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This document was prepared as an addendum to the Species Conservation Assessment published by the USDA Forest Service - Rocky Mountain Region (Region 2), available at:

http://www.fs.fed.us/r2/projects/scp/assessments/index.shtml

It is intended to accompany that assessment, and to provide the reader with scientific findings and conclusions derived since the assessment's publication.

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Summary of Addendum

Title of Assessment: **Mountain plover (*Charadrius montanus*): a technical conservation assessment**

Publication Date: **8 December 2003**

Original Author(s): **S.J. Dinsmore**

Reviewer(s): **Gary P. Beauvais**

Date of Review: **1 July 2006 - 1 September 2006**

Addendum Summary

Distribution: Collectively, the references listed herein suggest no substantial change to mountain plover range since the Technical Species Conservation Assessment was published. The species still occupies most areas assumed to be occupied in 2003, and it has not colonized new areas to any notable degree. However, there are significant increases to rangewide estimates of mountain plover abundance (see references 21, 22, 23, 28, and 32).

Taxonomic Status: The taxonomic status of mountain plovers has remained essentially unchanged. There is apparently very little genetic subdivision of the global population (reference 19). Analysis of the isotopic composition of feathers has great potential for elucidating the connections between specific winter ranges and breeding grounds (reference 31), which won't change species taxonomy, but could have management implications at the population level.

Agency Status: Mountain plovers have been designated as conservation priorities in the Comprehensive Wildlife Conservation Strategies of 4 of the 5 states in Region 2 (references 5, 25, 33, and 34); the exception being South Dakota, where breeding mountain plovers are considered absent. This should focus more conservation and management attention on the species. Protection via the U.S. Endangered Species Act has been rejected for both black-tailed and white-tailed prairie dogs (references 10 and

11); given commonalities of their range and habitat with mountain plover such protection would have afforded additional protection for mountain plovers.

Other: There is increasing advocacy for using more complex and accurate techniques of estimating distribution, abundance (reference 9), and nest success (references 14, 24, and 27) for birds in general, and mountain plovers in particular. These newer techniques can better inform management and monitoring programs.

There is continued interest in grassland birds as conservation priorities (references 3, 12, and 20), and many new management and/ or conservation plans center on grassland birds (references 3, 4, 5, 7, 16, 25, 33, 34, and 35).

Significance of Change relative to original assessment: Recent research and management documents have substantially changed the knowledge base, management context, and conservation context for mountain plover throughout its range and in USDA Forest Service Region 2. Two of the most prominent mountain plover experts in the region - F. Knopf and M. Wunder - consider the information developed over the past 3 years to have significantly increased our understanding of the species. These 2 experts have collaborated on a new "Birds of North America" account of mountain plover, which is slated for release very soon and could serve as an efficient platform on which to base an updated Species Conservation Assessment (reference 36).

Reference 1:

Alberta Sustainable Resource Development. 2003. Status of the mountain plover (*Charadrius montanus*) in Alberta. Alberta Sustainable Resource Development - Fish and Wildlife Division / Alberta Conservation Association. Alberta Wildlife Status Report No. 50. Edmonton, Alberta, Canada.

Summary of new information:

The maximum number of breeding pairs of mountain plovers in Alberta is $\leq$6; all of Canada probably supports $\leq$10 breeding pairs total. This report essentially reaffirms the very minor role that Canadian prairies play in mountain plover management and conservation.

Sections in the Technical Conservation Assessment most affected by this new information (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY
- Biology and Ecology
  - Distribution and abundance

Reference 2:

Beauvais, G.P. and R. Smith. 2003. Model of breeding habitat of the mountain plover (*Charadrius montanus*) in western Wyoming. Western North American Naturalist 63: 88-96.

Summary of new information:
This study modeled habitat use by mountain plovers in the shrub-steppe basins of southwestern Wyoming. Mountain plovers there strongly preferred the same general environments that they prefer in Great Plains grasslands; namely, flat areas with relatively short and sparse vegetation. A logistic regression model predicting mountain plover presence as a function of topographic slope and vegetation stature is presented. The map form of this model suggests a distribution in the state similar to that estimated by reference 34. The authors suggest that the factors producing low and sparse vegetation in western Wyoming (e.g., poor soil, low precipitation, persistent wind) are more stable in time and space than those producing similar vegetation in the Great Plains (e.g., episodic drought, mammal grazing, wildfire), and thus plover habitat in western Wyoming is also more stable. Also, the authors suggest that nesting plovers may prefer landscape positions such as ridge crests, rims, and plateau tops because such positions force aerial predators (raptors) to skyline themselves upon approach.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
- Biology and Ecology
  - Distribution and abundance
  - Habitat

Reference 3:
Brennan, L.A. and W.P. Kuvlesky, Jr. 2005. North American grassland birds: an unfolding conservation crisis? Journal of Wildlife Management 69:1–13.

Summary of new information:
This paper presents the broad case that grassland birds as a group have undergone, and will likely continue to experience, declines in abundance and distribution in North America as a result of a suite of interacting anthropogenic processes. This group's decline may become one of the most "prominent" wildlife conservation crises of the 21st century. Mountain plovers are mentioned only in passing. The authors suggest that the strategic actions proposed by the North American Bird Conservation Initiative have great potential to avert this crisis by coordinating conservation action across a range of organizations.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
- Management Status

CONSERVATION

Reference 4:
Colorado Division of Wildlife. 2003. Alliance aims to conserve mountain plover. Colorado Department of Natural Resources/Division of Wildlife (November 2003).

Summary of new information:
An alliance of state, federal, and private groups, including more than a dozen landowners, are working to conserve the mountain plover in Colorado. The program involves, among other things, a telephone alerting system whereby landowners call biologists prior to working fields so that mountain plover nest surveys can take place. Discovered nests are flagged by biologists, and avoided by farmers and ranchers operating in their fields. See reference 7.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies

CONSERVATION
Management of the Mountain Plover in Region 2

Reference 5:
Colorado Division of Wildlife. 2005. Colorado's comprehensive wildlife conservation strategy. Colorado Division of Wildlife. Denver, Colorado, USA.

Summary of new information:
This document is the Comprehensive Wildlife Conservation Strategy for the state of Colorado, and is guided by the following principles: (1) encourage and support conservation actions that meet the needs of species of greatest conservation need; (2) manage for healthy key habitats and ecosystems so that all species of greatest conservation need will benefit; (3) create a strategy that will be flexible enough to incorporate new research findings and successful management innovations; (4) acknowledge the pivotal role that private landowners and local stakeholders play in conservation; (5) enhance, not replace, other planning efforts; and (6) maintain an atmosphere of cooperation among wildlife managers, landowners, private and public land managers, and other stakeholders. Mountain plovers (*Charadrius montanus*) are identified as one of Colorado's species of greatest conservation need, and as such are described in this plan as to their distribution, status, habitat use, threats, and likely responses to particular management actions. The grasslands of eastern Colorado (i.e., primary mountain plover range) are described as being in the poorest condition, and hence in most need of conservation attention, of all ecological systems in the state. This reference provides a long list of management recommendations for mountain plover, both in its own text and by reference to existing mountain plover-related management plans

for the state of Colorado. This reference is probably best considered in the context of references 25, 33, and 34.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY
- Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies
- Biology and Ecology
  - Distribution and abundance
  - Population trend
  - Habitat

CONSERVATION
- Threats
- Conservation Status of the Mountain Plover in Region 2
- Management of the Mountain Plover in Region 2

Reference 6:

Dinsmore, S.J., G.C. White, and F.L. Knopf. 2005. Mountain plover population responses to black-tailed prairie dogs in Montana. Journal of Wildlife Management 69: 1546–1553.

Summary of new information:

This study related population growth (lambda) of mountain plovers to area occupied by black-tailed prairie dogs (*Cynomys ludovicanus*) using 4 years of data from a portion of Phillips County, Montana. Mountain plovers declined as prairie dogs declined (due to an outbreak of sylvatic plague), then increased as prairie dogs increased. The authors concluded that mountain plovers in this area are at least partially dependent on black-tailed prairie dogs, and thus the conservation and management of the former is affected by the conservation and management of the latter.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY
- Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies
- Biology and Ecology
  - Distribution and abundance
  - Population trend
  - Habitat
- Community Ecology

CONSERVATION
- Threats
- Conservation Status of the Mountain Plover in Region 2
- Management of the Mountain Plover in Region 2

Reference 7:
Dreitz, V.J. 2005. Resolving conflicts of mountain plovers (*Charadrius montanus*) breeding on agricultural lands in Colorado: final report. Colorado Natural Heritage Program - Colorado State University. Fort Collins, Colorado, USA.

Summary of new information:
This investigation addressed one major factor that may be driving mountain plover population declines in eastern Colorado: cultivation practices on private lands. Three-hundred ninety-five mountain plover nests, located in rangeland and cropland, were identified and studied between 2001-2003. Nest success was similar between rangeland and cropland. However, nest failure on croplands was primarily due to soil-compacting activities associated with agriculture. Locating and flagging cropland nests prior to soil-compacting activities may allow agricultural workers to avoid destroying the nests, and lead to greater mountain plover reproductive output. See reference 4.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
- Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies
- Biology and Ecology
  - Habitat
  - Breeding Biology

CONSERVATION
- Management of the Mountain Plover in Region 2

Reference 8:
Dreitz, V.J., M.B. Wunder, and F.L. Knopf. 2005. Movements and home ranges of mountain plovers raising broods in three Colorado landscapes. Wilson Bulletin 117:128-132.

Summary of new information:
Breeding mountain plovers were studied in 3 habitat types - rangeland, agricultural fields, and black-tailed prairie dog (*Cynomys ludovicianus*) towns - in eastern Colorado. Home range sizes (95% fixed kernel) were similar between all 3 types and were consistent with home range sizes reported previously in the literature. Additionally, the movement distances of individual mountain plovers were equivalent between all 3 habitats. Breeding mountain plovers were observed moving between individual prairie dog towns within a complex of towns, suggesting that complexes of small towns, in addition to single larger towns, should be considered as high quality mountain plover habitat.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY

Biology and Ecology
Habitat
Breeding Biology
Community Ecology

CONSERVATION
Management of the Mountain Plover in Region 2

Reference 9:
Dreitz, V.J., P.M. Lukacs, and F.L. Knopf. 2006. Monitoring low density avian populations: an example using mountain plovers. Condor 108-700-706.

Summary of new information:
The authors used the detection/ nondetection analytical technique of Royle and Nichols (Ecology [2003] 84:777-790) to estimate abundance of breeding mountain plovers in 3 habitats (agricultural fields, rangeland, and black-tailed prairie dog [*Cynomys ludovicianus*] towns) in eastern Colorado. The technique was judged to be both practical and effective, and estimated mountain plovers to be most abundant in prairie dog towns, slightly less abundant in agricultural fields, and much less abundant in rangeland. Detection/ nondetection models have great promise for accurate monitoring of mountain plover populations.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Biology and Ecology
Distribution and abundance
Habitat
Community Ecology

CONSERVATION
Management of the Mountain Plover in Region 2
Information needs

Reference 10:
Federal Register. 2004a. Endangered and Threatened Wildlife and Plants; Finding for the Resubmitted Petition To List the Black-Tailed Prairie Dog as Threatened. Federal Register 69:51217-51226.

Summary of new information:
Based on recent data that suggests the threats to black-tailed prairie dogs (*Cynomys ludovicianus*) are not as severe as previously assumed, the USDI Fish and Wildlife Service decided to not list the species as Threatened under the U.S. Endangered Species Act. Such a listing would have had significant management implications for mountain

plovers given the positive association between the 2 species, as documented in the Species Conservation Assessment and numerous references detailed in his update. Current estimates suggest about 1,842,000 acres are occupied by black-tailed prairie dogs in the U.S., with about 1,430,000 acres (78%) encompassed by the 5 states of USDA Forest Service Region 2. Mortality from infection by sylvatic plague was determined to be the most important rangewide threat to black-tailed prairie dogs, followed by deliberate poisoning.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY

Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies

CONSERVATION

Conservation Status of the Mountain Plover in Region 2

Management of the Mountain Plover in Region 2

Reference 11:

Federal Register. 2004b. Endangered and threatened wildlife and plants; 90-day finding on a petition to list the white-tailed prairie dog as Threatened or Endangered. Federal Register 69:64889-64901.

Summary of new information:

Based on recent data that suggests the threats to white-tailed prairie dogs (*Cynomys leucurus*) are not as severe as previously assumed, the USDI Fish and Wildlife Service determined to not list the species as Threatened or Endangered under the U.S. Endangered Species Act. Such a listing may have had significant management implications for mountain plovers in the western portion of their range, assuming that mountain plovers associate with white-tailed prairie dogs in a similar fashion as they associate with black-tailed prairie dogs (*C. ludovicianus*). Major sources of white-tailed prairie dog mortality are the same as those for black-tailed prairie dogs: namely, infection by sylvatic plague, deliberate poisoning, and shooting. Habitat degradation by oil and gas development is another possible impact, but has not yet been demonstrated conclusively.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY

Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies

CONSERVATION

Conservation Status of the Mountain Plover in Region 2

Management of the Mountain Plover in Region 2

Reference 12:

Guo, X., J. Wilmshurst, S. McCanny, P. Fargey., and P. Richard. 2004. Measuring spatial and vertical heterogeneity of grasslands using remote sensing techniques. Journal of Environmental Informatics 2004:24-32.

Summary of new information:

Analyses of Landsat imagery successfully detected vertical and horizontal heterogeneity in Canadian grasslands. Grasslands under conservation action had greater and more variable canopy heights than those subject to livestock grazing; grazed grasslands had more horizontal variability than conserved grasslands. The analytical techniques used in this study mapped grassland structure reliably at 15m resolution. Such remote sensing work could be extremely valuable in mapping mountain plover habitat across large areas.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

CONSERVATION

- Conservation Status of the Mountain Plover in Region 2
- Management of the Mountain Plover in Region 2
- Information Needs

Reference 13:

Hamer, T.L., C.H. Flather, and B.R. Noon. 2006. Factors associated with grassland bird species richness: the relative roles of grassland area, landscape structure, and prey. Landscape Ecology 21:569–583.

Summary of new information:

The species richness of grassland birds in eastern Wyoming was positively associated with area of grassland habitat; negatively associated with habitat dispersion; positively associated with edge habitats; negatively associated with landscape matrix attributes that may restrict movement of grassland birds; and positively related to grasshopper species richness. This suggests that grassland birds in general are influenced by a complex suite of habitat and prey factors. This reference is tangentially relevant to mountain plovers.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY

- Biology and Ecology
  - Distribution and abundance
  - Habitat
  - Community Ecology

Reference 14:

Lukacs, P.M., V.J. Drietz, F.L. Knopf, and K.P. Burnham. Estimating survival probabilities of unmarked dependent young when detection is imperfect. Condor 106:926-931.

Summary of new information:
A capture-recapture analytical approach was used to estimate the survival probability of mountain plover chicks. If the attending adult is marked, the nest is found prior to hatching, and number of hatched eggs is known, subsequent data on the number of chicks observed with the marked adult can be used to successfully estimate chick survival. This method can be used for a variety of bird species.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
CONSERVATION
- Conservation Status of the Mountain Plover in Region 2
- Management of the Mountain Plover in Region 2
- Information Needs

Reference 15:
Mettenbrink, C.W., V.J. Dreitz, and F.L. Knopf. 2006. Nest success of mountain plovers relative to anthropogenic edges in eastern Colorado. Southwestern Naturalist 51:191-196.

Summary of new information:
From 2003-2004 163 mountain plover nests were monitored in eastern Colorado; 81 nests successfully hatched at least 1 egg, and 82 hatched no eggs. Based on logistic regression modeling, successful nests were neither closer nor farther from anthropogenic edges (fence lines, roads, perimeter of crop fields) than unsuccessful nests. Nest success of mountain plovers in this landscape appears to be independent of distance-to-edge.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
- Biology and Ecology
  - Habitat

Reference 16:
Neely, B. S. Kettler, J. Horsman, C. Pague, R. Rondeau, P. Comer, L. Grunau, G. Belew, F. Pusateri, B. Rosenlund, D. Runner, J. Sovell, D. Anderson, T. Jackson and M. Klavetter. 2006. Central Shortgrass Prairie ecoregional assessment and partnership initiative. The Nature Conservancy / Department of Defense Legacy Resource Management Program / Colorado Division of Wildlife.

Summary of new information:

This project identified a suite of sites in the Central Shortgrass Prairie Ecoregion (extreme southeastern Wyoming, southwestern Nebraska, eastern Colorado, western Kansas, Oklahoma panhandle, and extreme northern Texas panhandle) that, if placed under conservation action, would efficiently conserve most of the biological diversity present in that ecoregion. Mountain plovers were selected as a conservation target to explicitly inform this effort, and the plan includes a map of estimated mountain plover density (an interpolated density surface) based on documented sightings of the species throughout the ecoregion.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY
- Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies
- Biology and Ecology
  - Distribution and abundance

CONSERVATION
- Conservation Status of the Mountain Plover in Region 2
- Management of the Mountain Plover in Region 2

Reference 17:

Obele, K.A. 2005. A vegetative characterization of mountain plover nest sites on the Pawnee National Grassland : a management perspective. MS Thesis, Colorado State University. Ft. Collins, Colorado, USA.

Summary of new information:

This reference was not directly reviewed given the difficulty of its acquisition. Internet-based literature search engines failed to uncover any publications attributable to this author; it may be that publications derived from this thesis are in-preparation or in-press at this time.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

NA

Reference 18:

Oring, L.W., L. Neel, and K.E. Oring. 2006. Intermountain west regional shorebird plan: version 1.0.

Summary of new information:

The goals of this plan are to: (1) facilitate protection, restoration, and management of shorebird habitat in the Intermountain West region (IMW); (2) acquire and organize existing information on shorebird distribution and abundance needed for conservation in the IMW; (3) gather new information needed for shorebird conservation in the IMW; (4)

develop an informed and supportive constituency for long-term shorebird conservation in the IMW; and (5) achieve regional cooperation for shorebird conservation by developing a process to facilitate planning among states and agencies, and working toward integration of shorebird concerns with land management plans. This plan recognizes that the IMW supports small but important breeding concentrations of mountain plovers; more importantly, virtually all mountain plover winter range falls in this region.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies

Reference 19:
Oyler-McCance, S., J. St. John, F.L. Knopf, and T.W. Quinn. 2005. Population genetic analysis of mountain plover using mitochondrial DNA sequence data. Condor 107:353-362.

Summary of new information:
Mitochondrial DNA analysis suggests that the current population of mountain plovers is not differentiated into distinct genetic subunits. This contrasts with the pattern expected for a long-distance migrant with high site fidelity. It is hypothesized that the observed genetic homogenization might result from pair bond formation in mixed flocks on wintering grounds. The molecular analysis also suggests that mountain plovers expanded their range rapidly following the Pleistocene/ Holocene transition.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Biology and Ecology
Distribution and abundance
Site fidelity
Breeding Biology

Reference 20:
Peterson, A.T. 2003. Subtle recent distributional shifts in Great Plains bird species. Southwestern Naturalist 48:289-292.

Summary of new information:
Data from the Breeding Bird Survey suggests that 5 species of bird endemic to the Great Plains, including mountain plover, have collectively shifted their range northward in recent decades. The shift was not as significant for the mountain plover as it was for other species, or for the collective group of 5 species. It is suggested that global climate change may be driving these subtle but significant range shifts.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Biology and Ecology
Distribution and abundance

Reference 21:
Plumb, R.E., S.H. Anderson, and F.L. Knopf. 2005. Habitat and nesting biology of mountain plovers in Wyoming. Western North American Naturalist 65:223-228

Summary of new information:
Fifty-five mountain plover nests were studied in grassland and desert shrub throughout Wyoming in 2002-2003. Mean hatch date was estimated at 26 June (2002) and 21 June (2003). Eggs in 64% of known-fate nests hatched. Almost all nests occurred in the presence of ungulate grazers; prairie dogs were absent at 64% of nest sites. Nests were typically placed on flat and barren sites, consistent with existing descriptions of habitat use. Compared to random sites, nest sites had less dense and shorter grass. Over 50% of nests were placed on elevated plateaus. It is assumed that this reference is one major publication arising from reference 23; see also reference 22.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Biology and Ecology
Habitat
Breeding Biology

Reference 22:
Plumb, R.E., F.L. Knopf, and S.H. Anderson. 2005. Minimum population size of mountain plovers breeding in Wyoming. Wilson Bulletin 117:15-22.

Summary of new information:
Data from a statewide survey of mountain plovers was analyzed with distance-sampling methods, and extrapolated using observed home range sizes, to estimate the number of breeding individuals in the state of Wyoming. The minimum estimated population of 3,393 individuals is a substantial increase over previous estimates of only 500 - 1,500 individuals. This new number indicates that Wyoming supports 24 - 31% of the global population of mountain plovers. It is assumed that this reference is one major publication arising from reference 23; see also reference 21.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Management Status

Biology and Ecology
Distribution and abundance
Population trend

CONSERVATION
Conservation Status of the Mountain Plovers in Region 2

Reference 23:
Plumb, R. 2004. Minimum population size and concentration areas of mountain plovers breeding in Wyoming. MS Thesis. University of Wyoming, Laramie, Wyoming, USA.

Summary of new information:
See references 21 and 22 for presumed publications of the major findings in this reference. Chapter 4 of this reference summarizes these findings, and forwards 5 recommendations for future management of mountain plovers: (1) livestock grazing is effective at maintaining breeding habitat; (2) other range management practices will affect mountain plover breeding habitat, most notably fire (habitat improvement) and exotic plant introduction (habitat degradation); (3) population trends may be tracked through annual monitoring of concentration areas; (4) effects of industrial (i.e., petroleum) development on mountain plovers is currently unclear, and should be a top research priority; and (5) the association between mountain plovers and prairie dogs (*Cynomys* spp.) may not be as strong as previously assumed.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Biology and Ecology
Distribution and abundance
Population trend
Habitat
Breeding Biology

CONSERVATION
Threats
Conservation Status of the Mountain Plovers in Region 2
Management of the Mountain Plover in Region 2
Information Needs

Reference 24:
Rotella, J.J., Dinsmore, S.J. & Shaffer, T.L. 2004. Modeling nest–survival data: a comparison of recently developed methods that can be implemented in MARK and SAS. Animal Biodiversity and Conservation 27:187–205.

Summary of new information:

Given recent advances in statistical theory and software, the authors suggest that more complex and accurate methods of estimating nest success should become the norm, and previous coarser methods are no longer justifiable. This source outlines the fine-points of some of the more complex models, using an example data set for mountain plovers. It is notable that the suggested methods include information theoretic techniques, which are seeing increased use in most areas of ecology. See reference 27.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

CONSERVATION
- Information needs

Reference 25:

Schneider, R., M. Humpert, K. Stoner, and G. Steinauer. 2005. The Nebraska natural legacy project: a comprehensive wildlife conservation strategy. Nebraska Game and Parks Commission. Lincoln, Nebraska, USA.

Summary of new information:

This document is the Comprehensive Wildlife Conservation Strategy for the state of Nebraska, and has as its major goals (1) reversing the decline of at-risk species (and avoiding the need for state or federal listing as threatened or endangered), (2) recovering currently listed species and allowing for their de-listing, and (3) keeping now-common species common in the future. Mountain plovers are identified as a "Tier 1 At-Risk" species for Nebraska, and as such are described in this plan as to their distribution, status, habitat use, threats, and likely responses to particular management actions. Suitable habitat is generally described as short- or mixed-grass prairie in the western 1/3 of the state. This reference provides a long list of habitat management recommendations for mountain plover, and is probably best considered in the context of references 5, 33, and 34.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY
- Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies
- Biology and Ecology
  - Distribution and abundance
  - Population trend
  - Habitat

CONSERVATION
- Threats
- Conservation Status of Mountain Plover in Region 2
- Management of Mountain Plover in Region 2

Reference 26:
Schneider, S.C., M.B. Wunder, and F.L. Knopf. 2006. Relationship between shrubs and foods in mountain plover habitat in Park County, Colorado. Southwestern Naturalist 51:197-202.

Summary of new information:
This study related percent cover of bare ground, percent cover of shrubs, linear distance to nearest shrub, arthropod biomass, and grasshopper density to the probability of presence of mountain plovers with broods, and without broods, in South Park, Colorado. Results were complex and indicated that brood-rearing adults select habitat features differently than do non brood-rearing adults. Availability of invertebrate forage, and predator avoidance by chicks, appeared to be the driving factors: adults without broods positioned themselves in sites of high invertebrate abundance, and adults with broods positioned themselves relatively close to shrubs in similar sites (it was assumed that shrub proximity equated to cover from predators). The authors speculate that habitat edges (e.g., grassland/ shrubland, cropland/ rangeland, prairie dog town/ non-prairie dog town) may be important to breeding mountain plovers in that they can provide both high invertebrate abundance and vegetative cover.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Biology and Ecology
Habitat

Reference 27:
Shaffer, T.L. 2004. A unified approach to analyzing nest success. Auk 121:526-540.

Summary of new information:
Similar to reference 24, this source suggests that field workers use more complex and accurate statistical methods to estimate nest success of birds, including mountain plovers. A "logistic exposure" approach is outlined, and examples are given using mountain plover field data. It is notable that the suggested methods include information theoretic techniques, which are seeing increased use in most areas of ecology.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
CONSERVATION
Information needs

Reference 28:
Shuford, W.D., N. Warnock, and R.L. McKernan. 2004. Patterns of shorebird use of the Salton Sea and adjacent Imperial Valley, California. Studies in Avian Biology 27:61–77.

Summary of new information:
Shorebird surveys performed in 1999 revealed that 2486 - 3758 individual mountain plovers (30-38% of the global population) winter on agricultural fields near the Salton Sea, California.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Biology and Ecology
Habitat

Reference 29:
Smith, G.A., and M.V. Lomolino. 2004. Black-tailed prairie dogs and the structure of avian communities on the shortgrass plains. Oecologia 138:592–602.

Summary of new information:
Avian communities were studied on 36 black-tailed prairie dog (*Cynomys ludovicianus*) towns and 36 paired (i.e., no prairie dog towns) sites in the Oklahoma panhandle from 1997-1999. In general, prairie dog towns supported more individuals and more species of bird than did paired sites; prairie dog towns also supported a unique assemblage of bird species as compared to the paired sites. Even in their current "remnant" state, black-tailed prairie dog towns appear to significantly structure bird communities in the Great Plains. Importantly, it appears that mountain plovers were not observed with enough frequency during this study for any specific conclusions to be made; thus, this study is only tangentially relevant to mountain plovers.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Community ecology

Reference 30:
Strickland, D. 2004. Overview of non-collision related impacts from wind projects. Wind Energy and Birds/ Bats Workshop Proceedings, 2004.

Summary of new information:
The author reports a decline in mountain plover numbers during and following the construction of wind power turbines in southern Wyoming. However, this decline was paralleled by similar declines in mountain plovers on nearby sites that were not affected by the turbine project. The main relevance of this source to the Species Conservation Assessment may be to alert readers to an apparent lack of information on the effects of wind power projects (forecasted to increase in the near future) on mountain plovers.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
CONSERVATION
Information needs

Reference 31:
Wunder, M.B., C.L. Kester, F.L. Knopf, R.O. Rye. 2005. A test of geographic assignment using isotope tracers in feathers of known origin. Oecologia 144:607-617.

Summary of new information:
Feathers were collected from 194 mountain plovers from across the species' range, and feather isotopic signatures were analyzed in an attempt to correctly identify place of origin. Whereas traditional regression approaches did not accurately assign feathers to place of origin, discrete-response Bayesian probability models did. Correct assignment rates were highest when 3 isotopes were analyzed simultaneously, but even the use of a single isotope produced higher assignment rates than random assignment. This technique shows great promise for linking mountain plover breeding ranges to winter ranges.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
CONSERVATION
Information needs

Reference 32:
Wunder, M.B., F.L. Knopf, and C.A. Pague. 2003. The high-elevation population of mountain plovers in Colorado. Condor 105:654-662.

Summary of new information:
The population of mountain plovers in South Park, Colorado, was carefully surveyed and analyzed to estimate the total number of birds using the area during the breeding season. A map of potential habitat was created, and areas of known occupation were overlain on that map. Breeding densities were then estimated in occupied areas using distance sampling techniques. Estimated densities of 7.9 birds/ km^2 were high compared to other extant subpopulations of mountain plovers. Extrapolations of density estimates to all occupied habitat in South Park suggested a total of 2310 mountain plovers in South Park, which translates to about 16 - 21% of the most recent global population estimates.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Biology and Ecology
Distribution and abundance

CONSERVATION

Conservation status of the mountain plover in Region 2
Management of the mountain plover in Region 2

Reference 33:
Wasson, T., L. Yasui, K. Brunson, S. Amend, and V. Ebert. 2005. A future for Kansas wildlife: Kansas' comprehensive wildlife conservation strategy. Dynamic Solutions Inc. in cooperation with Kansas Department of Wildlife and Parks. Topeka, Kansas, USA.

Summary of new information:
This document is the Comprehensive Wildlife Conservation Strategy for the state of Kansas, and serves as a strategic plan that identifies broad priorities of species habitats, management and conservation issues, and, by inference, management and conservation strategies. Mountain plover is identified as a "Tier 1" priority species in Kansas, and as such is described in this plan as to its distribution, status, habitat use, threats, and likely responses to particular management actions. Suitable habitat is generally described as short- or mixed-grass prairie on flat or gently rolling topography, usually with abundant prairie dog or other ground squirrel colonies. This reference provides a long list of habitat and non-habitat management recommendations for mountain plover, and is probably best considered in the context of references 5, 25, and 34.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):
MANAGEMENT STATUS AND NATURAL HISTORY
Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies
Biology and Ecology
Distribution and abundance
Population trend
Habitat

CONSERVATION
Threats
Conservation Status of the mountain plover in Region 2
Management of the mountain plover in Region 2

Reference 34:
Wyoming Game and Fish Department. 2005. A comprehensive wildlife conservation strategy for Wyoming. Wyoming Game and Fish Department. Cheyenne, Wyoming, USA.

Summary of new information:
This document is the Comprehensive Wildlife Conservation Strategy for the state of Wyoming. Its intent is to serve as a central "hub" for all existing and future management plans and conservation strategies in Wyoming, and to guide the combined efforts of government agencies at all levels, non-profits, academia, non-governmental

organizations, tribes, and individuals to conserve all Wyoming wildlife. Mountain plover is identified as one of Wyoming's species of greatest conservation need, and as such is described in this plan as to its distribution, status, habitat use, threats, and likely responses to particular management actions. The grasslands of eastern Wyoming (i.e., mountain plover range) are described as being the least intact, and hence in most need of conservation attention, of all ecological systems in the state. Mountain plovers are mapped as occurring in the grasslands of eastern Wyoming as well as the basins of central and western Wyoming, similar to the distribution mapped by reference 2. Suitable habitat is generally described as short- or mixed-grass prairie on flat or gently rolling topography, usually with abundant prairie dog or other ground squirrel colonies. This reference provides a long list of habitat and non-habitat management recommendations for mountain plover, and is probably best considered in the context of references 5, 25, and 33.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY
- Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies
- Biology and Ecology
  - Distribution and abundance
  - Population trend
  - Habitat

CONSERVATION
- Threats
- Conservation Status of the mountain plover in Region 2
- Management of the mountain plover in Region 2

Reference 35:

Wyoming Game and Fish Department. 2006. Draft: a plan for bird and mammal species of greatest conservation need in eastern Wyoming grasslands. Wyoming Game and Fish Department. Cheyenne, Wyoming, USA.

Summary of new information:

This draft plan recognizes that grasslands are the most imperiled natural system in North America, and although Wyoming grasslands are in good condition relative to those in other states they also represent the least intact natural systems in Wyoming. Its goal is to formalize strategies that will help the Wyoming Game and Fish Department (WGFD) work cooperatively with landowners, other agencies and the public to conserve healthy grassland ecosystems in Wyoming, and enable the WGFD to address the conservation needs of Wyoming's grasslands and associated wildlife in a proactive manner. Mountain plover is recognized as a Wyoming grassland species-of-concern, and is described as to its distribution, status, habitat use, threats, and likely responses to particular management actions. However, most of this information appears very similar to that presented by reference 34. This reference may be best considered as an "extension" of reference 34.

Relevant sections in the Technical Conservation Assessment (following the original table of contents):

MANAGEMENT STATUS AND NATURAL HISTORY
- Existing Regulatory Mechanisms, Mgmt Plans, and Conservation Strategies
- Biology and Ecology
  - Distribution and abundance
  - Population trend
  - Habitat

CONSERVATION
- Threats
- Conservation Status of the mountain plover in Region 2
- Management of the mountain plover in Region 2

Reference 36:

Personal communications with individual biologists and land managers in Region 2 regarding mountain plover ecology, management, and conservation.

Summary of new information:

Doug Keinath (Lead Zoologist, Wyoming Natural Diversity Database - University of Wyoming; dkeinath@uwyo.edu; 307 766-3023). The Wyoming Natural Diversity Database is currently working with the Wyoming Game and Fish Department to compile a complete set of all known mountain plover sightings in the state. Preliminary indications are that there has been no substantial range expansion or contraction in the state relative to previous distribution maps for this species. This dataset will be available upon request.

John Sovell (Zoology Team Leader, Colorado Natural Heritage Program - Colorado State University; jsovell@lamar.colostate.edu; 970 492-6052). The extrapolated density surface map of mountain plovers outlined in reference 16 may be the most up-to-date information on distribution in the Central Shortgrass Prairie ecoregion.

Rick Schneider (Nebraska Natural Heritage Program; Rick.Schneider@ngpc.ne.gov). The Rocky Mountain Bird Observatory (RMBO) has been conducting mountain plover surveys in western NE for the last four years, mostly on cropland but some on rangeland as well. RS is uncertain if they have documented any range extensions. Bart Bly (308-762-2372; bart.bly@rmbo.org) would be the primary contact for this data, but note also that the Nebraska Natural Heritage Program has a complete set of RMBO observations of mountain plover, too.

Doug Backlund (South Dakota Natural Heritage Program; Doug.Backlund@state.sd.us). There are still no confirmed records of mountain plovers breeding recently in South Dakota. One adult was documented in Conata Basin in summer 2004, but follow-up surveys in the area in 2005 failed to find any mountain plovers. The only other recent

documentation of presence in South Dakota is a pair sighted in 1978, with no evidence of nesting (Lohoefner, R. and C.A. Ely. 1978. South Dakota Bird Notes 30:24-30). Breeding adults just across the state lines in both Montana and Wyoming suggest possible breeding in extreme peripheral South Dakota.

Bill Busby (Kansas Natural Heritage Program; wbusby@ku.edu). BB's general impression is that mountain plover distribution and abundance is stable in Kansas, with presence limited to the southwest corner of the state.

Victoria Drietz (Colorado Division of Wildlife; victoria.dreitz@state.co.us). At least 2 research projects involving mountain plovers are in-progress in Colorado: (1) a comparison of recruitment rates, and (2) a MS Thesis (Colorado State University) comparing methods to estimate density and occupancy of grassland birds, with mountain plovers as one of the focal species.

Andy Chappell (USDA Forest Service Cimarron National Grassland; atchappell@fs.fed.us). Mountain plovers are occasionally seen on the Cimarron NG, usually after prescribed burns.

Dave Augustine (USDA Forest Service Comanche National Grassland; daugustine@fs.fed.us). Many mountain plovers breed on the Comanche NG, and prescribed burning has been very successful at promoting their use of the area. DA has continued the plover-oriented prescribed burning outlined by Svingen and Giesen (1999; Colorado Field Ornithologists 33:208-212) with good success, as documented by available yearly project reports. Main conclusions from these reports are:

1. Prescribed burning provides much nesting habitat; nest success on burns is about 50%.
2. Cattle should be used to graze post-burn greenup. Nest trampling is not a concern, and grazing maintains the low vegetation preferred by plovers.
3. Prairie dog colonies are very important nesting habitat, but they need to be >320 acres in size and >5 years in age to be optimal.
4. Use of burns by mountain plovers seems to be higher in landscapes with dryland wheat farms. Plover use of native prairie may be low in dry years because they are using failed wheat fields instead. Farming activity likely crushes a lot of nests in these fields.

Larry Gerard (USDI Bureau of Land Management Buffalo Field Office; larry_gerard@blm.gov). Mountain plovers have been documented in several black-tailed prairie dog towns as a result of monitoring and permitting of coal-bed methane developments.

Michael Wunder (Colorado State University; mbw@lamar.colostate.edu). The body of scientific information regarding mountain plovers, both rangewide and in Region 2, has increased substantially since the Species Conservation Assessment was published. A new "Birds of North America" species account (prepared by M. Wunder and F. Knopf) of mountain plovers is currently in-press.

Fritz Knopf (USGS; Fritz_Knopf@usgs.gov). The body of scientific information regarding mountain plovers, both rangewide and in Region 2, has increased substantially since the Species Conservation Assessment was published. A new "Birds of North America" species account (prepared by M. Wunder and F. Knopf) of mountain plovers is currently in-press.

Stephen J. Dinsmore (Iowa State University; cootjr@iastate.edu). No significant range expansions or contractions have been noted since the Species Conservation Assessment was published.

Sue Oberlie (USDI Bureau of Land Management Lander Field Office; sue_oberlie@blm.gov). The Lander Field Office has been conducting many localized mountain plover surveys in conjunction with oil and gas development projects, and has documented several breeding pairs. Most have been in areas of typical habitat, with a few in marginal/ atypical locations.

Mary Read (USDI Bureau of Land Management Rawlins Field Office; mary_read@blm.gov). The Rawlins Field Office has been conducting mountain plover surveys since about 2000 in conjunction with oil and gas development projects. They are also mapping mountain plover habitat across about 1.2 million acres slated for future oil and gas work. Much of this work is being documented, but completeness and availability of study results is hampered by work overloads.