suggest symbioses or mutualism between Mountain Plovers and any other organisms.

Conservation

Conservation Status

Federal Endangered Species Act

The Mountain Plover has been considered for listing as threatened or endangered under the Endangered Species Act by the U. S. Fish and Wildlife Service (Service). A proposal for listing was first published in the Federal Register in 1999, but was withdrawn in 2003. Perceived threats to the species and available habitat were not as serious as perceived at the time of the petition, and do not pose an imminent threat to the survival of this is species in all or a significant portion of its range (68 Fed. Reg. 53,083, Sept. 9, 2003).

Bureau of Land Management

Petitioned species, species given candidate status after 1996, and those species that were evaluated in a U.S. Fish and Wildlife Service 12-month finding but were found to be not warranted were initially included on the BLM Wyoming Sensitive Species List *per* BLM Washington Office Instruction Memorandum IM 97-118 Guidance on Special Status Species Management (6840 Manual). The BLM developed the list to "ensure that any actions on public lands consider the overall welfare of these sensitive species and do not contribute to their decline." Wyoming included the Mountain Plover at the list's inception in 2001 as it was a petitioned species, granting the species the following four tier policy of protection:

- Maintain vulnerable species and habitat components in functional BLM ecosystems.
- Ensure sensitive species are considered in land management decisions.
- Prevent a need for species listing under the Endangered Species Act.
- Prioritize needed conservation work with an emphasis on habitat.

(BLM Wyoming 2001)

Mountain Plovers and associated favorable breeding habitats are extant to some degree in all field office jurisdictions within the state of Wyoming (Figure 3 and Figure 5).

Forest Service

The Rocky Mountain Region (Region 2) of the United States Forest Service lists the Mountain Plover as a Sensitive Species (http://www.fs.fed.us/r2/projects/scp/sensitivespecies/ ; 11/15/04). Hence, it is a recognized sensitive species under the Species Conservation Project (SCP) of the national forests and grasslands in the Rocky Mountain Region. The SCP operates on a mission to, "…form a science foundation for programs and projects that explicitly promote thriving species and ecosystems. Enhanced scientific credibility, legal defensibility, and public acceptance will better support active management." Under auspices of the SCP, funding was secured for preparation of "Mountain plover (*Charadrius montanus*): a technical conservation assessment" by Stephen J. Dinsmore (2003). Region 2 technical conservation assessments provide peer-reviewed synopses of species of conservation concern. In addition, Region 2 assessments are available online for ease of dissemination and use (http://www.fs.fed.us/r2/projects/scp/sensitivespecies/).

In Region 2, on the Pawnee National Grassland, an active Mountain Plover management plan has been incorporated. Factors such as active livestock grazing, and maintenance of 12 to 30 prairie dog towns on 200 to 1,000 acres have been integrated to protect and enhance Mountain Plover nesting habitat (Dinsmore 2003). The establishment of the black-tailed prairie dog as a Management Indicator Species in the Thunder Basin National Grassland Land and Resource Management Plan (USDA 2001) will be an effective tool for maintenance and monitoring of low structure grasslands. Management to support and promote prairie dog colonies is predicted to benefit other wildlife species including the Mountain Plover.

State Wildlife Agencies

The Mountain Plover, a non-game species, is classified as common by the Wyoming Game and Fish Department (Cerovski et al. 2004). Nests, or young dependent upon parental birds, have been confirmed in 18 of 28 latilongs, with breeding suspected in an additional two, according to the Wyoming Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (Figure 3, Cerovski et al. 2004). The Mountain Plover is listed in the Nongame Bird and Mammal Plan as NSS4, or a Species of Special Concern with a Native Species Status of four (Oakleaf et al. 1996). A NSS4 ranking applies to the status of vertebrate species the following:

> "Populations greatly restricted or declining, extirpation possible; habitat stable and not restricted -OR-Populations declining or restricted in numbers or distribution, extirpation not imminent; habitat not restricted, vulnerable but no loss; species not sensitive to human disturbance –OR- Species widely distributed, population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance - OR- Populations stable or increasing and not restricted in numbers or distribution; ongoing significant loss of habitat."

In addition, the state recognizes all protections granted to the Mountain Plover as a Neotropical Migratory Bird.

Heritage Ranks

Wyoming Natural Diversity Database (WYNDD) uses a standardized ranking protocol developed by The Nature Conservancy and a nationwide network of natural heritage programs. The network of natural heritage programs and systematic biological inventory protocol is now coordinated by NatureServe [Arlington, VA.]. Global, state, breeding, and non-breeding status are monitored and updated in accordance with current scientific standards. The Mountain Plover has a global rank (G-rank) of G2 on a scale of 1-5, which indicates the species is imperiled because of

rarity (often 6-20 extant occurrences) or because of factors making it vulnerable to extinction. Breeding Mountain Plovers are rare and locally distributed throughout the state, and because of factors making it vulnerable to extinction it has a state rank (S-rank) of S2, on scale of 1-5.).

The significance of the extant state population as a contributor to the range-wide persistence of the species is indicated by the Wyoming Contribution Rank. This ranking system is a decision ranking tree developed by WYNDD (Keinath and Beauvais 2003). The plover has the second highest rank out of four possible rankings (Low, Medium, High, Very High) as, in combination with populations in adjacent states, Wyoming populations of Mountain Plovers contribute substantially to the taxon's rangewide persistence; a moderate proportion of the rangewide distribution of plovers occurs in Wyoming, and native habitat is demonstrably more secure in Wyoming than in other states of the species' range (Keinath and Beauvais 2003, Plumb 2004).

Biological Conservation Issues

Abundance

Populations of Mountain Plovers have declined range wide since the turn of the century (Laun 1957). Knight (1902) reported that this species nested in great numbers in Wyoming, on elevated plateaus between 5,000 – 8,000 feet. Although seldom regarded as abundant, the Mountain Plover was a common inhabitant of plains habitat from central Kansas, westward (Laun 1957). Currently, the Mountain Plover is extirpated a large percentage of the eastern portion of its range. In what is today considered the periphery of the species' range, the Mountain Plover is scarce (Knopf 1996, Dinsmore 2003). The extant breeding populations of Colorado, Wyoming, and Montana, make up the vast majority of the remaining Mountain Plovers.

Global population estimates are tenuous, and difficult to verify. Knopf (1996) projected the current North American population, as of 1995, to be 8,000 – 10,000 birds. In the proposal to

withdraw the petition to list the Mountain Plover as threatened, USFWS (2003) suggested an estimate ranging from 5,000 – 11,000 birds, based on winter counts conducted from 1998-2002. Plumb (2004) offers a range of population estimates for Wyoming of 2,270 – 4,427 birds, based on three different predicted home range sizes. Currently, best available information support an estimate of breeding Mountain Plovers in Wyoming of between 2,000 – 5,000 individuals (USFWS 2003). Given previous speculative estimates of a Wyoming population of 500 – 1,500 birds, it is evident that Wyoming may host closer to a quarter of the global breeding population of Mountain Plovers.

Abundance, Habitat and Distribution Trends

Given that an accurate estimate of the North American population of Mountain Plover has only very recently been approached (Knopf 1996, USFWS 2003), it is very difficult to assess the current population trend. The best estimate is based on Breeding Bird Survey (BBS) data, for the period 1966-1993, over which Mountain Plovers reportedly declined at an annual rate of 3.7% (Knopf 1994). There is a moderate degree of uncertainty in this estimate due to the nature of BBS data collection (Dinsmore 2003); however, this assertion is supported by reports of Mountain Plover declines on the wintering grounds of California (Edson and Hunting, 1999; Hunting et al. 2001).

Habitat and distribution trends (see Abundance above) are both negative; however, reduction in range and available habitat may not exactly track together. Loss of native habitats, mostly due to conversion to agriculture, has been severe, accounting for over 30% of native habitats once used by Mountain Plovers (Knopf and Rupert 1999). The native grasslands of the Great Plains, and the prairie ecosystem as a whole, may be the most endangered ecosystem in North America (Samson et al. 2004). In the Southeast portion of the species range, as subset of agricultural practices (i.e.

low disturbance crops and fallow fields) have been utilized successfully for nesting (Shackford et al. 1999). Though some broods may come off successfully, it is still apparent that summer tillage, mechanical treatment, or increase height of cover during the nesting season are all detrimental to Mountain Plovers (Dinsmore 2003). In Wyoming, only 12.1% of the breeding range of the plover is cropland (Knopf and Rupert 1999), a possible factor in the relative stability of the state population.

Range Context

The areas of localized study where Mountain Plovers are currently stable provide evidence for conservation needs of this species. In north-central Montana (Southern Philips County) populations closely tracked the distribution of black-tailed prairie dog colonies (Dinsmore 2001). Numbers of plovers declined, seemingly as a response to outbreaks of sylvatic plague on a colony. Natural losses or eradication of prairie dogs is contrary to Mountain Plover recovery needs, especially in the northern extent of the species range (Dinsmore 2003) and some grassland habitat in Wyoming (Keinath and Ehle 2002).

A multi-year study in South Park, Colorado is an excellent example of management of domestic cattle and native herbivores, which maintains the landscape condition much as it has existed for over 100 years (Wunder et al. 2003). In a system with grazing regimes which mimic natural, historic herbivory, and an open, unobstructed landscape, nearly 20% of the global Mountain Plover population appears to be secure. Likewise, in Wyoming, natural disturbance regimes are more closely mimicked by current management strategies, and rates of cultivation and urbanization lag behind neighboring states (Plumb 2004), critical factors in the maintenance of the extant Mountain Plover population.

Extrinsic Threats and Reasons for Decline

Anthropogenic Impacts

Agricultural practices on native grasslands have had direct and indirect impacts on Mountain Plovers. Any mechanical treatment of the landscape (i.e. tilling, planting, application of fertilizers and pesticides) during the nesting phase can potentially destroy nests and eggs (Knopf 1996). Conversion of marginal native sod to winter wheat has altered the physical topography of much of the western Great Plains, precluding nesting plovers. Knopf and Rupert (1999) have analyzed impacts of recent planting activity on a regional scale, and suggest that certain crops appear attractive to Mountain Plovers during the courtship and nesting phase. Planting may destroy early nests, and re-nesting plovers may abandon when subsequent crops (millet and sunflower) grow beyond a certain height. The regional shift to large-scale plantings of such crops may result in a substantial reproductive sink for Mountain Plovers (Knopf and Rupert 1999).

Fragmentation of prairie grasslands, and loss of native habitats has been affected by many factors (for further treatment of this topic *see* Samson et al. 2004). Eradication of prairie dogs, which remarkably has been estimated from 99% of their former range (Dinsmore 2003), has resulted in disruption of the natural pattern of prairie disturbance which Mountain Plovers have an affinity for, especially in the northern portion of the species range.

Invasive Species

The best evidence that encroachment of non-native grasses, and disruption of natural herbivory regimes may influence Mountain Plovers comes from a survey of burned and unburned plots on the Comanche National Grassland (Svingen and Giesen 1999). Characteristics of burned pastures met vegetation requirements of suitable breeding habitat, suggest that the return of fire to the landscape may control over-growth of invasive grass species. Following burn treatments, habitat

remains in condition for only one season, requiring maintenance through grazing or prescribed fire.

Habitat in close proximity to urban/suburban development is susceptible to increased predation rates by such non-native predators as house cats (*Felis catus*) and impacts from landscape changes, such as introduction of non-native tree and shrub species which could affect raptor numbers and suitability of physical habitat characteristics (Dinsmore 2003).

Stochastic and Environmental Factors (e.g., weather events)

Weather events which can disrupt nesting, cause abandonment or direct mortality include late spring snows, flooding, hail damage, and overheating (Knopf 1996; Graul 1973; Graul 1975). Several very young chicks expired due to direct exposure to the sun during the presence of a researcher and absence of the adult. A late spring storm in Wald County, Colorado (26 April, 1972; Graul 1975) caused a nest abandonment and disruption of brooding at the nest. Possibly the most severe threat to nest contents, chicks, and adults are infrequent and localized strong hail events (Graul 1975). One such storm (5 May, 1969; Graul 1975) damaged 20 of 72 eggs in 14 of 15 active nests. This event caused the death of several adult birds of different species, including one adult Mountain Plover on a nest. Hailstorms accounted for the loss of 7 out of 641 nests in a six-year study in north-central Montana (Dinsmore 2001). Mountain Plovers will return immediately to an unattended nest in the event of rain (Graul 1975).

Natural Predation

There has been no detailed study of the predator guild (Dinsmore 2003), yet a summary of known incidences of predation is provided in Knopf (1996). Egg and chick predators include thirteen-lined ground squirrel, swift fox, and coyote. Chicks are also taken by Swainson's Hawk, Prairie Falcon, and Loggerhead Shrike. Bullsnake was strongly suspected of depredating eggs during mammalian predator exclosure efforts at nests (Knopf 1996). Two incidences of adult

depredation of wintering birds by kit fox have been reported, and a Prairie Falcon took an adult plover on the breeding grounds. It is likely that habitat in close proximity to urban/suburban development would experience increased predation rates by such subsidized predators as house cats and raccoons or impacts from landscape changes such as tree planting which could affect raptor numbers (Dinsmore 2003). Adult survival rates both on the wintering grounds, and the breeding grounds are high, therefore the greatest threat of predation is of nest contents and chicks prior to fledging. There is no information available to determine whether predation differentially effects populations in different habitat types or management schemes (Dinsmore 2003).

Intrinsic Vulnerability

Habitat Specificity and Fidelity

Habitat specificity is a critical attribute of Mountain Plover ecology. Physical habitat requirements have been well described, and alteration of suitable habitat can lead to serious declines. One example would be recent trends on the Pawnee National Grassland, once regarded as a breeding stronghold for Mountain Plovers. The population, estimated at near 1,300 birds in 1991, is presently reduced to less than 100 birds. Such a rapid and resounding decline is attributed, in part, to unusually cold and wet weather over several years, and change in the vegetation (Colorado Division of Wildlife 2003). The parameters describing suitable breeding habitat are presented (*see* Habitat above) in general terms, yet thresholds beyond which habitat is no longer occupied, and differences between breeding concentrations and areas of sparsely distributed breeding birds, are yet to be understood. If a land manager is aware of a present concentration of breeding Mountain Plovers, due to high habitat and site fidelity in the species, the recommended approach calls for conservation of that population in the occupied habitat. Restoration of Mountain Plover populations through translocation of adult plovers will almost certainly fail (Dinsmore 2003).

Adult male and female Mountain Plovers return to breeding grounds in subsequent years (Graul 1973, Knopf 1996). Natal philopatry has been documented as well; however, there is likely a small percentage of permanent emigration of juvenile plovers from their natal nesting grounds (Dinsmore 2001). Capture-recapture techniques from southern Phillips County, Montana, give additional insight to suspected high site fidelity in Mountain Plovers (Dinsmore 2001). During a six-year study, site fidelity appeared high, as many birds banded on the breeding grounds would return to the same prairie dog colony in subsequent years. Supporting this finding, there was no evidence of permanent emigration of adult Mountain Plovers to or from this study area. No banded birds were ever detected as breeders off location (including adjacent states), nor were any banded birds from separate studies relocated on the Phillips County study site (Dinsmore 2001).

Dispersal Capability

The dispersal capability of this species is low, especially as adults (Dinsmore 2001). Broad scale habitat patterns, and the optimal spatial arrangement of independent populations of Mountain Plovers is unknown at this time. There is a certain degree of permanent emigration of juvenile Mountain Plovers, yet there is no information available on factors influencing ability to colonize previously unoccupied habitat. The rapid recovery of an independent population in Montana, following the outbreak of sylvatic plague, was attributed both to reproduction and immigration from surrounding areas (2001).

Reproductive Capacity

The Mountain Plover clutch size is nearly always three eggs (Graul 1975; Knopf 1996). Rapid multiple-clutch breeding in this species increases the annual reproductive capacity for an individual. Commonly, the male will incubate a first clutch, and the second will be incubated by the female, although it is unknown what percentage of pairs will produce two broods. If a pair produces two broods, each adult will tend a single nest, and remain with the brood through

fledging (Dinsmore 2003). In addition to the commonality of a second brood per pair, this species will re-nest in the event of the loss of a clutch. Females are capable of producing clutches 11 to 13 days apart (Graul 1976), which illustrates how rapidly re-nest attempts may be initiated. Graul (1976) suggests that the rapid multiple-clutch reproductive system is an adaptation enabling Mountain Plovers maximize reproductive effort in the event of food abundance. Given the adaptations of Mountain Plovers to recover from brood loss, and maximize reproductive effort under optimal circumstances, reproductive capacity does not appear to be an intrinsic vulnerability; however, fledging rates suggest that this species is most vulnerable during brood rearing.

Sensitivity to Disturbance

There are specific guidelines developed by the U. S. Fish and Wildlife Service (2002; Appendix A.) regarding surveys prior to surface disturbance and timing restrictions during plover nesting to minimize impact to plovers on a site planned for development. Federal agencies have recognized the responsibility to proactively conserve the species through continued application of project based surveys, in an effort to reduce the likelihood of a future need to list the species. Surface disturbance is potentially threatening to Mountain Plovers both in terms of direct harassment or mortality during the breeding season, and prolonged indirect effects of habitat loss or fragmentation.

As a ground nesting species of short grass prairie and xeric shrublands, the Mountain Plover has evolved predator defense strategies, and is highly vigilant in defense of nest and brood. The intensity of distraction behavior in the presence of intrusion appears to progress and peak at the time of hatching (Graul 1975). The anti-predator response by adults does stress the individual, in one instance apparently stress related trauma from intruder response caused the death of an adult plover (Graul 1975).Researchers have caused abandonment of nests due to disturbance (n=4;

McCaffery et al. 1984). Additionally, handling of recent hatchlings caused departure from the nest by an adult, and subsequent mortality by overheating of chicks (Graul 1973).

Formal Population Viability Analyses (PVAs)

No formal Population Viability Analyses (PVAs) have been conducted for the Mountain Plover population in Wyoming.

Conservation Action

Existing or Future Conservation Plans

Existing Regulatory Mechanisms

Federal regulatory mechanisms exist, although not targeted specifically for Mountain Plovers. The Migratory Birds Treaty Act prohibits direct mortality or the destruction of active nests. The National Forest Management Act (NFMA) and the Federal Land Policy and Management Act (FLPMA) are lows that provide guidance that supports conservation awareness of Mountain Plovers in the arena of guidance for federal resource management plans and development. The Bureau of Land Management and the U. S. Forest Service (USFS) have implemented various measures to provide nesting habitat, and reduce disturbance during the nesting season. The BLM in the state of Wyoming has extended current stipulations protecting Mountain Plovers in the event of potential disturbance at development sites through 9/30/05. The USFS regulatory mechanism includes efforts to improve nesting habitat on the Pawnee National Grassland, and closure of the shooting season for black tailed prairie dogs on the Thunder Basin National Grassland. The Mountain Plover is listed as an endangered species in Canada (Knopf 1996) and threatened in Mexico (USFWS2003). Efficacy of current regulatory mechanisms is compromised by the broad breeding distribution of the species, and associated patchwork of land status, which

included public and private land, and numerous state, federal, and tribal land authorities (USFWS 2003).

Existing Management Plans

The only current model of an existing management plan for Mountain Plovers is the Mountain Plover Management Strategy implemented in 1994 on the Pawnee National Grassland (Dinsmore 2003). This plan incorporates habitat improvements via prescribed burns, appropriate grazing, and active management of prairie dog colonies. In addition, oil and gas restrictions are implemented to accommodate the courtship, nesting, and brood rearing activities of plovers (1 April – 30 June; Dinsmore 2003). Mountain Plover populations on the Pawnee National Grassland have collapsed and the effectiveness of the Management Strategy is yet to be determined.

Existing Conservation Strategies

The Nature Conservancy's Prairie Wings Initiative is an example of one recent conservation strategy which will enhance and protect potential Mountain Plover Habitat through targeted land acquisitions (Dinsmore 2003). The Service is consulting with the NRCS to explore ways to enhance Mountain Plover breeding opportunities on existing CRP tracts, through seeding with native shortgrass prairie species, management through grazing or haying to optimize grass height and density, and dissemination of conservation information to private land owners. Additional strategies which may which may serve to promote conservation awareness of the Mountain Plover are the federal, state, and private High Plains Partnership, and the Rocky Mountain Bird Observatory's Prairie Partners program (USFWS 2003).

Wyoming Partners In Flight; Wyoming Bird Conservation Plan

Wyoming Partners in Flight have prepared a comprehensive conservation strategy for bird species in greatest need of conservation, and associated habitat recommendations (Nicholoff 2003). The Mountain Plover is identified as a Priority One species of conservation concern, and as

such a species in immediate need of conservation attention. The following list of population objectives, habitat objectives, and recommendations from the Wyoming Bird Conservation Plan are the most comprehensive list of state-wide management recommendations currently available for this species.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".
2) Breeding Bird Survey (BBS) data from 1968 through 2002 indicate Mountain Plovers have been detected on 24 BBS routes in Wyoming, including 9 routes on which they were observed a minimum of 3 years.
    a) Maintain Mountain Plovers on the 24 BBS routes on which they were observed.
    b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run.
3) Increase monitoring in suitable habitat where monitoring is presently not being conducted and maintain monitoring in areas where it is currently in place.
4) Manage populations for an upward trend within the preferred habitat on a landscape scale by implementing recommendations in the grassland Best Management Practices and working with Bird Conservation Region partners.

Habitat Objectives

1) Minimize loss of shortgrass prairie habitat by reducing urban and suburban sprawl, habitat fragmentation, and habitat conversion.
2) On a landscape scale, maintain portions of shortgrass prairie habitat in low structure, an early seral stage, and with some bare ground in a mosaic that is well distributed throughout this habitat type. Maintain blocks of habitat [at least 50 acres (20 ha) in size] consisting of bare ground and up to 70% short, sparse vegetation on nearly level terrain in areas where Mountain Plovers occur.

3) Manage prairie dog colonies to enhance Mountain Plover habitat.

Recommendations

1) Monitor grass height, and use a combination of grazing and prescribed burning to eliminate woody vegetation that grows higher than the native grasses and to maintain habitat in an early successional stage.

2) Vary grazing pressure on a landscape level by interspersing areas of heavy, light, and non-grazing. Graze shortgrass or mixed grass habitats at moderate to heavy intensities in summer, late winter, or early spring in areas where Mountain Plovers occur. Employ high intensity grazing from mid-February through mid-May at specific nesting sites used by Mountain Plovers to maintain preferred vegetation structure at these sites.

3) Conduct prescribed burning in late summer or early fall to promote vegetation and habitat characteristics required by Mountain Plovers.

4) Reduce or eliminate prairie dog control in areas inhabited by Mountain Plovers. Prairie dog towns may provide islands of habitat in areas not otherwise suitable for nesting by Mountain Plovers. Maintenance of these towns is crucial to maintaining breeding populations of Mountain Plovers.

5) Avoid fragmenting existing tracts of shortgrass prairie habitat.

6) Avoid tilling existing shortgrass prairie habitat and seeding with exotic grasses.

7) Plant areas adjacent to existing Mountain Plover nesting areas with native grass mixtures (such as buffalo grass and blue grama).

8) Avoid spring tilling in fields that have lain fallow through April and May. Fields that are fallow, idle, or barren, or contain residual cover less than 4 inches (10 cm) tall through April and May may attract Mountain Plovers to begin nesting. Spring tilling practices to plant crops or control weeds may then destroy the nests and eggs.

9) Limit insect control, especially for grasshoppers, beetles, crickets, and ants, in areas where Mountain Plovers occur. Postpone all insecticide use until Mountain Plovers (and other insectivores) have completed their breeding cycle.

10) Avoid tree planting in shortgrass prairie habitat. This also fragments grassland habitats, and can increase parasitism by cowbirds and predation by crows, grackles, and jays.

11) Protect areas traditionally used by Mountain Plovers, as their fidelity to nesting territories is high.

12) Restrict oil, gas, and recreational activities near Mountain Plover habitat during the peak breeding season (April through July).

13) Fix leaking or overflowing livestock water tanks in areas managed for Mountain Plovers.

Conservation Elements

Key Elements

The greatest obstacles facing Mountain Plover conservation and management efforts are data gaps, and a lack of standardized monitoring of populations and suitable habitat. Our current best estimates of Wyoming and global abundance are very general, and incorporate assumptions of area currently occupied for breeding, homerange size of an adult bringing a brood to fledging, and overall density of plovers across all habitats. A great deal remains to be learned about Mountain Plover ecology, especially at the landscape scale. Sound management practices will continue protect Mountain Plovers in existing suitable habitat; however, must also be adaptive in nature such that important information gaps are addressed empirically. Habitat objectives (*see* Existing Conservation Strategies above) must be designed to minimize loss and fragmentation of shortgrass prairie and xeric shrubland, especially in areas of slope < percent, cover height < 5 cm, and area of bare ground ≥ 30 percent.

To date, it appears that Mountain Plover will continue to use breeding sites in the vicinity of roads, and oil and gas development. There will conceivably be 40,000 additional Coal Bed Methane wells, alone, in Wyoming by 2011 (USFWS 2003). The impact of the development of this natural resource to breeding Mountain Plovers, in addition to other oil, mineral, and wind

generated energy at this point is unknown (USFWS 2003). Tracking of Mountain Plover response to projected natural resource development in Wyoming will be essential to ensure the long term viability of this species.

The status of Mountain Plovers on large tracts of private land in Wyoming is relatively unknown. Current species management would benefit from any additional information related to private land contribution to overall state distribution and abundance of Mountain Plovers.

Inventory and Monitoring

The BLM has extended through September, 2005 implementation of Mountain Plover Survey Guidelines if a surface disturbing activity is scheduled to take place in Mountain Plover habitat from April 10 through July 10. Site specific clearance surveys are an essential programmatic means of minimizing impacts of development to breeding Mountain Plovers. However, broad scale inventory and monitoring to detect regional population trends do not exist at this time.

Monitoring Wyoming's Birds: The Plan for Count-based Monitoring (Leukering et al. 2001 *in* Nicholoff 2003)

The following excerpt addresses the drawbacks of utilizing Breeding Bird Survey data for monitoring bird population trends at the state-wide level.

> "The effective conservation and management of Wyoming's birds depend on adequate monitoring information, which, to a large extent, does not exist. To date, resource managers have relied on data derived from the Breeding Bird Survey (BBS), currently the best and most extensive bird-monitoring program, to monitor bird populations (Robbins et al. 1989, Sauer 1993). The BBS uses volunteers to conduct roadside surveys of birds across North America and produces indices of population abundance at the continental scale for many common bird species (see Robbins et al. 1986). However, many species and habitats are inadequately sampled by the BBS (Robbins et al. 1993, Sauer 1993) and BBS data do not reliably predict population trends at small geographic scales (Sauer 2000).

> Additionally, the design and implementation of the BBS is such that results generated from these efforts are often inconclusive due to the difficulty associated with interpreting index counts (Sauer 2000) and numerous confounding variables (Robbins et al. 1986, Bohning-Gaese et al. 1993, Sauer et al. 1994, James et al. 1996, Thomas 1996, Rosenstock et al. in prep.). For these reasons, BBS data are generally insufficient to guide local or regional management decisions."

Full implementation of the regional habitat-based monitoring plan, in grassland and shrubsteppe habitats, will be the first step towards gathering sufficient state-wide data for an empirical assessment of Mountain Plover density, distribution and trends. However, the current implementation of the "Monitoring Wyoming's Birds" plan is not sufficient to detect Mountain Plovers, a low density species with a patchy distribution, or make any empirical assessments of species' trends. In 2004, thirty transects were completed in habitats with a likelihood of detecting Mountain Plovers. Out of thirty possible transects monitored in 2005, one Mountain Plover was detected (Doug Faulkner, pers. comm. 11/24/05). A habitat specific Inventory and Monitoring design for grassland birds, beyond the scope of the current "Monitoring Wyoming's Birds" program, is required for empirical assessment of Mountain Plover density, distribution and trends. Improved knowledge of these population variables is essential for accuracy in addressing essential conservation questions.

Habitat Preservation and Restoration

In Wyoming, only 12.1% of the breeding range of the plover is cropland (Knopf and Rupert 1999), therefore conservation of Mountain Plover habitat lies much less in the realm of restoration from crop conversion and much more in the realm of maintenance and preservation of habitat parameters (*see* Habitat Requirements) which mimic landscape effects of the historic grazing and disturbance regimes. Conservation and restoration of prairie dogs, especially in the short grass prairie habitats of eastern Wyoming, will provide quality breeding habitat for Mountain Plovers

(Dinsmore 2003; Keinath and Ehle 2002; Plumb 2004). Area requirements are not well understood, beyond Graul's (1973) estimate of mean adult territory size (16 ha) and Knopf and Rupert's (1996) estimate of mean brood rearing areas (57 ha), both calculated from studies in northern Colorado. It is recommended that adequate area for Mountain Plover habitat preservation or restoration must be at least in excess of 57 ha, yet further research is needed to refine that estimate.

Captive Propagation and Reintroduction

There is little reason to believe captive propagation and reintroduction is a cost effective or appropriate tool for Mountain Plover conservation at this time. The authors are not aware of any successful captive propagation of this species, or whether is has been attempted. The single known instance of a reintroduction was a program in Kansas that involved translocation of chicks (Dinsmore 2003). This translocation was considered unsuccessful, as there were no subsequent resightings of the banded, introduced birds. Landscape suitability factors should be closely examined before any such translocation is considered, given the species' strong association with a particular habitat type.

Information Needs

Improve current estimates of species distribution and abundance state wide on public and private lands. Where possible design research to capture abundance, density, and long term population trends. Population monitoring will require from eight to ten years of annual data before trend analysis will be possible (Dinsmore 2003).

Continued evaluation of specific habitat attributes which address minimum area requirements, prey availability, and suitability at not only the individual level, but at the population level.

Factors which influence variation in site suitability at the landscape scale and landscape level habitat effects on Mountain Plover demography are largely unknown.

There have been no demographic studies of Mountain Plovers in the state of Wyoming. Fecundity, survival rates, fledging rates, emigration, natal and breeding site fidelity, and mortality factors are all yet to be explored in any depth. Data gaps are also evident at the community ecology level. Predator interactions, prey availability, and interspecific competition are all relatively unstudied in Wyoming.

The expansion of the Coal Bed Methane industry in Wyoming, projected to be approximately 40,000 new wells by 2011, will have an unknown impact on Mountain Plovers and their nesting habitat (USFWS 2003). Further research on the impacts of fragmentation and disturbance, especially density of well pads and increased vertical structure from natural resource development will be essential to ensure the long-term viability of this species.

Tables and Figures

Table 1. Summary of demographic parameters for the Mountain Plover; adapted from Dinsmore (2003)

Parameter	Estimate	Reference
Proportion of females on nests	Unknown	
Proportion of males on nests	Unknown	
Re-nesting rate	Unknown	
Fecundity	Unknown	
Eggs per clutch	2.90	S.J. Dinsmore, unpublished data
Hatching rate of eggs	Unknown	
Fledging rate (chicks per nest)	0.26	Knopf and Rupert (1996)
Fledgling survival rate	Unknown	
Juvenile annual survival rate	0.48	Dinsmore et al. (2003)
Adult annual survival rate	0.68	Dinsmore et al. (2003)
Adult survival rate during breeding season	1.00	Miller and Knopf (1993)
Over-winter survival rate	0.95	Knopf and Rupert (1995)
Juvenile emigration rate	0.24	Dinsmore et al. (2003)
Adult emigration rate	0.22	Dinsmore et al. (2003)
Mean lifespan (years)	1.92	Dinsmore et al. (2003)
Longevity record (years)	9	S.J. Dinsmore, unpublished data

Figure 1. Adult Mountain Plover. Photo © 2004 Stephen J. Dinsmore.

Figure 2. Species account based on the 28 state latilongs, modified from Dorn and Dorn (1999).

M	B	M	B	M	M	M
M	M	B	B	M	B	b
B	b	M	B	b	B	B
B	B	b	b	B	B	B

B = observed in summer, breeding confirmed; b = observed in summer, breeding suspected but unconfirmed; M = observed in migration season

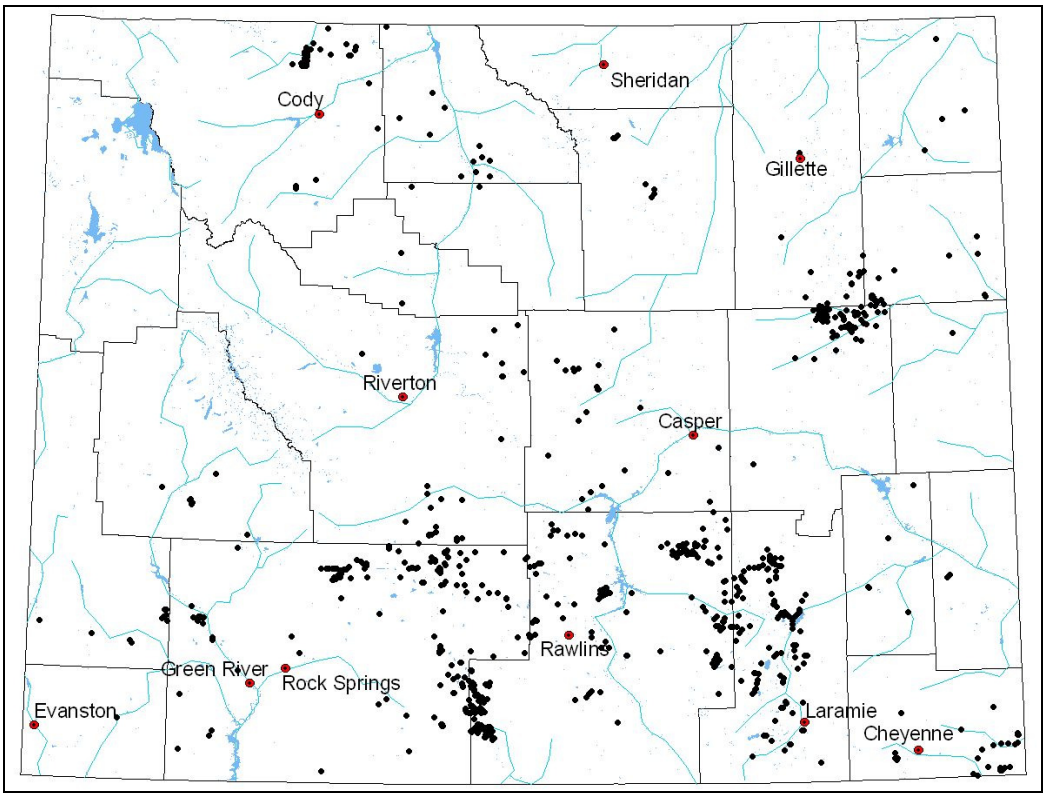
Figure 3. Species account based on the 28 state latilongs Modified from Cerovski et al. (2004).

O	B	B	B	O	O	O
O	O	B	B	O	B	O
B	b	B	B	B	B	B
B	B	b	B	B	B	B

B = Nest or young dependent upon parent birds was observed; b = Circumstantial evidence of nesting; O = The species has been observed, but there was no evidence of nesting. The observation may have been recorded during any season of the year

Figure 4. Mountain Plover nest with eggs. Photo © 2004 Stephen J. Dinsmore.

Figure 5. Distribution of Mountain Plover occurrence points from Wyoming Natural Diversity Database (WYNDD), 10/01/04 BHS.



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Appendix A: Mountain Plover Survey Guidelines-Montana

U.S. Fish and Wildlife Service
March 2002

The mountain plover (Charadrius montanus) is a small bird (17.5 cm, 7 in.) about the size of a killdeer (C. vociferus). It is light brown above with a lighter colored breast, but lacks the contrasting dark breast-belt common to many other plovers. During the breeding season it has a white forehead and a dark line between the beak and eye, which contrasts with the dark crown.

Mountain plover breeding habitat includes short-grass prairie and shrub-steppe landscapes; dryland, cultivated farms; and prairie dog towns. Plovers usually nest on sites where vegetation is sparse or absent, conditions that can be created by herbivores, including domestic livestock and prairie dogs. Vegetation in shortgrass prairie sites is typically less than 4 inches tall. Nest sites within the shrub-steppe landscape are also confined to areas of little to no vegetation, although surrounded by areas visually dominated by shrubs. Commonly, nest sites within shrub-steppe areas are on active prairie dog towns. Nests are commonly located near a manure pile or rock. In addition to disturbance by prairie dogs or livestock, nests have also been found on bare ground created by oil and gas development activities, and on dryland, cultivated agriculture in the southern part of their breeding range. Mountain plovers are rarely found near water. Positive indicators for mountain plovers therefore include level terrain, prairie dogs, bare ground, Opuntia pads, cattle, widely spaced plants, and horned larks. It would be unusual to find mountain plovers on sites characterized by irregular or rolling terrain; dense, matted vegetation; grass taller than 4 inches, wet soils, or the presence of killdeer.

These guidelines were developed by Service biologists and Dr. Fritz Knopf, USGS-BRD. Keep in mind these are guidelines - please call the, U.S. Fish and Wildlife Service, Ecological Services, Billings Suboffice, 406-247-7366, if you have any suggestions.

GENERAL GUIDELINES FOR SURVEYS

On February 16, 1999, the Service proposed the mountain plover for federal listing as threatened. Because listing of this species is proposed, the Service may recommend surveys for mountain plovers to better define nesting areas, and minimize potential negative impacts. The Service may recommend surveys for mountain plovers in all suitable habitat, as well as avoidance of nesting areas, to minimize impact to plovers in a site planned for development. While the Service believes that plover surveys, avoidance of nesting and brood rearing areas, and timing restrictions (avoidance of important areas during nesting) will lessen the chance of direct impacts to and mortality of individual mountain plovers in the area, these restrictions do nothing to mitigate indirect effects, including changes in habitat suitability and habitat loss. Surveys are, however, a necessary starting point. The Service has developed the following 3 survey guidelines, depending on whether the intent is to determine the presence or absence of plovers at a site during the nesting season for permanent and short term projects, or to determine the density of nesting plovers at known nesting sites.

Survey Protocol

Surveys for mountain plovers are conducted during the period where the highest numbers of plovers are likely to be tending nests and territories, and therefore are most likely to be detected. Throughout their range, these dates are generally from May 01 through June 15. However, seasonal restrictions for ground disturbing activities in suitable mountain plover nesting habitats are usually longer than the survey dates. The longer seasonal restrictions allow for protection of

early nesting birds, and very young chicks which tend to sit still to avoid detection during the first week post-hatch. Since specific nesting dates across the breeding range of the plover vary according to latitude and local weather, the project proponent or the land management agency should contact the local U.S. Fish and Wildlife Service Office to determine what seasonal restrictions apply for specific projects.

Two types of surveys may be conducted: 1) surveys to determine the presence/absence of breeding plovers (i.e., displaying males and foraging adults), or 2) surveys to determine nest density. The survey type chosen for a project and the extent of the survey area (i.e., beyond the edge of the construction or operational ROW) will depend on the type of project activity being analyzed (e.g., construction, operation) and the users intent. One methodology outlines a breeding survey that was used in northeastern Colorado to establish the density of occupied territories, based on displaying male plovers or foraging adults. The other was developed to only determine whether plovers occupy an area.

Techniques Common to Each Survey Method

- Conduct surveys during early courtship and territorial establishment. Throughout the breeding range, this period extends from approximately mid-April through early July. However, the specific breeding period, and therefore peak survey days, depends on latitude, elevation, and weather.
- Conduct surveys between local sunrise and 1000 and from 1730 to sunset (periods of horizontal light to facilitate spotting the white breast of the adult plovers).
- Drive transects within the project area to minimize early flushing. Flushing distances for mountain plovers may be within 3 meters for vehicles, but plovers often flush at 50 to 100 meters when approached by humans on foot.
- Use of a 4-wheel drive vehicle is preferable where allowed. Use of ATVs has proven highly successful in observing and recording displaying males. Always seek guidance from land

management agencies regarding use of vehicles on public lands, and always obtain permission of private landowners before entering their lands.

- Stay in or close to the vehicle when scanning. Use binoculars to scan and spotting scopes to confirm sightings. Do not use scopes to scan.
- Do not conduct surveys in poor weather (i.e., high wind, precipitation, etc.).
- Surveys conducted during the courtship period should focus on identifying displaying or calling males, which would signify breeding territories.
- For all breeding birds observed, conduct additional surveys immediately prior to construction activities to search for active nest sites.
- If an active nest is located, an appropriate buffer area should be established to prevent direct loss of the nest or indirect impacts from human-related disturbance. The appropriate buffer distance will vary, depending on topography, type of activity proposed, and duration of disturbance. For disturbances including pedestrian foot traffic and continual equipment operations, a 1/4 mile buffer is recommended.

SURVEY TO DETERMINE PRESENCE/ABSENCE

Large scale/long term projects

Conduct the survey between May 1 and June 15, throughout the breeding range.

1. Visual observation of the area should be made within 1/4 mile of the proposed action to detect the presence of plovers. All plovers located should be observed long enough to determine if a nest is present. These observations should be made from within a stationary vehicle, as plovers do not appear to be wary of vehicles. Because this survey is to determine presence/absence only, and not calculate statistical confidence, there is no recommended distance interval for stopping the vehicle to scan for birds. Obviously numerous stops will be required to conduct a thorough survey, but number of stops should be determined on a project and site-specific basis.
2. If no visual observations are made from vehicles, the area should be surveyed on ATVs. Extreme care should be exercised in locating plovers due to their highly secretive and quiet nature. Surveys by foot are not recommended because plovers tend to flush at greater distances when approached using this method. Finding nests during foot surveys is more difficult because of the greater flushing distance.

3. A site must be surveyed 3 times during the survey window, with each survey separated by at least 14 days. The need for 3 surveys is to capture the entire nesting period, with the intent of reducing the risk of concluding the site is not nesting habitat by an absence of nesting birds during a single survey.
4. Initiation of the project should occur as near to completion of the survey as possible. For example, seismic exploration should begin within 2 days of survey completion. A 14 day period may be appropriate for other projects.
5. If an active nest is found in the survey area, the planned activity should be delayed 37 days, or seven days post-hatching. If a brood of flightless chicks is observed, activities should be delayed at least seven days.

Short-term, linear projects

The Service recognizes that many projects have minimal, if any impact on mountain plover nesting habitat, and that these projects may only be present in suitable habitat for a day or less. In order to address concerns from project proponents about delays associated with mountain plover surveys for these projects, the Service has developed the following guidelines. However, the Service encourages the project proponent to plan these projects so that all work occurs outside the plover nesting season.

Short-term linear projects are defined as projects which move through an area within the course of a day and result in no permanent habitat alteration (e.g., vegetative/topographic changes), and no permanent project-related above ground features. Short-term, linear projects may include activities such as pipelines, fiber optic cables, and seismic exploration. For these projects, all ROW surveying/staking activities should be completed before April 1 to avoid discouraging plovers from nesting in suitable habitat. If ROW surveying cannot be completed before April 1, surveyors will need to coordinate with the lead Federal agency before entering

these areas, and a plover survey may be required prior to ROW demarcation. For these projects, the presence/absence guidelines above should adhere to the dates below.

1. **April 10 through July 10 -** a plover survey will need to be completed 1- 3 days prior to any construction activity, including initial brush clearing, to avoid direct take of mountain plovers. The survey should include the route and a 1/4 mile buffer on either of the project corridor. If there is a break in construction activity in these areas of more than 3 days (e.g., between pipe stringing, trenching, or welding), an additional plover survey is necessary before construction activity can resume after that break in activity. Generally, mountain plovers are either establishing territories and nests in April, and from late June to early July young chicks commonly freeze in place to avoid detection, increasing their vulnerability to direct take. After July 10, most mountain plover chicks are sufficiently mobile to reduce the risk of direct take.
2. If an active nest is found in the survey area, the planned activity should be delayed 37 days, or seven days post-hatching. If a brood of flightless chicks is observed, activities should be delayed at least seven days.

SURVEY TO DETERMINE DENSITY OF NESTING MOUNTAIN PLOVERS

We are assuming people will have received training on point counts in general before using this specialized point count technique adapted to mountain plovers.

Establishing Transects

1. Identify appropriate habitat and habitat of interest within geographic areas of interest.
2. Upon arriving in appropriate habitat, drive to a previously determined random starting point.
3. For subsequent points, drive a previously determined random distance of 0.3, 0.4 or 0.5 miles.
4. Each transect of point counts should contain a minimum of 20 points.

Conducting The Point Counts

1. Conduct counts between last week in June to July 4th at elevations equivalent to the eastern plains of Colorado (i.e., about 5,000 feet). Timing of counts at other elevations should be coordinated with the local FWS office.
2. Only 1 counter is used. Do not use a counter and recorder or other combinations of field help. Drivers are okay as long as they don't help spot plovers.
3. If an adult mountain plover is observed, plot occupied territories on a minimum of 1:24,000 scale map and on a ROW diagram or site grid (see attached). The ROW diagram will be at a greater level of detail, depicting the location of breeding birds (and possible nest sites) relative to ROW centerline, construction boundary, and applicable access roads.
4. Estimate or measure distances (in meters) to all mountain plovers. Method used should be noted, e.g., estimates w/distance training, estimates w/o distance training, rangefinder or measured with tape measure, etc.
5. Record "fly-overs" as "FO" in the distance column of the data sheet.
6. If you disturb a mountain plover while approaching the point, estimate the distance from point-center to the spot from which the bird was flushed.
7. Conduct counts for 5 minutes with a 3 minute subsample to standardize with BBS.
8. Stay close to your vehicle while scanning.

Recording Data

Record the following information AT EVERY POINT, EVERY DAY.

- start time
- unique point code (don't duplicate within a field crew or across dates)
- number of mountain plovers and distance to each
- land use and/or habitat type (e.g., fallow wheat, plowed, shortgrass)
- temperature, Beaufort wind, and sky conditions (clear, partly cloudy, overcast)
- Information on the data sheet somewhere.
- your name and address
- date
- Record for each point at some point during the census.
- detailed location description of each point count including road number, distance to important intersections.
- record transect and point locations on USGS county maps.
- Universal Transverse Mercator from maps or GPS are useful.

GENERAL HABITAT INDICATORS

Positive habitat images

- Stock tank (non-leaking, leaking tanks often attract killdeer)
- Flat (level or tilted) terrain
- Burned field/prairie/pasture
- Bare ground (minimum of 30 percent), usually a gravely pavement
- Spaced grass / plants
- Prairie dog colonies
- Horned larks
- Cattle
- Heavily grazed pastures
- *Opuntia* pads visible

Negative habitat images

- Killdeer present (indicating less than optimal habitat)
- Hillsides or steep slope
- Prominent, obvious low ridge
- Leaky stock tanks
- Vegetation greater than 4 inches in height in short-grass prairie habitat
- Increasing presence of tall shrubs
- Matted grass (i.e., minimal bare ground)
- Lark buntings