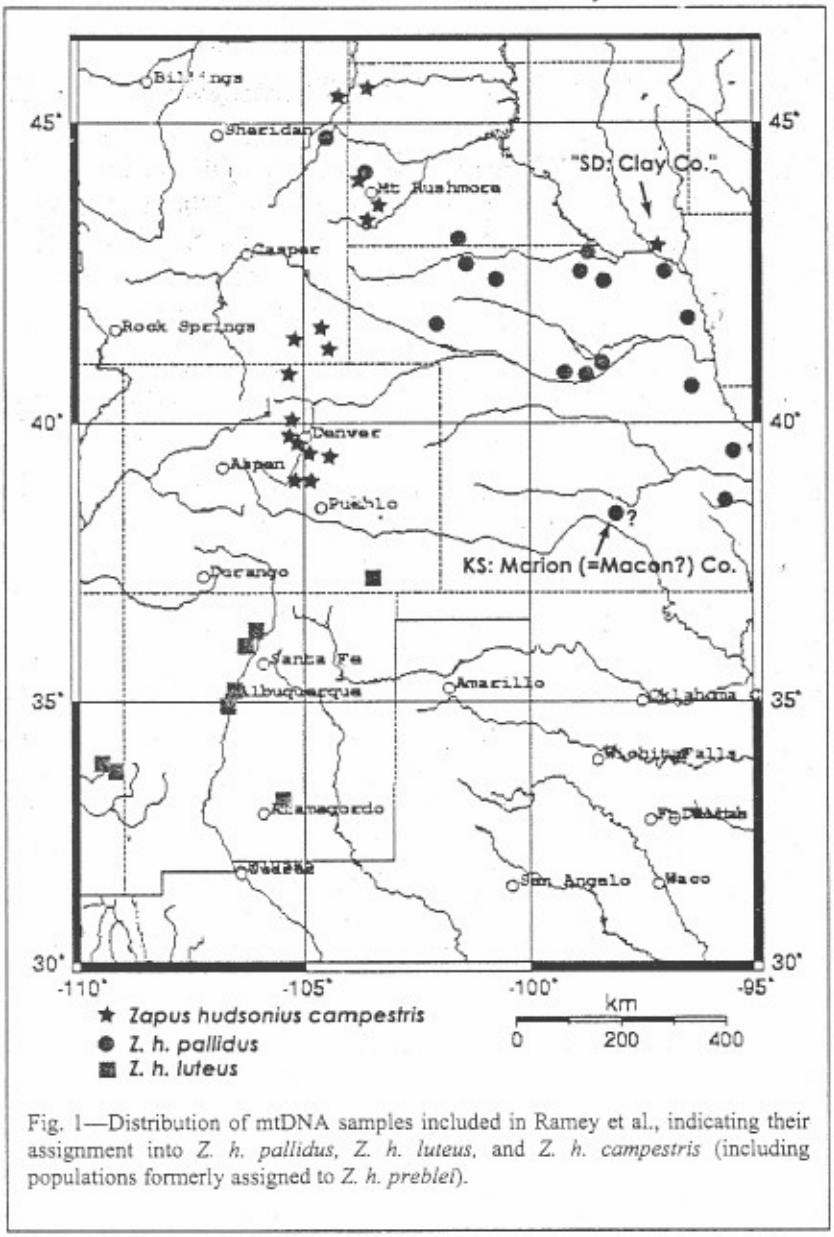

Fig. 1—Distribution of mtDNA samples included in Ramey et al., indicating their assignment into *Z. h. pallidus*, *Z. h. luteus*, and *Z. h. campestris* (including populations formerly assigned to *Z. h. preblei*).

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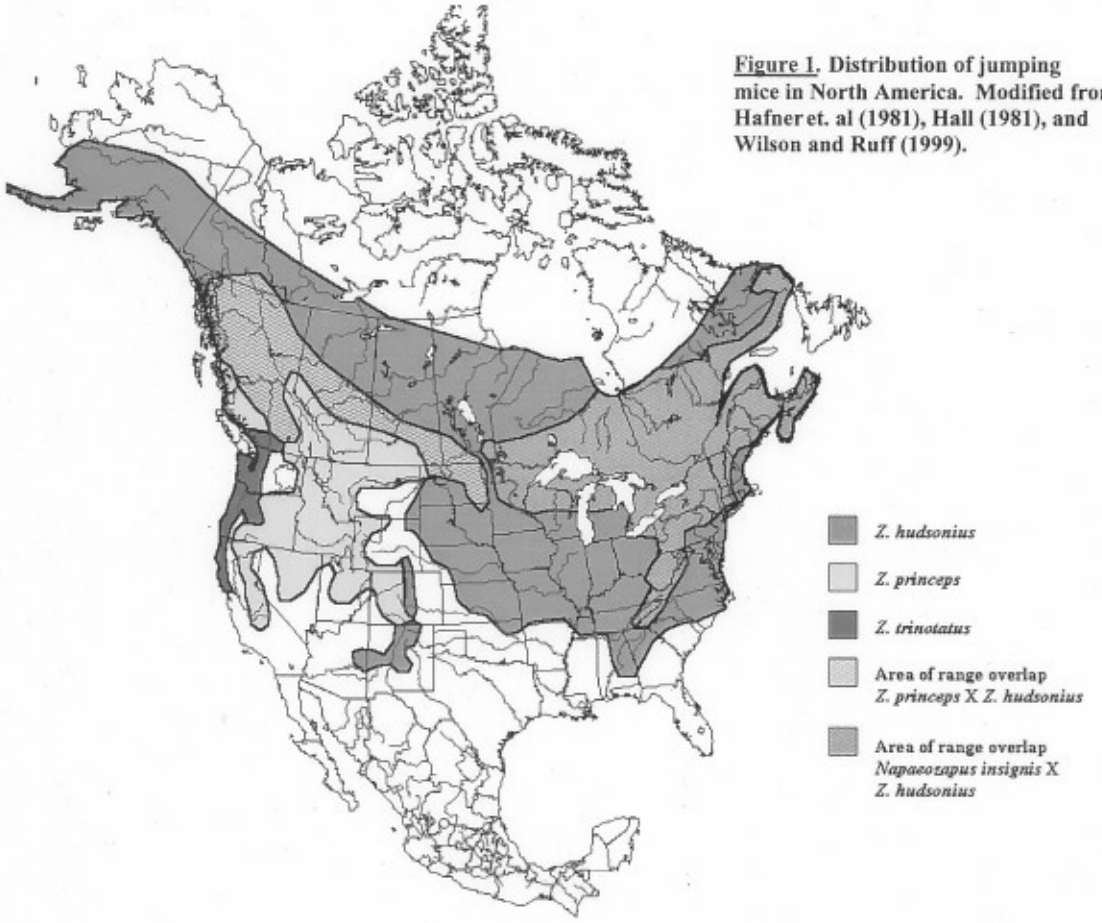

Figure 1. Distribution of jumping mice in North America. Modified from Hafner et. al (1981), Hall (1981), and Wilson and Ruff (1999).

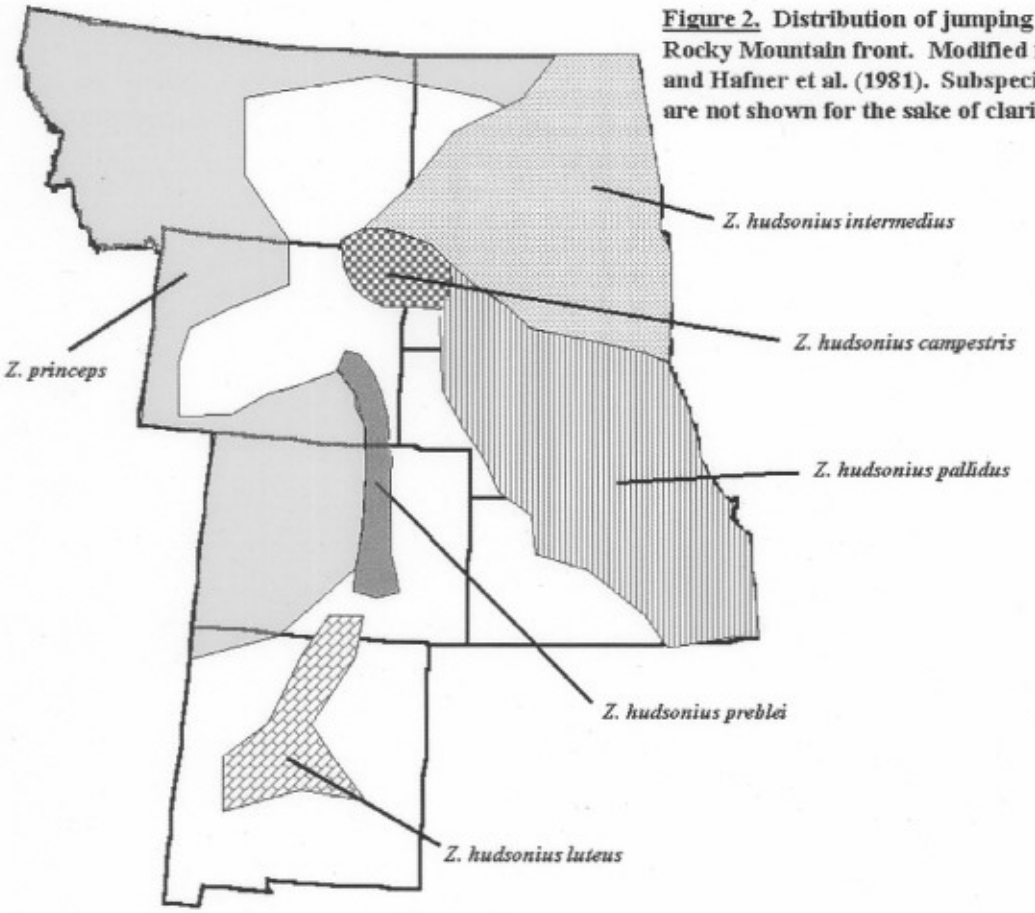

Figure 2. Distribution of jumping mice along the Rocky Mountain front. Modified from Hall (1981) and Hafner et al. (1981). Subspecies of *Z. princeps* are not shown for the sake of clarity.

upgrading is appropriate, based on the incremental benefits and costs and applicable statutory criteria, the agency issues an NPRM proposing to upgrade the FMVSS to the level of Country B's std. If upgrading is not appropriate, NHTSA considers issuing an NPRM proposing to add the requirements of Country B's std to the FMVSS as an alternative compliance option. The proposal to add the compliance option would set forth the basis for the agency's conclusion that upgrading the FMVSS is inappropriate. If NHTSA issues an NPRM, it would request comment on the tentative determination and the proposed amendment.

3. *Decision whether to issue a final rule.* Any final decision to make a determination regarding relative benefits and functional equivalency and to amend the FMVSS will be made in accordance with the process in the flowchart and applicable law and only after careful consideration and analysis of the public comments.

Issued on May 6, 1998.

Ricardo Martinez,

Administrator.

[FR Doc. 98–12598 Filed 5–12–98; 8:45 am]

BILLING CODE 4910–59–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018–AE06

Endangered and Threatened Wildlife and Plants; Final Rule to List the Preble's Meadow Jumping Mouse as a Threatened Species

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The U.S. Fish and Wildlife Service determines the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) to be a threatened species pursuant to the Endangered Species Act (Act) of 1973, as amended. The Preble's meadow jumping mouse, a small rodent in the family Zapodidae, is known to occur in seven counties in Colorado and two counties in Wyoming. Historical records document its former presence in additional counties in Colorado and Wyoming. The Preble's meadow jumping mouse lives primarily in heavily vegetated riparian habitats. Habitat loss and degradation caused by agricultural, residential, commercial, and industrial development imperil its continued existence. This action implements the protection of the Act for Preble's meadow jumping mouse.

DATES: This rule is effective June 12, 1998.

ADDRESSES: The complete file for this rule is available for public inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service's Colorado Field Office, 755 Parfet Street, Suite 361, Lakewood, Colorado.

FOR FURTHER INFORMATION CONTACT: LeRoy W. Carlson, Field Supervisor, Colorado Field Office, U.S. Fish and Wildlife Service, P.O. Box 25486, Denver Federal Center, Denver, Colorado 80225–0207 (telephone 303/275–2370).

SUPPLEMENTARY INFORMATION:

Background

The Preble's meadow jumping mouse (*Zapus hudsonius preblei*) (Preble's) is a small rodent in the family Zapodidae and is 1 of 12 recognized subspecies of the species *Z. hudsonius*, the meadow jumping mouse (Krutzsch 1954, Whitaker 1972, Hafner 1981). The family *Zapus* consists of small to medium-sized mice with long tails and long feet adapted for jumping. Krutzsch (1954) provided a revision of the taxonomy of the genus *Zapus* in North America and recognized three living species, *Z. hudsonius, Z. trinotatus*, and *Z. princeps.* As the most recent revision of *Z. hudsonius*, this stands as the authority for taxonomy. Fitzgerald et al. (1994) described *Z. hudsonius* as greyish to yellowish-brown in color with an indistinct mid-dorsal band of darker hair and paler sides, large hindlegs and hindfeet, and a sparsely haired tail that accounts for more than 60 percent of the total length.

In his 1899 revision of North American jumping mice, E. A. Preble referred specimens of the meadow jumping mouse from Colorado and southeastern Wyoming to the subspecies *Z. h. campestris* (Preble 1899, cited by Krutzsch 1954). Krutzsch (1954) described and named *Z. h. preblei* as separate from *Z. h. campestris*, indicating as the holotype a specimen obtained by E. A. Preble in July 1895 from Loveland, Larimer County, Colorado. All records of Preble's are from southeastern Wyoming and eastern Colorado. The coloration of Preble's was described by Krutzsch (1954) as ''color dull, back from near Clay Color to near Tawny-Olive with a mixture of black hair forming poorly defined dorsal band; sides lighter than back from near Clay Color to near Cinnamon-Buff; lateral line distinct and clear Ochraceous-Buff; belly white, sometimes faint wash of clear Ochraceous-Buff; tail bicolored, brownish to light brownish-black above, grayish-white to yellowish-white below'' (capitalized color terms refer to a scientific standard, while lower case terms reflect common usage). Krutzsch (1954) also provided a technical description of the skull of Preble's, which can prove important to its identification.

There is a similarity of appearance between the Preble's meadow jumping mouse and *Z. princeps*, which also occurs in portions of Colorado and Wyoming. In general, *Z. hudsonius* may be distinguished from *Z. princeps* by average external size and cranial size (Krutzsch 1954, Whitaker 1972). Preble's may be distinguished from *Z. princeps* by a less pronounced mid-dorsal band, smaller average total length, and a skull that is small and light with a narrower braincase and smaller molars (Fitzgerald et al. 1994). Since coloration of the mid-dorsal band and total length are not definitive characteristics, skull measurements are most useful for positive identification. Ranges of the Preble's and *Z. princeps* are not known to overlap in Colorado but the relationships between respective ranges in Wyoming is less clear (Garber 1995, Armstrong 1972).

Krutzsch (1954) commented on the presence of physical habitat barriers and lack of known intergradation between the Preble's meadow jumping mouse, known only from eastern Colorado and southeastern Wyoming, and other identified subspecies of *Z. hudsonius* ranging to the east and north. Among recognized subspecies, Krutzsch found that Preble's most closely resembled *Z. campestris* from northeastern Wyoming, but summarized differences in coloration and skull characteristics. Krutzsch concluded that considerable differences existed between Preble's and related subspecies. In contrast, Jones (1981) studied specific and intraspecific relationships within *Zapus* and recognized no subspecies of *Z. hudsonius.* Jones did, however cite that *Z. hudsonius* populations in Colorado and southeastern Wyoming were apparently isolated from other populations. Hafner et al. (1981) described an additional subspecies *Z. hudsonius luteus* present in New Mexico and Arizona and differentiated it from Preble's. This subspecies was previously considered *Z. princeps luteus*, a subspecies of the western jumping mouse. Recently, *Z. h. luteus* was found in Las Animas County, Colorado (Riggs et al. 1997), the furthest north that the subspecies has been recorded, but over 100 miles south of the confirmed range of Preble's in Colorado.

Results from genetic analysis of mice from Rocky Flats Environmental Technology Site (Rocky Flats) in Jefferson County, Colorado, *Z.*

hudsonius from Minnesota and Indiana, and, *Z. princeps* from Colorado, provided clear evidence that the Rocky Flats mice were of the species *Z. hudsonius.* However, the analysis did not provide a means of separating subspecies of *Z. hudsonius* (Bruce Wunder, Colorado State University, pers. comm. 1996). Under a cost-sharing agreement with the U.S. Fish and Wildlife Service, the Colorado Division of Wildlife supported genetic studies of Preble's trapped in Colorado and Wyoming during the 1996 and 1997 field seasons. Tissue samples from presumed Preble's trapped at 23 locations in Colorado and 2 in Wyoming were assessed, through mitochondrial DNA analysis, and compared to reference samples of *Z. princeps* and to samples of *Z. hudsonius* from outside the known range of Preble's. The analysis indicated that mice from Albany County, Wyoming (Medicine Bow National Forest) to western Las Animas County, Colorado (San Isabel National Forest) formed a coherent genetic group (Riggs et al. 1997). The report concluded that ''data appear consistent with the view that a geographically contiguous set of populations previously recognized as Preble's meadow jumping mouse (*Z. h. preblei*) form a homogenous group recognizably distinct from other nearby populations and from geographically-adjacent species of the genus'' (Riggs et al. 1997). However, some specimens of *Z. hudsonius* from outside the known range of Preble's, including *Z. h. campestris* from northern Wyoming, were indistinguishable from Preble's based on the analysis. Hafner (1998) reviewed the report cited above and found no fault with the currently accepted taxonomic relationship of the subspecies *Z. h. preblei, Z. h. campestris*, and *Z. h. luteus.* He commented that current recognition of these subspecies is appropriately based on geographic variation of morphological traits and distribution.

Other conclusions of interest from the Riggs et al. (1997) genetic study included a specimen from San Isabel National Forest, Las Animas County, Colorado, which was identified as *Z. princeps* when it was collected, but was later determined to be most similar to Preble's meadow jumping mouse. The presence of Preble's in Las Animas County would significantly expand its known range southward. Reexamination of this specimen confirmed diagnostic dentation of *Z. princeps* (Cheri Jones, Denver Museum of Natural History, *in litt.* 1998). A mouse from Lone Tree Creek, Weld County, Colorado, and six mice from F.E. Warren Air Force Base, Laramie County, Wyoming, were identified as Preble's when they were trapped and later determined to be most similar to *Z. princeps* (Riggs et al. 1997). Hafner (1998) suggested that the discrepancies in species associations found in the analysis by Riggs et al. (1997) could be due to the specific DNA segment chosen for analysis, or to limited hybridization in areas where the two species' ranges overlap. Riggs et al. (1997), Hafner (1998), Tanya Shenk (Colorado Division of Wildlife, *in litt.* 1998), and David Armstrong (University of Colorado, *in litt.* 1998) encouraged additional genetic and morphological investigations to further define relationships among Zapus in the region.

The Preble's meadow jumping mouse has not been studied as extensively as other subspecies of *Z. hudsonius* have been studied elsewhere. Preble's is thought to be similar to other *Z. hudsonius* in patterns of diet, behavior, breeding, and habitat utilization. In general, *Z. hudsonius* subsists on seeds, small fruits, fungi, and insects, and hibernates from October to May (Whitaker 1972, Fitzgerald et al. 1994). It is adapted for digging, creates nests of grasses, leaves, and woody material several centimeters below the ground, and is primarily nocturnal or crepuscular, but can be observed during daylight. During the breeding season (June to mid-August), females typically have 2 to 3 litters of 5 to 6 young per litter (Quimby 1951, Fitzgerald et al. 1994). *Z. hudsonius* hibernates approximately 7 months of the year in an underground burrow that it excavates itself (Quimby 1951, Whitaker 1963).

Krutzsch (1954), Quimby (1951), and Armstrong (1972) agree that across its range, *Z. hudsonius* occurs mostly in low undergrowth consisting of grasses, forbs (herbaceous plants other than grasses), or both, in open wet meadows and riparian corridors, or where tall shrubs and low trees provide adequate cover. In addition, *Z. hudsonius* prefers lowlands with medium to high moisture over drier uplands. Whitaker (1972) concluded that *Z. hudsonius* avoids the sparse vegetation that is generally associated with low moisture habitats. Fitzgerald et al. (1994) described *Z. hudsonius* as most common in lush vegetation along watercourses or in herbaceous understories in wooded areas. Tester et al. (1993) suggested that proximity to water may be the most important factor influencing habitat selection and utilization by *Z. hudsonius.*

Some aspects of Preble's meadow jumping mouse life history, behavior, and habitat utilization have been documented. Armstrong et al. (1997) and Shenk (*in litt.* 1998) have compiled summaries of information on Preble's gleaned from recent studies. Data on the timing of the initial breeding period and time of hibernation of the Preble's meadow jumping mouse have been gathered by researchers at Rocky Flats (PTI Environmental Services 1996a). The month of May marks the beginning of the active period for Preble's, with May 5 the earliest capture date at Rocky Flats. Breeding probably occurs soon after emergence. Adults begin hibernation in early September, while juveniles enter hibernation from mid-September to late October. The latest recorded date of capture of Preble's at Rocky Flats is October 27. Adults reach approximately 20 percent body fat before going into hibernation (Wunder pers. com. 1997).

Little information exists on Preble's meadow jumping mouse food preferences. It has been speculated that Preble's may need an open water source to fulfill dietary water requirements. Armstrong et al. (1997) reported that trapping success in ephemeral drainages decreased notably in late summer after creekflow ceased.

Preble's meadow jumping mouse has been shown to move a significant distance along drainages but has not been shown to cross dry uplands to reach adjacent drainages. A male Preble's was recaptured 1.6 kilometers (km) (1 mile) (mi) upstream from a previous capture site and a female Preble's captured 1.2 km (.75 mi) downstream from a previous capture site (Thomas Ryon, PTI Environmental Services, pers. com. 1998).

At Rocky Flats, the Preble's meadow jumping mouse appears to be primarily dependent on riparian shrublands, and on mesic mixed grasslands that are adjacent to shrublands and in close proximity to streams (PTI Environmental Services 1996b). Field studies at Rocky Flats led to the conclusion that Preble's is typically found in or near complex riparian communities with multi-strata woodland and herbaceous species (Harrington et al. 1996). Capture locations were typically humid with high litter content. In a spring 1996 study at Rocky Flats, all captures were within 25 meters (m) (82 feet) (ft) of streams, with 48 percent of captures within 5 m (16 ft) of streams (PTI Environmental Services 1996a). In the same study, 90 percent of captures occurred within 5 m (16 ft) of canopy edge consisting of *Salix exigua* (coyote willow), *Symphoricarpos occidentalis* (western snowberry), *Prunus americana*

(choke cherry), and other species. Margins of artificial ponds at Rocky Flats are thought to be important foraging sites (Harrington et al. 1996).

Most successful capture sites at Rocky Flats were in dense vegetation that presented burrowing or nesting opportunities. Five nests were located in dense vegetation (Harrington et al. 1995). Based on a single underground hibernaculum, located through use of telemetry, upland habitats may be used for hibernation by Preble's (Fred Harrington, Pawnee Natural History Society, pers. comm. 1995). Robert Schorr (Colorado Natural Heritage Program, pers. com. 1997) reported four apparent hibernacula located by telemetry from 7 m (23 ft) to 31 m (101 ft) from the creek bed of Monument Creek, U.S. Air Force Academy, El Paso County, Colorado. All four hibernacula appeared to be below *Salix exigua.*

Ryon (1996) reported that four of five recent (1990 or later) Preble's meadow jumping mouse capture sites he evaluated in Colorado had five structural habitat components: trees, tall shrubs, short shrubs, herbaceous vegetation, and ground cover. The fifth site had few trees. In contrast, historical capture sites where Ryon failed to capture Preble's generally lacked one or more of these components.

Preble's was captured along Monument Creek within the U.S. Air Force Academy lands primarily in densely vegetated riparian communities where *Salix* spp., *Symphoricarpos occidentalis, Populus angustifolia* (narrow-leaf cottonwood), and thick grass understory were dominant (Corn et al. 1995). Garber (1995) characterized capture sites along Lodgepole Creek, Albany County, Wyoming as moist areas near beaver ponds with dense sedges and *Salix* sp. Ryon (1996) suggested that where Preble's occupies habitat along intermittent streams, adjacent wet meadows and seeps may be important habitats in dry periods.

Armstrong et al. (1997, p. 77) described typical Preble's meadow jumping mouse habitat as ''well-developed plains riparian vegetation with relatively undisturbed grassland and a water source in close proximity.'' Also noted was a preference for ''dense herbaceous vegetation consisting of a variety of grasses, forbs and thick shrubs.'' Meaney et al. (1997) suggested that Preble's has a broader ecological tolerance than previously thought and while they require diverse vegetation and well developed cover, this can be met in a variety of circumstances. Recent captures that were exceptions to the typical habitat described include individuals found along a small irrigation ditch and in a mesic grassy field on City of Boulder Open Space land (Clint Miller, City of Boulder, *in litt.* 1996). Ensight Technical Services (1997) reported instances of Preble's meadow jumping mouse trapped at or near sites of human alteration including ditches along roads and driveways, and wetlands adjacent to highways. Meaney et al. (1997) emphasized that vegetated ditches may be a significant habitat for Preble's and may provide dispersal routes.

Preble's meadow jumping mouse may never have been widespread in the period since western settlement. Armstrong (1972) described it as poorly known in Colorado and apparently nowhere abundant. The known historical range of Preble's may represent a relict of a more southern range of *Z. hudsonius*, occupied when the climate was cooler and more damp (Fitzgerald et al. 1994). The apparent local extirpation of Preble's from historically occupied sites in Colorado and Wyoming, and the difficulty in finding it in patches of apparently adequate but fragmented habitat isolated by human land uses, suggests a decline in populations of Preble's in recent decades.

Records for Preble's meadow jumping mouse define a range including Adams, Arapahoe, Boulder, Denver, Douglas, El Paso, Elbert, Jefferson, Larimer, and Weld Counties in Colorado; and Albany, Laramie, Platte, Goshen, and Converse Counties in Wyoming (Krutzsch 1954, Compton and Hugie 1993). Historical sites in Colorado were further discussed by Meaney and Clippinger (1995), Ryon (1996), and Ryon and Harrington (1996). Garber (1995) discussed historical sites from Wyoming and suggested that some *Zapus* from Wyoming may have been misidentified. He indicated that based on study skins alone (without skulls) positive identification was not possible. Garber concluded that two specimens from the University of Wyoming collection listed as Preble's were probably *Z. princeps*, and that several specimens listed as *Z. princeps* are believed to be Preble's.

As one might expect, given the intensity of recent surveys for Preble's meadow jumping mouse, more individuals have been trapped in the decade of the 1990's than were documented prior to 1990. Preble's is thought to currently exist in seven counties in Colorado and two in Wyoming, but it is not known to be present in three other counties in Colorado and three counties in Wyoming where it was previously documented.

Colorado

Recent (since 1992) presence of Preble's meadow jumping mouse in Colorado has been documented in seven counties along the following watercourses and their tributaries: South Boulder Creek and St. Vrain Creek (Boulder County); Coal Creek, and Ralston Creek, and Rock Creek, Walnut Creek and Woman Creek at Rocky Flats (Jefferson County); East Plum Creek, West Plum Creek, and Indian Creek (Douglas County); Monument Creek and tributaries including West Monument Creek, Smith Creek, Beaver Creek, Pine Creek, Jackson Creek, Dirty Woman Creek, and Cottonwood Creek (El Paso County); Lone Tree Creek (Weld County); Rabbit Creek and Lone Pine Creek (Larimer County); and, Running Creek (Elbert County).

A number of historical and recent records of Preble's meadow jumping mouse exist for Boulder County. A summary of past records and a report of 1995 survey results was provided by Armstrong et al. (1996). In 1995, extensive surveys were conducted, through a challenge grant cost-share agreement with the Service, to determine the presence of Preble's on City of Boulder and Boulder County Open Space lands supporting suitable habitat. Of 13 sites surveyed, Preble's were captured from 2 sites, both along South Boulder Creek (Armstrong et al. 1996). In 1996, 3 Preble's were captured on City of Boulder Open Space along South Boulder Creek, during an extensive study of grassland biodiversity entailing 6,600 trapnights (one trap set for one night equals one trapnight) of effort (Miller *in litt.* 1996). Perhaps indicative of population fluctuations, Carron Meaney (Denver Museum of Natural History, *in litt.* 1998) reported a total of 55 individual Preble's captured during 1997 studies along South Boulder Creek.

Meaney et al. (1996) reported capturing at least seven different Preble's meadow jumping mice at a Boulder County Open Space site on St. Vrain Creek, the only captures on five Boulder County sites they surveyed in 1996. A 1997 survey failed to find Preble's on a site along St. Vrain Creek near the 1996 capture site (Meaney et al. 1997). However, 1997 surveys conducted for the Colorado Department of Transportation along State Highway 36 at St. Vrain Creek, and at various wetland sites up to two miles south, resulted in captures of Preble's in six of seven locations (Ensight Technical Services 1997).

Annual studies have taken place at Rocky Flats since the discovery of the

Preble's meadow jumping mouse there in 1991 (Harrington et al. 1996). Recent populations have been reported in all four major drainages within the Rocky Flats buffer zone. During the 1995 field season, 61 Preble's were trapped at Rocky Flats, bringing the total number of individual mice trapped since 1991 to 161 (Harrington pers. comm. 1995). Estimated density of Preble's in areas trapped during 1995 studies ranged up to 36 per hectare (ha) (15 per acre (ac)). Spring 1996 trapping studies at Rocky Flats, designed to document emergence from hibernation, resulted in 29 captures of Preble's in 3,553 trapnights (PTI Environmental Service 1996a). During summer 1996 studies at Rocky Flats, 3,882 trapnights of effort resulted in capture of only 4 Preble's (PTI Environmental Service 1996b).

During 1996 and 1997 the Colorado Natural Heritage Program reviewed numerous sites on Jefferson County Open Space lands for potential presence of Preble's meadow jumping mouse and trapped at eight sites. In 1996, Preble's were captured on Jefferson County Open Space land near the mouth of Coal Creek Canyon, west of Rocky Flats (Fleming et al. 1996). In 1997, Preble's were captured at Ralston Creek (White Ranch Park, Jefferson County Open Space) (Peterson 1997).

In Douglas County, Preble's meadow jumping mice were captured from a site on East Plum Creek, near Larkspur in 1995 (Harrington 1995). Also in 1995, the Colorado Natural Heritage Program located Preble's at two sites, one on East Plum Creek and one on West Plum Creek, Douglas County. Surveys in 1996 (Meaney et al. 1996) located Preble's at an additional site on West Plum Creek south of Sedalia, and at a Colorado Division of Wildlife property on Indian Creek (a tributary to Plum Creek) south of Louviers. In 1997 the Colorado Natural Heritage Program identified, through aerial photographs, 104 sites in the Plum Creek watershed in Douglas County that appeared to have suitable Preble's habitat. Preble's were captured on 10 of 13 private land sites trapped. Use of a habitat relationships model provided an estimate of 30.6 miles of occupied streamside habitat in the watershed (Chris Pague and Parker Schuerman, The Nature Conservancy, *in litt.* 1998). Meaney et al. (1997) captured Preble's at two of three sites they trapped within the Plum Creek drainage in 1997; Willow Creek in Roxborough State Park, and a site along East Plum Creek currently being purchased by The Conservation Fund.

In El Paso County, the Colorado Natural Heritage Program discovered the Preble's meadow jumping mouse on U.S. Air Force Academy lands along Monument Creek while performing small mammal surveys in 1994. In comprehensive 1995 studies, 67 Preble's were captured (Corn et al. 1995). Using varying assumptions regarding trapping results and habitat available, total population estimates for Air Force Academy property of 308 and 449 Preble's were generated. These correspond to density estimates in occupied habitat of 2.00 per ha (0.81 per ac) and 2.92 per ha (1.18 per ac). Twenty Preble's were captured in 1996 on private land along Smith Creek, east of the Air Force Academy (Meaney et al. 1996). Trapping surveys submitted to the Service in 1997 from sites of proposed construction documented Preble's within the Monument Creek drainage off of Air Force Academy property at Monument Creek, Pine Creek, Black Squirrel Creek, Cottonwood Creek, and Dirty Woman Creek. Meaney et al. (1997) located Preble's within the Monument Creek drainage on Beaver Creek.

Meaney et al. (1997) reported an improved ability to recognize suitable habitat and, by targeting mostly small drainages with dense vegetation, captured Preble's meadow jumping mouse at 7 of 10 sites trapped, including sites in 3 counties not known to have extant populations. Preble's were captured at Rabbit Creek and Lone Pine Creek, within Cherokee Park State Wildlife Management Area, Larimer County. A single apparent Preble's was captured on private land along Lone Tree Creek, Weld County (see discussion of genetic studies by Riggs et al. 1997). In Elbert County, a single Preble's was found at Hay Gulch, a tributary of Running Creek. Among sites recommended for future surveys were the confluence of Lone Tree Creek and the South Platte River (Weld County), and Bijou Creek, Kiowa Creek, and Running Creek (Elbert County) (Meaney et al. 1997).

Wyoming

In Wyoming, Preble's meadow jumping mouse has been recently documented in two counties, along Crow Creek at F.E. Warren Air Force Base (Laramie County) and in the Lodgepole Creek drainage, within the Medicine Bow National Forest (Albany County). The Wyoming Cooperative Research Unit successfully captured two Preble's on F.E. Warren Air Force Base, Laramie County, in the 1995 field season (Garber 1995). Garber conducted Preble's surveys at four Wyoming sites during the 1995 field season. He was unable to locate any Preble's on F.E. Warren Air Force Base, but did find Preble's at two locations in the Lodgepole Creek drainage within the Medicine Bow National Forest in Albany County. The Colorado Natural Heritage Program surveyed for Preble's at Warren Air Force Base in 1996 and captured 8 apparent Preble's (see discussion of genetic studies by Riggs et al. 1997) in 2,200 trapnights of effort (Schuerman and Pague 1997).

Previous Federal Action

The Service included the Preble's meadow jumping mouse as a category 2 candidate species in the 1985 Animal Notice of Review (50 FR 37958) and retained that status in subsequent notices, published in the **Federal Register** on January 6, 1989 (54 FR 554), November 21, 1991 (56 FR 58810), and November 15, 1994 (59 FR 58982). In 1996 the Service discontinued the practice of maintaining a list of category 2 species and the Preble's did not appear in the February 28, 1996 (61 FR 7596), Notice of Review. Category 2 species were those species for which information in the Service's possession indicated that listing was possibly appropriate, but for which substantive data on biological vulnerability and threats were not available to support a proposed rule. Candidate species are currently defined as those species for which the Service has sufficient information on file detailing biological vulnerability and threats to support issuance of a proposed rule, but issuance of the proposed rule is precluded by other listing actions.

On August 16, 1994, the Service received a petition from the Biodiversity Legal Foundation to list the Preble's meadow jumping mouse as endangered or threatened throughout its range and to designate critical habitat within a reasonable amount of time following the listing. The petitioner submitted information that Preble's populations in Colorado and Wyoming are imperiled by: ongoing and increasing urban, industrial, agricultural, ranching, and recreational development; ongoing and increasing wetland/riparian habitat destruction and/or modification; small size of known populations; and inadequacy or lack of governmental protection for the species and its habitats.

On March 15, 1995 (60 FR 13950), the Service published notice of the 90-day finding that the petition presented substantial information indicating that listing the Preble's meadow jumping mouse may be warranted, and requested comments and biological data on the status of the mouse. On March 25, 1997, the Service issued a 12 month finding on the petitioned action along with a

proposed rule to list Preble's as an endangered species and announced a 90-day public comment period (62 FR 14093). On May 5, 1997, the Service announced three public hearings regarding the proposed rule and extended the comment period through July 28, 1997 (62 FR 24387). The Service reopened the public comment period on December 23, 1997, for a period of 30 days, through January 22, 1998 (62 FR 67041).

Summary of Comments and Recommendations

In the March 25, 1997, proposed rule and associated notifications, and in subsequent notices to extend or reopen the public comment period, all interested parties were requested to submit factual reports or information that might contribute to the development of a final rule. The public comment period was extended through July 28, 1997 (62 FR 24387) and reopened from December 23, 1997, through January 22, 1998 (62 FR 67041). Various Federal and State agencies, county governments, scientific organizations, and other interested parties were contacted and requested to comment. Newspaper notices were published in the Rocky Mountain News (Denver, CO), the Colorado Springs Gazette-Telegraph (CO), the Boulder Daily Camera (CO), the Casper Star Tribune (WY), and the Wyoming Eagle Tribune (Cheyenne, WY), which invited general public comment and attendance at public hearings.

Public hearings were initiated by the Service and held May 19, 1997, in Cheyenne, Wyoming; May 21, 1997, in Colorado Springs, Colorado; and May 22, 1997, in Denver, Colorado. Each hearing began with opening comments by the Service followed by an opportunity for public comments. In Cheyenne, 8 people attended and 1 commented; in Colorado Springs 28 attended and 8 commented; and in Denver 27 attended and 4 commented.

One hundred and thirty-eight written comments were received. Significant issues are discussed below. Several individuals or groups submitted comments in both the original and the reopened comment periods, or during hearings and later in writing. Senator Craig Thomas of Wyoming opposed the proposal. Two Federal agencies commented and opposed the proposal; the Department of Energy's Rocky Flats Field Office supported a 6-month extension of the proposed rule. The Department of Energy's Western Area Power Administration supported a threatened listing. Six State agencies commented, four from Wyoming and two from Colorado. From Wyoming, three State agencies opposed the proposal (two of the three supported an extension) and one Wyoming agency neither supported nor opposed the proposed rule. From Colorado, one agency opposed the proposal and supported an extension and one neither supported nor opposed the proposed rule. Of 128 comments by individuals or other groups, 29 supported the proposed rule, 74 opposed it, and 25 were neutral. Five stockgrowers or farm organizations provided comments opposing the proposal. Five of six conservation or environmental groups supported the proposal and one was neutral.

Written comments and oral statements presented at the public hearings and received during the comment periods are addressed in the following summary. Comments of similar nature are grouped under a number of general issues.

Issue 1: The Preble's meadow jumping mouse is not a valid subspecies since genetic studies conducted to date have not conclusively differentiated it from certain other subspecies of *Z. hudsonius*.

Response: Preble's is widely recognized as a valid subspecies by the scientific community. Genetic studies point to an aggregate of similar *Z. hudsonius* populations consistent with ecological, distributional, and morphological information on Preble's (*Z. h. preblei*).

Issue 2: Preble's meadow jumping mouse identification in the field is not possible because of the similarity between Preble's and *Z. princeps*.

Response: Field identification of *Zapus* is difficult when attempted by individuals not thoroughly familiar with both species. To date, no overlap has been documented between the range of Preble's and the range of *Z. princeps* in Boulder, Jefferson, Douglas, and El Paso Counties in Colorado. These counties support the vast majority of currently known Preble's populations. Since the two species may coexist in portions of southeastern Wyoming, some historical records from Wyoming are difficult to confirm. Recent genetic studies may indicate some uncertainty regarding the identity of apparent Preble's trapped in Weld County, Colorado and Laramie County, Wyoming. However, populations of *Zapus* that are consistent morphologically and ecologically with Preble's, will be considered Preble's by the Service pending conclusive studies resolving the identities of the two species. Identification of any *Zapus* captured in Weld County, Colorado (as well as in adjacent Larimer County, Colorado) and in southeastern Wyoming should be throughly documented and tissue samples should be obtained for future genetic analysis.

Issue 3: Historical trapping records support the contention that Preble's meadow jumping mouse has long been a rare mammal and they provide a poor baseline from which to measure current trends in populations.

Response: Conclusions regarding the status and trends of Preble's made by the Service are based on the best available historical and recent population information on Preble's, the distribution of its preferred habitats, and on the significant threats to these habitats. While historical records come from diverse trapping efforts that rarely targeted *Zapus*, they document a former presence in locations where Preble's is not currently found. Recent surveys of several historical sites have failed to locate Preble's. Loss of these populations has been attributed to changes in habitat.

Issue 4: Comprehensive trapping surveys throughout Preble's meadow jumping mouse range are needed to ascertain its true status and distribution.

Response: Existing data are sufficient to determine the overall status of Preble's. Additional trapping studies will be conducted to better document Preble's status within certain portions of its range. Since 1992, numerous studies have addressed the status and distribution of Preble's. Trapping studies supported by the Colorado Division of Wildlife in 1995, 1996, and 1997 helped to document distribution of Preble's in Colorado. In 1997 alone, more than 120 locations in Colorado were trapped, with a minimum of 400 trapnights of effort at each location. Limited access to private lands has hampered survey efforts at some locations and will probably continue to do so in the future.

Issue 5: Since Preble's exists on some sites where grazing, mowing, and other human land uses occur, these activities should not be considered threats.

Response: Land uses that have a dramatic adverse impact on habitats that the Preble's meadow jumping mouse requires can present significant threats to its existence. The relationships between human land use and Preble's populations are undoubtedly complex and need further study. The manner, timing, and extent of grazing or mowing may dictate what effects these activities have on Preble's and its habitat. However, Preble's do coexist in grazed areas such as the Medicine Bow National Forest in Wyoming and Boulder Open Space lands in Colorado, and some ranching and farming practices are thought likely to be

compatible with maintaining Preble's populations. The Service believes that best management ranching and farming practices, which avoid adverse affects on habitat characteristics, are compatible with many natural resource objectives.

Issue 6: Water projects and irrigation may be beneficial to the Preble's meadow jumping mouse, since these activities can create wetland habitat.

Response: Preble's seems largely dependent on moist habitat with dense vegetation in or near riparian corridors. Effects of water projects on Preble's and its habitat can vary greatly. Water projects can effectively eliminate, degrade, or fragment Preble's habitat. However, activities that enhance and extend such habitat can benefit Preble's.

Issue 7: Trapping studies are a significant threat to Preble's meadow jumping mouse.

Response: The scientific value of trapping studies will be measured against the threats such studies represent to Preble's. The Service will issue permits to qualified individuals conducting approved trapping studies on Preble's. While ''live traps'' are being used, the Service is aware of a few mortalities associated with recent trapping. Trapping techniques that best safeguard Preble's will be required by the Service.

Issue 8: Predators may be a threat to the Preble's meadow jumping mouse and should be controlled.

Response: While Preble's has co-existed with a community of predators over time, little is known regarding the effect of predators or competing species on Preble's populations. Human activities have undoubtably altered predator populations. Human development may, for example, increase numbers of great-horned owls and raccoons. However, there is presently insufficient evidence to demonstrate that control of predators would benefit Preble's.

Issue 9: Captive breeding and release, and relocation of the Preble's meadow jumping mouse should be used to stabilize populations and eliminate the need for listing.

Response: Scarcity of suitable habitat presumably limits current Preble's distribution. Maintenance of quality habitat is the principal conservation goal. Relocation and reintroduction of Preble's into unoccupied sites with suitable habitat may become a part of the future recovery of this species.

Issue 10: If the Preble's meadow jumping mouse were protected on Federal land there would be no need to protect it on private land.

Response: The Service is working with the U.S. Air Force, the Department of Energy, and the Forest Service to assure that conservation of Preble's is carried out on all Federal lands on which it currently exists. While both the Air Force Academy and Rocky Flats support apparently stable populations of Preble's, these sites compose a small fraction of the total Preble's range. Protection of these sites alone would not alleviate the need for listing of Preble's or achieve recovery.

Issue 11: Local regulations exist that currently protect the Preble's meadow jumping mouse and its habitat.

Response: The Service has received from the Colorado Department of Natural Resources a summary of local regulations, incentive programs, Colorado Water Conservation Board instream flow decrees, and open space purchase programs that help protect habitats that support Preble's. A variety of regulations apply to activities in riparian areas and, in effect, contribute to conservation of Preble's. However, few local ordinances currently provide direct protection of Preble's or its habitat. Natural areas and wildlife habitat may be considered in zoning or development review, but most ordinances will permit significant variance and provide for considerable latitude in interpretation. For example, construction within the 100-year floodplain may be tightly restricted by such measures, but the mowing, cutting, or overgrazing of Preble's habitat is generally not addressed. The City of Boulder wetlands protection ordinance has a specific provision designed to protect rare and declining species including Preble's. Fort Collins provides protection for ''endangered species habitat'' in development review, but apparently does not address rare, declining, or threatened species. Incentives and purchase programs contribute to riparian conservation but afford no direct legal protection for Preble's. While often beneficial to Preble's, public acquisition of riparian areas may, at times, result in increased human use incompatible with Preble's.

The Service supports use of local land use regulations to conserve Preble's and its habitat; however, the best measure of their past effectiveness in protecting Preble's is the success of these regulations in maintaining the integrity of riparian systems within Preble's range. Direct and secondary effects of human activity continue to cause alteration of riparian areas despite these protections. The Service is currently engaged in discussions with the Colorado Department of Natural Resources and the Colorado Preble's Meadow Jumping Mouse Working Group to determine how local regulations and acquisition programs can be used more effectively to protect Preble's and its habitat.

Issue 12: The Service should designate critical habitat for Preble's meadow jumping mouse.

Response: The Service has determined that designation of critical habitat will not provide additional benefits beyond that achieved by the listing of Preble's at this time (see the Critical Habitat section of this rule). The Service could reevaluate designation of critical habitat at some future time should circumstances change and more becomes known about Preble's, its habitat, and potential benefit to the species to be gained from designation of critical habitat.

Issue 13: The Service should extend the proposed rule for a period of 6 months.

Response: The Service can only extend a proposed rule when it finds that there is a substantial disagreement among scientists knowledgeable about the species regarding the sufficiency or accuracy of the data available relevant to the listing. The Service finds no substantial disagreement among scientists knowledgeable about Preble's that would serve as a basis for extension of the proposed rule.

Issue 14: The collaborative planning process for Preble's meadow jumping mouse conservation, initiated by the State of Colorado, should be pursued as an alternative to listing.

Response: Consistent with the spirit and intent of the 1995 ''Memorandum of Agreement between the State of Colorado and the Department of Interior Concerning Programs to Manage Colorado's Declining Native Species,'' the Service fully supports the collaborative planning process for Preble's conservation that is under way in Colorado. The intent of the Memorandum of Agreement is to facilitate and promote collaboration and cooperation in managing and conserving fish and wildlife in Colorado. It was not intended to serve as an alternative to listing threatened or endangered species as required by the Endangered Species Act. The collaborative planning process includes stakeholders from local governments, the private sector, the State, and Federal agencies. This final rule to list Preble's as a threatened species is not intended to discourage or detract from this conservation effort; however, the Service recognizes that it will take time and commitment on the part of numerous stakeholders for this process to achieve meaningful protection of Preble's. The Service

believes that, ultimately, this process will produce a conservation plan and implementation agreements that both protect Preble's and its habitat over the long term and will minimize regulatory and economic effects of this listing. These products may form the basis of one or more Habitat Conservation Plans or a rule prepared in accordance with section 4(d) of the Endangered Species Act. To this end, the Service is providing financial support to help move this process forward.

Issue 15: Rodents are destructive and carry disease. Listing the Preble's meadow jumping mouse may impact pest control and lead to disease or increased crop losses.

Response: Preble's has not been implicated as a vector for human disease. Its rarity and dependence on riparian and wetland areas minimize its potential as a pest. Pest control efforts within and around residences and other buildings, and in crop fields when carried out in accordance with pesticide label restrictions, are unlikely to conflict with Preble's conservation. However, in some cases the application or discharge of agrichemicals, or other pollutants, and pesticides, onto plants, soil, ground water, or other surfaces within areas that drain into streams occupied by Preble's may result in the deterioration of Preble's habitat and cause harm to the species. Use of such chemicals in violation of label directions, or any use following Service notification that such use, application or discharge is likely to harm the species, would be evidence of unauthorized use, application or discharge.

Peer Review

In accordance with policy promulgated July 1, 1994 (59 FR 34270), the Service solicited the expert opinions of independent specialists regarding pertinent scientific or commercial data and assumptions relating to the taxonomy, population models, and supportive biological and ecological information for species under consideration for listing. The purpose of such review is to ensure listing decisions are based on scientifically sound data, assumptions, and analyses, including input of appropriate experts and specialists.

The data and assumptions regarding the Preble's meadow jumping mouse were reviewed by three specialists. Peer reviewers were identified through inquiries to research institutions, universities, and museums for individuals with recognized expertise with the subject taxa. The reviewers were asked to comment upon specific assumptions and conclusions regarding the species. Their comments have been incorporated into the final rule as appropriate and are summarized below.

One reviewer provided a context for species status over time scales reflecting long-term climate change and effects of European settlement within Preble's meadow jumping mouse range. The same reviewer (citing a relative lack of species-specific trapping efforts prior to the 1990's and geographical gaps in recent survey efforts) stated that while conclusions regarding recent Preble's decline might be accurate, they were not strongly supported by capture data. The reviewer suggested that examination of the adverse changes to the riparian habitats required by Preble's could provide additional insight to population status and trends.

The reviewers of the Preble's meadow jumping mouse information concluded that additional study of habitat requirements and population biology are needed to implement effective conservation of Preble's. Specifically, the limited knowledge of hibernation habitat requirements was cited by two reviewers. A better understanding of Preble's movement patterns was cited by two reviewers as important. One reviewer emphasized that more information on Preble's food habitats is needed.

All three reviewers discussed threats to the Preble's meadow jumping mouse. One reviewer suggested that known populations at the Air Force Academy and Rocky Flats reflect the long-term protection of these sites from human disturbance rather than presence of optimal Preble's habitat. Another reviewer concluded that currently only two or three sites supporting Preble's are adequately protected. Threats discussed by reviewers included fragmentation of riparian corridors, gravel mining, and alteration of water regimes and the resulting effects on riparian vegetation.

Summary of Factors Affecting the Species

Section 4 of the Act and regulations (50 CFR Part 424) promulgated to implement the listing provisions of the Act set forth the procedures for adding species to the Federal lists. A species may be determined to be a threatened or endangered species due to one or more of the five factors described in section 4(a)(1). These factors and their application to the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) are as follows:

A. *The present or threatened destruction, modification, or curtailment of its habitat or range.* After reviewing the best scientific data currently available, the Service believes that Preble's meadow jumping mouse has undergone a decline in range and that populations within its remaining range have been lost. Habitat loss and fragmentation resulting from human land uses have adversely impacted Preble's populations, and continue to do so. Armstrong (*in litt.* 1997) concluded that the meadow jumping mouse, in this region as elsewhere, is a habitat specialist, and that its specialized habitat is declining. As the summary below demonstrates, a variety of known and potential threats to its habitat have been documented.

The Colorado Natural Heritage Program ranks Preble's meadow jumping mouse as T2, imperiled globally, and S2, imperiled in Colorado; the Wyoming Natural Diversity database ranks Preble's as S1, critically imperiled in Wyoming (Schuerman and Pague 1997).

A study by Compton and Hugie (1993), which was funded by the Service, found it difficult to assess historical trends and current status of Preble's meadow jumping mouse due to the scarcity of demographic data. Based on their review, they recommended that Preble's be federally listed as a threatened species. However, after a largely unsuccessful search for suitable habitat in Wyoming and unsuccessful trapping surveys for Preble's at five sites in southeastern Wyoming in 1993, they concluded that Preble's might be extirpated from Wyoming (Compton and Hugie 1994). Their revised recommendation was that Preble's be federally listed as an endangered species.

Since 1993, efforts to document existing populations of Preble's meadow jumping mouse have increased commensurate with rising concern over its status. Recent trapping efforts have located Preble's meadow jumping mouse populations in some areas (Douglas, El Paso, and Elbert counties, Colorado) where few or no historical records exist. However, recent trapping has also failed to produce captures at historical sites and sites with apparently suitable habitat within Preble's historical range. Preble's is not known to be currently present in Adams, Arapahoe, and Denver counties in Colorado where it was historically documented.

Ryon (1996, *in litt.* 1997) investigated nine historical Preble's meadow jumping mouse capture sites in six Colorado counties through trapping and site history. Ryon concluded that Preble's was absent at all nine sites and related absence of Preble's to changes in habitat (see also Ryon and Harrington

1996). Specific human activities impacting habitat at these sites included real estate development, highway construction, stream alteration, and grazing. In addition, offsite impacts may have caused isolation of sites that rendered them unsuitable for Preble's. Ryon concluded that the range of Preble's has decreased, especially adjacent to or east of the Interstate Highway 25 urban corridor.

Extensive studies of public lands in Boulder County in 1995 resulted in capture of 23 Preble's, on 2 of 13 sites surveyed, in 17,800 trapnights of effort (Armstrong et al. 1996). Sites were selected, in part, based on documented historical presence and perceived quality of habitat. Among the authors' conclusions were that Preble's is not abundant in the Colorado Piedmont of Boulder County and that suitable habitat appeared to be present on some sites where trapping was unsuccessful.

Recent surveys for Preble's meadow jumping mouse at certain other sites with potential habitat in Colorado have been unsuccessful in documenting presence. Surveys funded and carried out by the Department of the Army at the Army's Fort Carson Military Reservation in El Paso and Pueblo counties resulted in no Preble's captures despite 3,311 trapnights of effort in apparently suitable habitat (Bunn et al. 1995). Private researchers and U.S. Department of Agriculture Forest Service personnel found no Preble's in limited surveys of seemingly adequate habitats within the Forest Service's Pawnee National Grassland in northern Weld County (Harrington pers. comm. 1995).

Patterns of capture suggest that populations may fluctuate over time at occupied sites (Shenk *in litt.* 1998). This raises questions regarding security of documented populations and significance of unsuccessful trapping reports. However, trapping surveys provide the best available information regarding current status and distribution of Preble's.

Over 150 surveys for Preble's meadow jumping mouse have been conducted in recent years at locations where development is anticipated. In 1997, results of 104 Colorado surveys were submitted to the Service for proposed or potential development sites that supported potential Preble's habitat. Nine of 35 surveys in El Paso County, 7 of 19 in Boulder County, and 1 of 17 from Jefferson County documented Preble's presence. All successful surveys in El Paso County were on Monument Creek and its tributaries upstream from (north of) downtown Colorado Springs. In contrast, approximately 15 trapping studies from El Paso County downstream of the Cottonwood Creek and Monument Creek confluence (on Monument Creek, Fountain Creek, and their tributaries) failed to document Preble's. Six of 7 successful Boulder County surveys were near a 2-mile segment of State Highway 36 near Lyons (Ensight Technical Services 1997). Thirty-three 1997 surveys from Adams, Arapahoe, Denver, Douglas, Larimer, and Weld counties failed to locate Preble's. Fragmentation and isolation of habitat have apparently caused local extirpation of Preble's in highly developed areas. Shenk (*in litt.* 1998) suggested that development of the Denver metropolitan area has created a north-south gap in Preble's range.

In contrast to surveys above at anticipated development sites, Meaney et al. (1997) targeted likely Preble's meadow jumping mouse habitat throughout its known range and successfully trapped Preble's at 7 of 10 sites in 1997. Their results filled gaps regarding Preble's status in north-central Colorado and suggest that their ability to identify Preble's habitat has improved over their 1995 and 1996 efforts which found Preble's at 0 of 10 and 4 of 10 sites respectively.

While historical status in Wyoming is less clear (Garber 1995), Preble's meadow jumping mouse is not currently known from its former range in Albany, Goshen, and Natrona counties. Garber documented Preble's persisting at only two Wyoming sites, commented on the difficulty of capturing Preble's at these sites, and concluded that substantial additional work was needed to fully determine the status of Preble's in Wyoming. The Wyoming Game and Fish Department (Bill Wichers *in litt.* 1997) concurred with the conclusion that Preble's has likely been extirpated from most or all of its historical range in Wyoming.

Trapping surveys provide evidence that the Preble's meadow jumping mouse has declined throughout portions of its range. This decline and future threats to existing Preble's populations are linked to widespread habitat alteration. The Colorado Piedmont east of the Front Range and adjacent areas of southeastern Wyoming have changed from predominantly prairie habitat intermixed with perennial and intermittent streams and associated riparian habitats, to a more agricultural and urban setting with grazing, residential, commercial, industrial, and recreational development. The Colorado Front Range urban corridor represents only about 4 percent of the State's land area but supports 80 percent of its population (Wright 1993). Unfortunately, this area of development corresponds almost directly to known Preble's range. Fueled by human population increases, an increase of 1 million people is estimated by 2020, development in this area continues at an unprecedented rate.

Compton and Hugie (1993, 1994) cited human activities that have adversely impacted Preble's meadow jumping mouse including: conversion of grasslands to farms; livestock grazing; water development and management practices; and residential and commercial development. They mentioned the effects of urbanization occurring from Colorado Springs, Colorado, to Cheyenne, Wyoming, as a continuing threat to remaining populations. Ryon (1995) commented that recent capture sites he observed were on large, historically undisturbed lands supporting native plant communities.

Shenk (*in litt.* 1998) linked potential threats to ecological requirements of Preble's meadow jumping mouse and suggested that factors which impacted vegetation composition and structure, riparian hydrology, habitat structure, distribution, geomorphology, and animal community composition must be addressed in any conservation strategy.

Some researchers hypothesize that overgrazing by livestock may be an important cause of the decline of the Preble's meadow jumping mouse. Compton and Hugie (1994) stated that in southeastern Wyoming almost all private land of appropriate topography and hydrology to support Preble's habitat was heavily grazed by livestock and that overgrazing was the most significant factor in reducing habitat for Preble's. While not mentioning grazing specifically, the Wyoming Game and Fish Commission (Wichers *in litt.* 1997) cited riparian degradation as the primary cause of Preble's decline in Wyoming and stated that the situation would not improve without active management. Ryon (1996) cited livestock grazing as a contributor to lack of structural habitat diversity he observed on historical Preble's sites in Colorado. Two of the largest documented populations of Preble's exist on Federal properties (Rocky Flats and the U.S. Air Force Academy) where livestock grazing is excluded.

The importance of ''late season obesity'' (the buildup of fat reserves) in meadow jumping mice and its positive correlation to hibernation survival, post-hibernation development, and successful reproduction has been well documented (Nichols and Conley 1982, Muchlinski 1980). Preble's meadow jumping mice entering hibernation with

low fat reserves are less likely to survive the winter or to successfully breed the following spring. Late season grazing of Preble's habitat, as well as mowing or burning, could adversely affect Preble's by reducing the availability of food resources essential for buildup of fat reserves.

City of Boulder Open Space lands endured intensive grazing, farming, or haying regimes until they became part of the City of Boulder Open Space system. Grazing and haying continue on sites supporting the Preble's meadow jumping mouse, largely as land management tools. Impacts of current management practices to Preble's and their habitats are largely unknown.

The Preble's meadow jumping mouse has been documented to coexist on sites supporting grazing, including the Medicine Bow National Forest in Wyoming and Plum Creek, Douglas County, in Colorado. Armstrong et al. (1997) suggested that timing and intensity of grazing are probably important factors in maintaining Preble's habitat and that maintenance of woody vegetative cover may be a key consideration.

Human development has produced profound changes in the hydrology of streams flowing east from the Colorado Front Range. Riparian habitat on which the Preble's meadow jumping mouse depends is in turn dependent on surface flows and groundwater. Water development and management in its various forms can alter Preble's meadow jumping mouse habitat, often, but not always, with adverse impacts. Fitzgerald et al. (1994) stated that inundation of riparian areas to create reservoirs had decreased available Preble's habitat. Compton and Hugie (1993) concluded that management of water for commercial and residential use tends to channelize and isolate water resources, and has reduced in size and fragmented riparian habitats used by Preble's. They found development of irrigated farmland had a negative impact on Preble's habitat, and that any habitat creation it produced was minimal. However, Preble's has been shown to use overgrown water conveyance ditches and pond edges and may use ditches for dispersal (Meaney et al. 1997, Shenk *in litt.* 1998).

Water diversions and associated land use changes can impact Preble's meadow jumping mouse habitat directly, as well as through hydrologic alterations to Preble's habitat located downstream. While an integrated natural resource management plan at the Air Force Academy includes specific provisions for Preble's conservation, Corn et al. (1995) expressed concern over the hydrologic integrity of Monument Creek and its tributaries because of activities upstream of the Air Force Academy. Flood control, through the placement of riprap and other structural stabilization options, has been proposed on areas that support Preble's, including portions of Monument Creek and its tributaries.

While Rocky Flats supports one of the largest known populations of Preble's meadow jumping mouse and has served as a refuge for Preble's, the future conservation of Preble's at this site is uncertain due to possible impacts to occupied habitats. Without careful planning, Preble's meadow jumping mouse habitats at Rocky Flats could be impacted by the Department of Energy's planned bioremediation (the detoxification of toxic substances using biological agents) and hazardous contaminant cleanup, associated water management practices designed to contain hazardous materials spills and prevent their migration offsite, and dam safety and maintenance activities. An additional threat is potential disruption of the current hydrology by mining operations. There are proposals to expand existing commercial sand and gravel extraction and processing activities in the Rock Creek drainage both outside and within the boundary of Rocky Flats. The Department of Energy does not control mineral rights on the land in question. The Service is currently working with the Department of Energy to provide permanent protection of Preble's habitat at Rocky Flats.

Alluvial aggregate extraction, often in or near riparian habitats, continues to expand as development intensifies along the Colorado Front Range. Ryon (1996) and Armstrong et al. (1997) suggested that such mining can destroy and fragment Preble's meadow jumping mouse habitat. Armstrong (*in litt.* 1997) suggested that mining impacts are significant and, unlike some other human uses, cause permanent changes to Preble's habitat. Mining also targets gravel deposits that may provide key hibernation sites.

Residential and commercial development, accompanied by highway and bridge construction, and instream alterations to implement flood control, directly remove Preble's meadow jumping mouse habitat, or reduces, alters, fragments, and isolates habitat to the point where Preble's meadow jumping mouse can no longer persist. Corn et al. (1995) proposed that a 100 m (328 ft) buffer of unaltered habitat be established to protect the floodplain of Monument Creek from a range of human activities that might adversely effect Preble's or its habitat. At some historical capture sites, habitat appears intact, but isolation has probably rendered the sites unsuitable for Preble's (Ryon 1996). Roads, trails, or other linear development through Preble's habitat may act as barriers to movement. Shenk (1998) suggested that on a landscape scale, maintenance of acceptable dispersal corridors linking patches of Preble's habitat may be critical to its conservation.

Development and heavy use of trails within occupied Preble's meadow jumping mouse habitats may impact the species by destroying its habitat, nests, and food resources, or by disrupting behavior. Recreational trail systems have been established or are proposed along many riparian corridors within Preble's range. Heavily used recreational trails currently exist on City of Boulder Open Space lands, including sites that support Preble's. A current study near a new paved trail along South Boulder Creek is assessing impacts to a known Preble's population (Meaney *in litt.* 1998).

Habitat alteration may encourage invasion of weeds. While little is known regarding impact of invasive, nonnative vegetation on Preble's meadow jumping mouse, Ryon (1996) expressed concern and Garber (1995) stated that this may represent one of the most serious problems facing the mouse. Corn et al. (1995) discussed both the problem of invasive weeds degrading Preble's habitat and the potential problem of weed control programs removing cover and thereby impacting Preble's habitat.

In summary after reviewing the best scientific data currently available, the Service finds that Preble's meadow jumping mouse has undergone a decline in range and that populations within its remaining range have been lost. Habitat alteration, degradation, loss, and fragmentation resulting from residential, commercial, recreational, flood control and water development, and agricultural and livestock grazing land uses have adversely impacted and fragmented Preble's populations. Significant threats to the continued existence of Preble's are also posed by hazardous materials, mining, and highway and bridge construction. This species is also highly susceptible to localized extinction from naturally occurring events such as flooding, predation, and disease outbreaks.

B. *Overutilization for commercial, recreational, scientific, or educational purposes.* The Preble's meadow jumping mouse has no known commercial or recreational value. Scientific and educational collecting has not been widespread over the past century. While

the Service is aware of a small amount of incidental mortality associated with recent scientific studies, this is not thought to present a threat to Preble's populations.

C. *Disease or predation.* The Preble's meadow jumping mouse, as well as other native rodents, carries parasites and diseases that may reduce vigor, curtail reproductive success, and cause death. There is no evidence whether or not any epizootic disease has caused significant impact to Preble's. While plague is regularly found in other rodent species within Preble's range, its impact to Preble's populations is not known.

Predation on the Preble's meadow jumping mouse has always existed as a naturally occurring association between predator and prey. While evidence is scant, human development may have altered this relationship. Armstrong et al. (1996) recommended studies be conducted on influences of the suburban environment and associated densities of species such as striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and the domestic cat (*Felis catus*) on Preble's. Free-ranging domestic cats may locally present a problem to Preble's. Corn et al. (1995) recommended a 1.5 km (.9 mi) setback of housing development from Preble's habitat to exclude predation by ''house cats.'' As an alternative they suggested a strict prohibition on free-ranging cats. More information is needed about the effects from predation by domestic and feral cats, and perhaps dogs (*Canis familiaris*), on Preble's.

D. *The inadequacy of existing regulatory mechanisms.* The decline of the Preble's meadow jumping mouse is partially due to the inherent weakness or non-application of the existing laws and regulations that could serve to protect Preble's and its habitat. Relevant Federal laws include the Clean Water Act, Endangered Species Act, Federal Power Act, Fish and Wildlife Coordination Act, Food Security Act, and National Environmental Policy Act. Federal regulations and policies have limited protection authority and scope for non-listed species. These statutes only recommend, not require, that projects carried out, funded, or permitted by the Federal government attempt to mitigate impacts to species of special concern due to scarcity or decline.

Colorado Division of Wildlife Regulations (Chapter 10, Article IV) classify *Z. hudsonius* as a ''nongame'' species. This designation means that permits must be obtained for take of Preble's meadow jumping mouse related to scientific, educational, or rehabilitation purposes. Preble's is a ''species of special concern'' in Colorado; however, this is not a statutory designation. Preble's is currently under consideration for endangered species designation in Colorado. In Wyoming, the Wyoming Game and Fish Department has classified *Z. hudsonius* as a nongame species protected under Wyoming Game and Fish Department Nongame Wildlife Regulations promulgated by WF23–1–103 and 23–1–302. This designation protects Preble's from takings and sales by only issuing permits for the purpose of scientific collection. While the above regulations limit the taking of Preble's, they provide no measures to protect the species' habitats. State listing encourages State agencies to allocate funds and exercise authority to achieve recovery, stimulate research, and allow redirection of priorities within State natural resource departments. However, without additional measures to protect habitat, such State laws are generally inadequate.

There are few regional or local laws, regulations, or ordinances that specifically protect Preble's meadow jumping mouse or its habitat from inadvertent or intentional adverse impacts. A myriad of local regulations, incentive programs, and open space programs exist, as documented in materials forwarded to the Service by the Colorado Department of Natural Resources. While certain regulations are designed to conserve wetlands or floodplains, it is unlikely that they effectively control land uses (grazing, mowing, cutting, burning) that may impact vegetation on which Preble's depends. Further, Preble's may be dependent on hibernacula sites outside the protected wetlands or floodplains. Many existing local regulations create a process of site plan review which ''considers'' or ''encourages'' conservation of wildlife, wetlands, and natural habitats. Effectiveness of local regulations in maintaining naturally functioning riparian corridors may vary greatly depending on how these apparently flexible regulations are implemented. Beyond direct impact to Preble's habitat, secondary impacts of development (increased recreational use, altered flow regimes and groundwater levels, and increase in domestic predators) may not currently be addressed at the local level.

Of note is the 1997 creation of a Preble's Meadow Jumping Mouse Working Group, organized by the Colorado Department of Natural Resources to initiate a collaborative planning process designed to produce a legally and scientifically sound approach to conservation of Preble's. This effort is supported in part by appropriations from Congress, specifically for the Preble's planning process. The Service is an active participant in this process and is fully supportive of the goal of developing a Preble's conservation plan and implementing agreements. However, there are no such plans or agreements currently in place. The Service anticipates that this planning process may lead to the creation of one or more Habitat Conservation Plans or to the application of the Service's discretionary rule-making authority pursuant to section 4(d) of the Endangered Species Act.

E. *Other natural or manmade factors affecting its continued existence.* Use of pesticides and herbicides has undoubtably increased across known Preble's meadow jumping mouse range as human land use has intensified. These chemicals could directly poison Preble's or may be ingested through contaminated food or water. Specific impacts to Preble's from pesticides and herbicides are not currently known. Intensive human development creates a range of additional environmental impacts (including but not limited to noise, and the degradation of air and water quality) that could alter Preble's behavior, increase the levels of stress, and ultimately contribute to loss of vigor or death of individuals, and extirpation of populations.

In summary, the Preble's meadow jumping mouse, historically a rare mammal, has declined. Seven counties in Colorado and two in Wyoming are known to support Preble's populations. Riparian habitats required to support Preble's have been severely modified or destroyed by human activities in many areas east of the Colorado Front Range and in southeastern Wyoming. With current human population increases, the loss and modification of riparian habitat continues. Existing regulations have proven to be inadequate to protect Preble's, as witnessed by its apparent decline and the continued destruction and modification of its habitats.

The Service has carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by this species in developing this rule. Based on this evaluation, the preferred action is to list the Preble's meadow jumping mouse as a threatened species. The Service has determined that the Preble's meadow jumping mouse is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and therefore meets the requirements to be listed as threatened. Based on 1997

survey data, Preble's is now known to exist in several additional sites in Colorado. In addition, 1997 studies in Douglas County, Colorado, suggest substantial occupied habitat exists along East Plum Creek and West Plum Creek. For this reason, the Service believes that a designation as threatened more accurately reflects the threats facing this species than the endangered status that was identified in the March 25, 1997, proposed rule. The Service knows of no substantial disagreement among scientists knowledgeable about Preble's regarding the sufficiency or accuracy of the available data relevant to this determination, which would serve as a basis for extension of the proposed rule. Critical habitat is not being proposed for the reasons stated below.

Critical Habitat

Critical habitat is defined in section 3 of the Act as: (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and, (ii) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. ''Conservation'' means the use of all methods and procedures needed to bring the species to the point at which listing under the Act is no longer necessary.

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12) require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time the species is determined to be endangered or threatened. Service regulations (50 CFR 424.12(a)(1)) state that designation of critical habitat is not prudent when one or both of the following situations exist: (1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species, or (2) such designation of critical habitat would not be beneficial to the species. The Service finds that designation of critical habitat is not prudent for Preble's meadow jumping mouse for the reasons described below.

Critical habitat receives consideration under section 7 of the Act with regard to actions carried out, authorized, or funded by a Federal agency (see Available Conservation Measures section). As such, designation of critical habitat may affect activities on Federal lands and may affect activities on non-Federal lands where such a Federal nexus exists. Potential benefits of critical habitat designation derive from section 7(a)(2) of the Act, which requires Federal agencies, in consultation with the Service, to ensure that their actions are not likely to jeopardize the continued existence of listed species or to result in the destruction or adverse modification of critical habitat of such species.

Critical habitat, by definition, applies only to Federal agency actions. 50 CFR 402.02 defines ''jeopardize the continued existence of'' as meaning to engage in an action that would reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species. Both jeopardizing the continued existence of a species and adverse modification of critical habitat have similar standards and thus similar thresholds for violation of section 7 of the Act. In the section 7(a)(2) consultation process, the jeopardy analysis focuses on potential effects on the species' populations, whereas the destruction or adverse modification analysis focuses on habitat value, specifically on those constituent elements identified in the critical habitat listing.

Common to both jeopardy and destruction or adverse modification biological opinions is the requirement that the Service find an appreciable effect on both the species' survival and recovery. This is in contrast to the public perception that the adverse modification standard sets a lower threshold for violation of section 7 than that for jeopardy. Thus, Federal actions satisfying the standard for adverse modification are nearly always found to also jeopardize the species concerned, and the existence of designated critical habitat does not materially affect the outcome of consultation. Biological opinions that conclude that a Federal agency action is likely to adversely modify critical habitat but is not likely to jeopardize the species for which it is designated are extremely rare historically; none have been issued in recent years. Thus, the Service believes that, from a section 7 consultation perspective, little or no additional conservation benefit would be achieved for Preble's meadow jumping mouse by the designation of critical habitat.

Additionally, designation of critical habitat provides protection only on Federal lands or on non-Federal lands when there is Federal involvement, through authorization or funding or participation, in a project or activity. Four populations of the Preble's meadow jumping mouse are located on Federal lands administered by the U.S. Forest Service, U.S. Air Force and the Department of Energy. These agencies are aware of the species' occurrence at these sites and the requirement to consult with the Service. The Department of Energy (DOE) at Rocky Flats and the Air Force Academy have both been active in Preble's meadow jumping mouse survey, research and conservation. The DOE continues to study Preble's at Rocky Flats, has mapped occupied and potential habitat, and is developing a PMJM Protection Plan for the facility. The Air Force Academy has been active in surveying for Preble's and continues to support research into habitat use including radio tracking of animals. Warren Air Force Base and the Forest Service have supported some survey work with additional work remaining to be accomplished. In each case these facilities, Rocky Flats and the Air Force Academy, both of which support important populations, are well aware of their responsibilities regarding section 7. The designation of critical habitat would provide no change in their present operations and impart no additional benefit. Therefore, informing these agencies of the species location and need to consult is unnecessary.

Designation of critical habitat provides no limitations or constraints on private landowners if there is no Federal nexus, and, as such, provides the species no benefit. Activities on private lands rarely have a federal nexus. A Federal nexus may in some cases be found for parcels of lands where there is an activity either funded, authorized or permitted by a Federal agency. Under the Clean Water Act section 404 a permit is required for any activity resulting in the discharge of dredge and fill material from jurisdictional waters. Generally such activities on small parcels of private lands are excluded from individual permit requirements under the Corps section 404 Nationwide Permit program. In all cases where there is a Federal nexus to an activity occurring on private lands, any underlying Federal action (the issuance of a permit) triggering the standard for adverse modification would also be found to trigger the jeopardy standard, with the existence of designated critical habitat not materially affecting the outcome of consultation. Therefore such designation of critical habitat on balance would not afford the Preble's meadow jumping mouse any additional benefit.

Expansive blocks of public lands ensures that Federally sponsored activities will receive the benefit of section 7 consultation, regardless of whether or not critical habitat is designated. Protection of the habitat of the species will also be addressed through the Act's recovery process. Only through the recovery process will a recovery plan be created that will prescribe specific management actions and the establishment of numerical population goals. In addition, the landowners may choose to develop a habitat conservation plan through the section 10 permitting process that will manage for the conservation of the species. Thus, protection of habitat can be addressed through the recovery, section 10 and section 7 consultation processes, and designation of critical habitat would afford the Preble's meadow jumping mouse no additional benefit.

Listing of the Preble's meadow jumping mouse as a threatened species also publicizes the present vulnerability of this species and, thus, can be reasonably expected to increase the threat of vandalism or intentional destruction of the species habitat. In light of the vulnerability of this species to vandalism or the intentional destruction of its habitat (for example poisoning, lethal trapping, burning or cutting of habitat), the designation of critical habitat in and of itself and the publication of maps providing its precise locations and descriptions of essential elements, as required for the designation of critical habitat, would reasonably be expected to increase the degree of threat to the species and its habitat, increase the difficulties of law enforcement, and further contribute to the decline of Preble's.

The Service acknowledges that critical habitat may provide some minor benefit in that it may identify areas important to a species, call attention to those areas in special need of protection and contribute a positive influence for securing funding or land acquisitions, etc., if a parcel of land is designated as critical habitat. However, in this case, where identification of such areas is expected to exacerbate a potentially serious additional threat (vandalism), information regarding the special needs of the species for protection can be disseminated more effectively through alternative means, and such designation could also impart negative connotations and dissuade people from participating in conservation activities simply because an area is designated critical habitat.

Therefore, because of the increased threat of taking, the fact that designation of critical habitat would provide little different or greater benefit than that provided by the jeopardy standard under section 7 regulations, and that any minor benefits accruing from such designation are outweighed by its negative effects, the Service has determined that the designation of critical habitat for the Preble's meadow jumping mouse is not prudent.

The Service will continue its efforts to obtain more information on Preble's meadow jumping mouse biology and ecology, including essential habitat characteristics, current and historical distribution, and existing and potential sites that can contribute to conservation of the species. The information resulting from this effort will be used to identify measures needed to achieve conservation of the species, as defined under the Act. Such measures could include, but are not limited to, development of conservation agreements with the States, other Federal agencies, local governments, and private landowners and organizations.

Available Conservation Measures

Conservation measures provided to a species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness and conservation actions by Federal, State, and local agencies, private organizations, and individuals. The Act provides for possible land acquisition, cooperation with the States, and requires that recovery actions be carried out for all listed species. The protection required of Federal agencies and the prohibitions against taking and harm are discussed, in part, below.

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened, and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(2) requires Federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

The Preble's meadow jumping mouse occurs on lands administered by the U.S. Air Force, Department of Energy, U.S. Forest Service, Colorado Division of Wildlife, Colorado State Parks, Boulder County, Jefferson County, City of Boulder, and on private lands. For Federal lands where Preble's occur, the Act would require the appropriate land management agency to evaluate potential impacts to Preble's that may result from activities they authorize or permit. The Act requires consultation under section 7 of the Act for activities on Federal, State, county, or private lands, including tribal lands, that may impact the survival and recovery of Preble's, if such activities are funded, authorized, carried out, or permitted by Federal agencies. The Federal agencies that may be involved as a result of this proposed rule include the Service, Department of Energy, Forest Service, U.S. Army Corps of Engineers, Natural Resources Conservation Service, Bureau of Land Management, Bureau of Reclamation, Department of the Army, Department of the Air Force, Office of Surface Mining, Western Area Power Administration, Rural Utilities Service, Federal Energy Regulatory Commission, Department of Housing and Urban Development, Federal Highway Commission, and Environmental Protection Agency. Federally listing Preble's as a threatened species will require these agencies to consider potential impacts to Preble's prior to approval of any activity authorized or permitted by them (e.g., Clean Water Act's section 404 permits, grazing management, military maneuvers, bioremediation and hazardous materials cleanup, mining permitting and expansion, highway construction, etc.).

Federal agency actions that may require consultation as described in the preceding paragraph include: removing, thinning or altering vegetation; implementing livestock grazing management that alters vegetation during warm seasons; construction of roads or access along or through riparian areas; channelization and other alteration of perennial and intermittent streams and their hydrological regimes for flood control and other water management purposes; permanent and temporary damming of streams to create water storage reservoirs or deviate the stream's course; human activities in or near Preble's meadow jumping mouse habitats; construction of residential, commercial, and industrial developments, including roads, bridges, public utilities and telephone lines, pipelines, and other structures; bioremediation and hazardous materials

management, containment, and cleanup efforts such as those at Rocky Flats; and, sand and gravel and other types of mining activities within or upstream of Preble's meadow jumping mouse habitats.

The Act and implementing regulations set forth a series of general prohibitions and exceptions that apply to all listed wildlife. The prohibitions codified at 50 CFR 17.21, in part, make it illegal for any person subject to the jurisdiction of the United States to take (including harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or attempt any of these), import or export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It also is illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

Permits may be issued to carry out otherwise prohibited activities involving listed wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22 and 17.23. Such permits are available for scientific purposes, to enhance the propagation or survival of the species, and/or incidental take in connection with otherwise lawful activities. Information collections associated with these permits are approved under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.*, and assigned Office and Management and Budget clearance number 1018–0094. For additional information concerning these permits and associated requirements, see 50 CFR 17.32.

Requests for copies of the regulations regarding listed wildlife and inquiries about prohibitions and permits may be addresses to U.S. Fish and Wildlife Service, P.O. Box 25486, Denver Federal Center, Denver, Colorado 80225 (telephone 303/236–8155, Facsimile 303/236–8192).

The Service adopted a policy on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of the listing on proposed and ongoing activities within a species' range. The Service believes that, based upon the best available information, the following actions will not result in a violation of section 9, provided these activities are carried out in accordance with existing regulations and permit requirements:

(1) Activities authorized, funded, or carried out by Federal agencies (e.g., grazing management, agricultural conversions, wetland and riparian habitat modification, flood and erosion control, mineral development, housing and commercial development, recreational trail development, road and dam construction, hazardous material containment and cleanup activities, prescribed burns, pest control activities, pipelines or utility lines crossing riparian/wet meadow habitats, logging, military maneuvers and training) when such activity is conducted in accordance with any incidental take statement prepared by the Service in accordance with section 7 of the Act;

(2) Activities such as grazing management, flood and erosion control, agricultural conversions, wetland and riparian habitat modification, mineral development, housing and commercial development, road and dam construction, recreational trail development, hazardous material containment and cleanup activities, prescribed burns, pest control activities, pipelines or utility lines crossing riparian/wet meadow habitats, logging, military maneuvers and training when such activity does not occur in habitats suitable for the survival and recovery of the Preble's meadow jumping mouse, does not alter downstream hydrology or riparian habitat supporting Preble's, and does not result in actual death or injury to the species by significantly modifying essential behavioral patterns;

(3) Within the hibernation period and outside denning areas, controlled burns and mowing, or other activities that temporarily alter the Preble's meadow jumping mouse food sources. The period when mowing and burning activities would not impact the Preble's meadow jumping mouse nourishment may vary at specific locations, but would usually fall between October 15 and April 15 of every year;

(4) Human recreational activities undertaken on foot or horseback at breeding, feeding, and hibernating sites that do not degrade Preble's meadow jumping mouse habitat (e.g., waterfowl hunting, bird watching, sightseeing, photography, camping, hiking); and,

(5) Application of pesticides in accordance with label instructions, in areas that do not drain into Preble's meadow jumping mouse habitats.

Activities that the Service believes could potentially result in a violation of section 9 include, but are not limited to:

(1) Unauthorized or unpermitted collecting, handling, harassing, or taking of the species;

(2) Activities that directly or indirectly result in the actual death or injury death of Preble's meadow jumping mice, or that modify the known habitat of the species, thereby significantly modifying essential behavioral patterns (e.g., plowing, mowing, or cutting; conversion of wet meadow or riparian habitats to residential, commercial, industrial, recreational areas, or cropland; overgrazing; road and trail construction; water development or impoundment; mineral extraction or processing; off-highway vehicle use; and, hazardous material cleanup or bioremediation); when such activities are not carried out pursuant to either a section 10(a)(1)(B) permit issued by the Service; a protective regulation issued under section 4(d) necessary and advisable for the conservation of the species, or in accordance with any reasonable and prudent measures given by the Service under section 7(b)(4)(C)(ii) of the Act.

(3) The application or discharge of agrichemicals, or other pollutants, and pesticides, onto plants, soil, ground water, or other surfaces in violation of label directions, or any use following Service notification that such use, application or discharge is likely to harm the species; would be evidence of unauthorized use, application or discharge.

Questions regarding whether specific activities, such as changes in land use, will constitute a violation of section 9 should be directed to the Colorado Field Office (see **ADDRESSES** section).

The prohibition against intentional and unintentional ''take'' of listed species applies to all landowners regardless of whether or not their lands are within designated critical habitat (see 16 U.S.C. 1538(a)(1), 1532(1a) and 50 CFR 17.3). Section 10(a)(1)(B) authorizes the Service to issue permits for the taking of listed species incidental to otherwise lawful activities such as agriculture, surface mining, and urban development. Take permits authorized under section 9 must be supported by a habitat conservation plan (HCP) under section 10 that identifies conservation measures that the permittee agrees to implement to conserve the species, usually on the permittee's lands. The Service would approve an HCP, and issue a section 10(a)(1)(B) permit only if the plan would minimize and mitigate the impacts of the taking and would not appreciably reduce the likelihood of the survival and recovery of that species in the wild.

National Environmental Policy Act

The Service has determined that Environmental Assessments and Environmental Impact Statements, as defined under the authority of the

National Environmental Policy Act of 1969, need not be prepared in connection with regulations adopted pursuant to Section 4(a) of the Act. A notice outlining the Service's reasons for this determination was published in the **Federal Register** on October 25, 1983 (48 FR 49244).

Required Determinations

The Service has examined this regulation under the Paperwork Reduction Act of 1995 and found it to contain no information collection requirements. This rulemaking was not subject to review by the Office of Management and Budget under Executive Order 12866.

References Cited

A complete list of all references cited is available upon request from the Colorado Field Office (see **ADDRESSES** above).

Author. The primary author of this document is Peter Plage of the Colorado Field Office (see **ADDRESSES** section).

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation

Accordingly, the Service amends part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as amended, as set forth below:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 16 U.S.C. 1531–1544; 16 U.S.C. 4201–4245; Pub. L. 99–625, 100 Stat. 3500, unless otherwise noted.

2. Section 17.11(h) is amended by adding the following, in alphabetical order under Mammals, to the List of Endangered and Threatened Wildlife to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
Mammals:							
*	*	*	*	*	*	*	
Mouse, Preble's meadow jumping.	*Zapus hudsonius preblei.*	U.S.A. (CO, WY)	.....do	T	636	NA	NA
*	*	*	*	*	*	*	

Dated: May 8, 1998.

John G. Rogers,

Director, Fish and Wildlife Service.

[FR Doc. 98–12828 Filed 5–12–98; 8:45 am]

BILLING CODE 4310–55–P

Draft Recovery Plan
Preble's Meadow Jumping Mouse
(*Zapus hudsonius preblei*)
November 5, 2003

U.S. Department of the Interior, Fish and Wildlife Service
Mountain-Prairie Region

Approved_____ **Date**_____
Regional Director, U.S. Fish and Wildlife Service

U.S. Fish and Wildlife Service's Mission in Recovery Planning

Section 4(f) of the Endangered Species Act (ESA) of 1973, as amended, directs the Secretary of the Interior and the Secretary of Commerce to develop and implement recovery plans for species of animals and plants listed as endangered or threatened unless such plans will not promote the conservation of the species. The Fish and Wildlife Service (FWS) and the National Marine Fisheries Service have been delegated the responsibility of administering the ESA. Recovery is the process by which the decline of an endangered or threatened species is arrested or reversed, and threats to its survival are neutralized, so that its long-term survival in nature can be ensured. The goal of the process is the maintenance of secure, self-sustaining wild populations of species with the minimum necessary investment of resources. A recovery plan delineates, justifies, and schedules the research and management actions necessary to support recovery of a species. Recovery plans do not, of themselves, commit staff or funds, but are used in setting regional and national funding priorities and providing direction to local, regional, and State planning efforts. Means within the ESA to achieve recovery goals include the responsibility of all Federal agencies to seek to conserve endangered and threatened species, and the Secretary's ability to designate critical habitat, to enter into cooperative agreements with the States, to provide financial assistance to the respective State agencies, to acquire land, and to develop Habitat Conservation Plans (HCPs) with applicants.

DISCLAIMER

Recovery Plans delineate reasonable actions that are believed to be required to recover and protect listed species. Plans are published by the FWS, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained, and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the FWS. They represent the official position of the FWS only after they have been signed as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature Citation should read as follows:

U.S. Fish and Wildlife Service. 2003. Preble's Meadow Jumping Mouse Recovery Plan, Colorado. Region 6, Lakewood, Colorado. XX pages.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
301-492-3421 or 1 800-582-3421

The fee for the Plan varies depending on the number of pages of the Plan.

A copy of the Plan is available on the Service's website at www.fws.gov

ACKNOWLEDGMENTS

The Preble's Meadow Jumping Mouse Recovery Plan has benefitted from the collaboration, advice, and assistance of many individuals, agencies and organizations. We thank the following people:

Dr. Mary Conner, Consultant, Taxonomy
Paul Hellmund, Meeting Facilitator
Jon Kindler, (Colorado Division of Wildlife), GIS
Dr. Cheri Jones, Denver Museum of Nature and Science
Carol Marander, (Colorado State University), Graphics
Dr. Carron Meaney, Consultant
Rob Schorr, Colorado Natural Heritage Program
Audrey Taylor, U.S. Fish and Wildlife Service
Dr. Gary White, Colorado State University
Patricia Worthing, U.S. Fish and Wildlife Service

Many of the threats to the Preble's meadow jumping mouse are associated with habitat loss and urbanization of the east slope of the Rocky Mountain Front Range from Cheyenne, Wyoming, to Colorado Springs, Colorado. To aid in the urban and population planning process, several approved recovery plans were reviewed, and we express our thanks to the authors of other recovery plans, especially the Recovery Plan for Upland Species of the San Joaquin Valley, California, Region 1, U.S. Fish and Wildlife Service 1998, and the Mexican Spotted Owl Recovery Plan, Region 2, U.S. Fish and Wildlife Service 1995.

The FWS also is grateful to the members of the Preble's Meadow Jumping Mouse Recovery Team, and the organizations that supported them. The Recovery Team wrote the initial draft document which served as the basis for this Recovery Plan.

Recovery Team Advisors, Members, and Alternates:

Don Britton	2000-present	Wheatland Irrigation District
Shirley Casey	2000-present	Strategic Linkages, Inc.
Dana Green	2000-2002	U.S. Air Force
Taylor Haynes	2000-present	Wyoming Stock Growers & Co Agriculture
Mary Jennings	2000-present	U.S. Fish and Wildlife Service
Bob Luce	2000-2002	Wyoming Game and Fish
Dr. Brian Mihlbachler	2002-present	U.S. Air Force
Bob Oakleaf	2000-present	Wyoming Game and Fish
Chris Pague	2000-present	The Nature Conservancy
Pete Plage	2000-present	U.S. Fish and Wildlife Service
Karen Rose	2000-present	CPR Marketing
Bruce Rosenlund	2000-present	U.S. Fish and Wildlife Service
Dr. Tanya Shenk	2000-present	Science Advisor, Colorado Division of Wildlife
Gary Skiba	2000-present	Colorado Division of Wildlife
Renee Taylor	2002-present	Wyoming Stock Growers & Co Agriculture

EXECUTIVE SUMMARY

Current Species Status: The Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*) was listed as threatened in 1998, pursuant to the ESA. No rangewide population estimates exist for the species. Numerous surveys conducted in the last decade have documented the species presence or absence at locations of suitable habitat; some locations were historically known to be occupied and other locations had no known previous surveys. We believe that adequate numbers, sizes, and distribution of populations may currently exist to meet recovery criteria, but there are substantial threats to these populations that need to be abated to prevent further decline and endangerment of the species. Therefore, the species is still in need of protection of the Endangered Species Act.

Habitat Requirements and Limiting Factors: The Preble's meadow jumping mouse is found in foothills riparian habitat from southeastern Wyoming to south central Colorado. The species is often found in dense, herbaceous riparian vegetation, that may have an overstory canopy layer. Preble's meadow jumping mice regularly use upland grasslands adjacent to riparian habitat, and they may be dependent upon some amount of open water. The species hibernates near riparian zones from mid-October to early May. Loss of riparian habitats and other factors associated with urbanization appear to be the major threat to the species.

Recovery Objective: The purpose of this Plan is to remove the Preble's meadow jumping mouse from the list of threatened species. This plan proposes four criteria for delisting under Section II of the Plan. When the four criteria are met, and following an analysis of the ESA listing factors, the species will no longer be considered in need of protection under the ESA and may be delisted.

Recovery Criteria For Delisting:

1. Document and maintain wild, self-sustaining Preble's meadow jumping mouse populations.
2. Protect and manage habitat of Preble's meadow jumping mouse populations.
3. Abate threats to Preble's meadow jumping mouse populations.
4. Develop and implement a long-term management plan and cooperative agreement prior to delisting.

Guiding Principles and Actions:

1. Manage Species by River Drainage (South Platte, North Platte, Arkansas).
2. Conduct Research on Preble's Habitat and Taxonomy.
3. Use Monitoring and Adaptive Management to Achieve Stable Preble's Populations.
4. Encourage Local Involvement in Conserving Preble's Populations.
5. Encourage Cooperative Management to Achieve Preble's Recovery Efforts.
6. Use Economic Incentives to Encourage Conservation of Preble's Populations.
7. Use Public Education to Achieve Preble's Recovery Objectives.

Cost of Recovery ($000's): ????

Date of Recovery: Because recovery is defined as populations that are stable or increasing over a period of time, the date of recovery is estimated at approximately 20 years.

The Preble's Meadow Jumping Mouse Recovery Team is a group of stakeholders and interagency scientists convened to advise the FWS on Preble's issues. The Recovery Team wrote the initial draft of this Recovery Plan, which served as the basis for this version. This is the first FWS recovery plan written for this species. Revisions of this Plan will occur as often as is feasible and appropriate.

The Plan is organized into four sections:

I. Introduction - Species description, taxonomy, distribution, habitat, demography, natural history, reasons for listing, threats to recovery, impediments to recovery, management and conservation efforts, conservation principles and recovery strategies.

II. Recovery - Recovery objectives and tasks considered vital to the successful recovery of the Preble's meadow jumping mouse.

III. Implementation Schedule - Scheduled recovery tasks and estimated costs.

IV. Appendices

We anticipate that this document will be used by agencies and stakeholders involved with Preble's meadow jumping mouse management to coordinate efforts and work towards recovery of this species.

CONTENTS

PART I: BACKGROUND

LEGAL STATUS

Preble's meadow jumping mouse (*Zapus hudsonius preblei*; herein referred to as Preble's) was listed as a threatened subspecies under the ESA in May of 1998 (63 FR 26517). This rare subspecies of meadow jumping mouse is considered "threatened" by the Colorado Division of Wildlife (1998) and of "unknown status" by the Wyoming Game and Fish Department (B. Oakleaf, Wyoming Game and Fish Department, pers. comm.). The species (*Zapus hudsonius*) is protected under the Wyoming Nongame Wildlife Regulations (1999).

Both the Colorado Natural Heritage Program (1999a) and the Wyoming Natural Diversity Database (Fertig and Beauvais 2001) consider Preble's "imperiled globally" and "critically imperiled within the State because of five or fewer occurrences" in their respective States. However, the Wyoming Natural Diversity Database may upgrade the subspecies to status S2 (imperiled within Wyoming because of 6 to 20 occurrences) in the near future (Beauvais 2001). In their recent evaluation of the conservation status of rodents of North America, Hafner et al. (1998) classified Preble's as "endangered" in the International Union for Conservation of Nature and Natural Resources' Red List.

Because there are several other taxa for which include"Preble's" in their common name, referring to this subspecies as "Preble's" is not technically appropriate. Scientifically, it is more appropriate to refer to this subspecies as Zapus hudsonius preblei or Z. h. preblei. Some may feel it would be preferable to use the entire common name, Preble's meadow jumping mouse, or the acronym, PMJM; however, in order to make this plan user friendly for the general public we have chosen to refer to the subspecies as "Preble's," consistent with past FWS usage.

GENERAL BIOLOGY OF PREBLE'S MEADOW JUMPING MOUSE

Much of what is now known about the subspecies is a result of information gained from the early 1990s to the present. Since Preble's was listed by the FWS in 1998, knowledge about distribution, population dynamics, abundance, taxonomy and habitat of the subspecies has grown substantially. However, much of the biology and ecology of Preble's is still not well understood. Where gaps in knowledge exist, scientists have relied on information from closely-related subspecies whose biology and ecology are believed to be similar to Preble's. Information that is specific to Preble's will be described as being relevant to the subspecies ("Preble's"), but when information is gleaned from what is known about other subspecies it will be described as pertinent to the species ("meadow jumping mouse").

Description

Preble's is a relatively small rodent with an extremely long tail, large hind feet and long hind legs (Figure 1). The tail is bicolored, lightly-furred and typically twice as long as the body. The large hind feet can be one third again as large as those of other mice, such as the deer mouse

(*Peromyscus maniculatus*). Preble's has a distinct, dark, broad stripe on its back that runs from head to tail and is bordered on either side by gray to orange-brown fur. The hair on the back of

Figure 1. Photograph of Preble's

all jumping mice appears coarse compared to other mice. The underside fur is white and much finer in texture. Total length of adult Preble's is approximately 180-250 mm (7-10 inches), with the tail comprising 108-155 mm (4-6 in) of that length (Krutzsch 1954, Fitzgerald et al. 1994).

Weights can be used to define three age classes of meadow jumping mice. Juveniles weigh less than 13 g (0.46 oz), subadults weigh 13-14 g (0.46-0.50 oz), and adults weigh 15 g (0.53 oz) or more (Krutzsch 1954, Nichols and Conley 1982). Upon emergence from hibernation, adult Preble's can weigh as little as 14 g (0.50 oz) (Meaney et al. in review, T. Shenk, Colorado Division of Wildlife, and M. Bakeman, Ensight Technical Services, unpublished data). The mean weight of 78 adult male Preble's captured prior to June 18 was 18 $\pm$ 2 g (0.65 $\pm$ 0.07 oz), and of 47 adult females was 18.2 $\pm$ 2.8 g (0.65 $\pm$ 0.1 oz); 10 of the females were pregnant and weighed more than 22 g (0.79 oz) (Meaney et al. in review). Pregnant females can reach weights up to 28 g (1.0 oz) or more (M. Bakeman, Ensight Technical Services, unpublished data). Through late August into mid-September, adult Preble's gain weight in preparation for hibernation and typically attain weights of 25 to 34 g (0.89 to 1.2 oz), with these weights comparable to pre-hibernation weights for the species (Muchlinski 1988). However, several individual Preble's have weighed as much as 38 g (1.4 oz) (Meaney et al. in review, T. Shenk, Colorado Division of Wildlife, pers. comm., T Ryon, Greystone Consultants, unpublished data).

Taxonomy

Preble's is a member of the family Dipodidae (jumping mice; Wilson and Reeder 1993), which contains four extant genera. Two of these, *Zapus* and *Napaeozapus,* are found in North America (Hall 1981, Wilson and Ruff 1999). The three species within the genus *Zapus* are *Z. hudsonius* (meadow jumping mouse), *Z. princeps* (western jumping mouse), and *Z. trinotatus* (Pacific jumping mouse). Edward A. Preble (1899) first documented meadow jumping mice from Colorado. Krutzsch (1954) described Preble's as a separate subspecies of meadow jumping mouse. Preble's is now recognized as 1 of 12 subspecies of meadow jumping mouse (Hafner et al. 1981; Figure 2).

The range of the western jumping mouse (*Zapus princeps*) overlaps that of Preble's (Hall 1981; Figure 2) and the two species are similar in appearance. Compared to western jumping mice, Preble's are generally smaller, have a more distinctly bicolored tail, and a less obvious dorsal stripe. However, field identification of western jumping mice and Preble's where their ranges overlap is difficult due to their similarity in size and color. In fact, field identifications have led to some confusion and reversal of identification. A second and better technique for identification of Preble's requires skulls of specimens housed in natural history museums. With museum identification, one can view the specimen's dental characteristics such as the presence or absence of the anterior median fold on the first lower molar (Klingener 1963, Hafner 1993) and shape of the anteroconid (a tooth cusp) in combination with distribution and elevation. These have been useful tools for almost half a century. A third and more recent technique is discriminant function analysis (DFA) which uses a larger data set comprised of a series of skull measurements in addition to the tooth fold. The DFA suggests that the tooth fold is not a perfect identification

Figure 2. Distribution of the meadow jumping mouse *(Zapus hudsonius*) and its 12 subspecies (a), and the western jumping mouse (*Zapus princeps)* (b) in North America (modified from Hall 1981).

tool by itself (Conner and Shenk in press, 2001, Conner and Schenk 2001, and unpublished

data). With DFA, two museum identifications from Colorado and seven from Wyoming have been reversed (Conner and Shenk 2001). A fourth technique is genetic analysis (Riggs et al. 1997). Future genetic studies will go a long way toward resolving some of the few identification inconsistencies. A fifth technique is being developed, in which DFA is applied to digitized skull measurements. Overall, most accurate identifications are likely those where two or more approaches produce the same results.

Riggs et al. (1997) analyzed the mitochondrial DNA from tissue samples of meadow and western jumping mice from Colorado and Wyoming and concluded that Preble's form "a homogenous group recognizably distinct from nearby populations and adjacent species of the genus." Hafner (1997) reviewed the Riggs study, and concluded that Preble's do in fact form a relatively homogenous group, as determined by inspection of the original sequence data. Hafner (1997) also remained convinced of the accuracy of the biogeography and taxonomic arrangement of jumping mice.

Studies on genetic relationships between Preble's, and other related species and subspecies are currently be conducted by the Denver Museum of Nature and Science. Results of these studies are not yet available. When these studies have been completed, any available results will be incorporated into the final version of this Recovery Plan.

Two subspecies of meadow jumping mouse occur in Colorado: Preble's and *Z. h. luteus.* The subspecies *Z. h. luteus* was previously known as *Z. princeps luteus*, but was subsequently assigned to *Z. hudsonius* by Hafner et al. (1981). Although *luteus* mainly occurs within central New Mexico and eastern Arizona, it was recently discovered in southern Colorado by Jones (1999). Two subspecies of meadow jumping mouse also occur in Wyoming: Preble's and *Z. h. campestris* (Hall 1981, Clark and Stromberg 1987; Figure 2). The subspecies *Z. h. campestris* was described from northeastern Wyoming, southeastern Montana, and western South Dakota (Hall 1981).

Distribution

Preble's is found in both the North and South Platte River basins, from the eastern flank of the Laramie Mountains and the Laramie Plains in southeastern Wyoming south along the eastern flank of the Front Range in Colorado and into the headwaters of the Arkansas River Basin near Colorado Springs, Colorado (Long 1965, Hall 1981, Clark and Stromberg 1987, Fitzgerald et al. 1994, Clippinger et al. in review). The most recent knowledge regarding the distribution of Preble's comes from live-trapping locations and specimens from site-specific research efforts, range-wide survey efforts, and numerous additional surveys conducted in Colorado and Wyoming since the mid-1990s. Most specimens collected in recent years are housed at the Denver Museum of Nature and Science; survey reports from live-trapping efforts are filed with the FWS Field Offices in Colorado and Wyoming. Museum specimens from Colorado Springs mark the southern distributional limit of Preble's. At the nothern end, museum specimens from the southern notch of Converse County mark the limit; trapping records of *Zapus* are recorded as far north as Douglas, Wyoming (Rodgers 1999), but it is not known whether these are Preble's

(Figure 3, Appendix C and D).

The ranges of Preble's and the western jumping mouse overlap in Colorado and southeastern Wyoming (Long 1965, Clark and Stromberg 1987; Figure 2). Many drainages are inhabited by both Preble's and the western jumping mouse. The general pattern is one of elevational gradient, where *Z. princeps* occurs at higher elevation and *Z. h. preblei* occurs at lower elevation. This pattern manifests itself along the Front Range in Colorado and the eastern flank of the Laramie Mountains in Wyoming. In some of the drainages, a number of specimens of one species have been collected as well as a single specimen of the other species. This may be the result of individual mice traveling up- or downstream to a population of the other species. Preble's are able to travel long distances (Ryon 1999, Shenk and Sivert 1999a) and meadow jumping mice are not aggressive toward conspecifics in captivity (Whitaker 1963). These behaviors may contribute to the frequency with which both species may occur at a particular site.

There are two drainages where both species appear to occur over a distance of 13 kilometers (8 miles) or more and from which at least two specimens of each species have been collected: Trout Creek in Douglas and Teller counties, Colorado and the Laramie River drainage in Wyoming. Trout Creek heads in the Rampart range, flows north through rolling hills, and empties into the South Platte. In Wyoming, the Laramie River provides access for Preble's to the Laramie Plains. Whereas most of the Laramie Mountains have a "divide" along the top which restricts Preble's to the eastern flank, the Laramie River flows through a low saddle enabling Preble's to come upstream onto the Laramie Plains. The western jumping mouse comes downstream from the higher-elevation headwaters in the mountains of Larimer County, Colorado. A study of the ecological separation of the two species would be of considerable interest.

Zones of co-occurrence raise the question of hybridization (Beauvais 2001). In New Mexico and Arizona, *Z. hudsonius* and *Z. princeps* coexist in narrow zones of contact where limited hybridization between the two species may occur (Hafner 1997). However, Krutzsch (1954) looked at areas of potential hybridization and found no evidence of hybridization at the species level. Future genetic studies will likely clarify this issue.

There is very little information on the past distribution or abundance of Preble's. Over the past decade, numerous surveys have been undertaken within the subspecies range. Many of these surveys have been conducted in suitable habitat at locations that had not previously been surveyed and often have documented Preble's presence. These new surveys do not represent a substantial range expansion of the subspecies nor do they provide evidence of increased subspecies abundance, as Preble's were and still are presumed present in suitable habitats within the subspecies' current range. The new surveys document this presence, but do not provide information on trend of the Preble's populations at most of the sites.

Surveys have identified various locations where the subspecies was historically present but is now absent (Ryon 1996). Despite increased trapping, Preble's has not been found in Denver, Adams, and Arapahoe Counties in Colorado in the past decade (Colorado Natural Heritage

Program 1999b, Clippinger et al. in review). Their absence in these counties is likely due to urban development, which has reduced, altered, or completely eliminated riparian habitat (Compton and Hugie 1993, Ryon 1996). This represents a large hole in the middle of Preble's range and underscores the effect that extensive urbanization can have on the distribution of the subspecies. The loss of habitat has been so extensive in the Denver metropolitan area that the FWS has "block-cleared" portions of Denver, Adams, and Arapahoe Counties. Block clearance indicates that due to loss of habitat, the FWS believes that Preble's is no longer likely to exist in the area. However, should Preble's be found within this area in the future, it would be fully protected under the ESA.

The semi-arid climate of southeastern Wyoming and eastern Colorado limits the extent of riparian (river) corridors and restricts the range of Preble's within this region. Preble's is likely an Ice Age relict (Armstrong 1972, Hafner et al. 1981); once the glaciers receded from the Front Range of Colorado and the foothills of Wyoming and the climate became drier, the mouse was confined to riparian systems where moisture was more plentiful. Preble's has not been found east of Cheyenne, Wyoming, or on the extreme eastern plains in Colorado (Beauvais 2001, Clippinger et al. in review). The eastern boundary for the subspecies is likely defined by the dry shortgrass prairie, which may present a barrier to eastward expansion (Beauvais 2001). In a modeling study of Preble's habitat associations in Wyoming, Keinath (2001) predicted extensive habitat in the Laramie Basin and Snowy Range Mountains, but limited habitat in Goshen, Niobrara, and eastern Laramie Counties.

Preble's is generally found at elevations between 2,318 m (7,600 ft) and 1,418 m (4,650 ft) (U.S. Fish and Wildlife Service 1998a), although elevations may vary across the range of the subspecies. The lowest elevation Preble's specimen is from Greeley, Colorado, at 1,218 m (3,983 ft) (Armstrong 1972). The highest elevation specimen is from Middle Lodgepole Creek in Albany County, Wyoming, at 2,430 m (7,970 ft) (DMNH #9569). This latter specimen has a museum identification of Preble's, and has not been included in a DFA.

Figure 3. Distribution of museum specimens of Preble's meadow jumping mouse (*Z. h. preblei*) as identified by Conner and Shenk (200x), and capture localities of jumping mice (*Zapus* spp.) in Colorado and Wyoming.

Demography and Natural History

Reproduction
Little research has been done on the number or size of Preble's litters, but it is assumed that they are similar to other subspecies of meadow jumping mouse. Meadow jumping mice usually have two litters per year (Whitaker 1963, 1972), but Quimby (1951) lists records of three litters per year. The size of a litter can range from two to eight young but averages five young (Quimby 1951, Whitaker 1963). A Preble's nest with six young was found in Jefferson County, Colorado (Ryon 2001). After 4 weeks of age, meadow jumping mouse young are independent and resemble adults (Whitaker 1963). First reproduction can occur at 2 months of age for young of early litters (born in June); young of later litters appear to have their first reproduction in the next year (Quimby 1951).

Longevity and Mortality
Preble's annual survival rate is low, and appears to vary seasonally. As is typical of many small rodent species, the lifespan is short. The Preble's seems to survive fairly well during winter hibernation' most of the mortalities probably occur when the subspecies is active during the summer. Summer survival rates, defined as June through August or October, ranged from 9 to 37%. Over-winter survival rates, defined as August or October to May or June, ranged from 9 to 76% (Shenk and Sivert 1999b; Ensight Technical Services 2001; Schorr 2001; Meaney et al. in review; Bruce Lubow, Colorado State University, pers. comm.). A model was fit to these data to account for the different lengths of time between trapping sessions in each study and in order to include Shenk's (date) estimates for summer only. Based on this fitted model, Preble's average summer survival standardized to 4 months was 11.0% (5.6% standard error) and average winter survival over 8 months was 83.4% (8.8% standard error). The average annual survival rate (summer rate x winter rate) based on the full data set was 9.1% (5.2% standard error) (Bruce Lubow, Colorado Division of Wildlife, unpublished data). These annual survival rates are based upon limited field observation, and may change as additional information is obtained.

Causes of Mortality
Preble's have a host of known predators including garter snakes (*Thamnophis* spp.), prairie rattlesnakes (*Crotalus viridus*), bullfrogs (*Rana catesbiana*), foxes (*Vulpes vulpes* and/or *Urocyon cinereoargenteus*), house cats (*Felis catus*), long-tailed weasels (*Mustela frenata*), and red-tailed hawks (*Buteo jamaicensis*) (Shenk and Sivert 1999a, Schorr 2001). Other potential predators of jumping mice include coyotes (*Canis latrans*), barn owls (*Tyto alba*), great horned owls (*Bubo virginianus*), western screech owls (*Otus kennicottii*), long-eared owls (*Asio otus*), northern harriers (*Circus cyaneus*), northern pike (*Esox lucius*), and creek chub (*Semolitus atromaculatus*) (Whitaker 1963, Poly and Boucher 1997).

Other mortality factors for Preble's include drowning and occasional losses associated with vehicles (Shenk and Sivert 1999a, Schorr 2001). Mortality factors known for other subspecies of meadow jumping mice, including starvation, exposure, disease, cannibalism, and insufficient fat stores for hibernation (Sheldon 1934, Whitaker 1963) also are likely causes of death for Preble's.

Abundance

White and Shenk (2000) determined that riparian shrub cover, tree cover, and the amount of open water nearby are predictors of Preble's densities. These researchers also summarized abundance estimates from nine sites in Colorado for field work conducted during 1998 and 1999 (Shenk and Sivert 1999b; Meaney et al. 2000; Kaiser-Hill 2000; Ensight Technical Services 1999, 2000, 2001; Schorr 2001). Since Preble's are found in linear riparian communities, abundances are estimated in number of individuals per mile or kilometer of stream corridor. Estimates of linear abundance ranged from 6 to 107 mice/mi (4 to 67 mice/km) with a mean of 53 mice/mi (33 mice/km; standard error = 8 mice/mi or 5 mice/km, sample size = 15 sites; White and Shenk 2000, T. Shenk, Colorado Division of Wildlife, pers. comm.). The subsequent addition of new sites and 2 more years of data (2000-2001), for a total sample size of 25 sites, provided a mean of 44 mice/mi (27 mice/km; standard error = 6 mice/mi or 4 mice/km), and a range of 3 to 107 mice/mi (2 to 67 mice/km) (T. Shenk, Colorado Division of Wildlife, unpublished data, R. Schorr, Colorado Natural Heritage Program, unpublished data, C. Meaney, University of Colorado, unpublished data, T. Ryon, Greystone Consultants, unpublished data, M. Bakeman, Ensight Technical Services, unpublished data, and M. Fink, Exponent, unpublished data).

Diet

Although fecal analyses have provided the best data on Preble's diet to date, they overestimate the components of the diet that are less digestible. Those food items that are digested more completely, such as vegetation, are not as easily detected in fecal samples and are likely under-represented in the following fecal analyses: Based on fecal analyses, Preble's eat arthropods, fungus, moss, pollen, willow, lamb's quarters (*Chenopodium* sp.), Russian thistle (*Salsola* sp.), sunflowers (*Helianthus* spp.), sedge (*Carex* spp.), mullein (*Verbascum* sp.), grasses (*Bromus, Festuca, Poa, Sporobolus* and *Agropyron* spp.), bladderpod (*Lesquerella* sp.), rushes (*Equisetum* sp.), and assorted seeds (Shenk and Eussen 1998, Shenk and Sivert 1999a). Willows were present in 38% of scats from Larimer County, Colorado (Shenk and Eussen 1998). The diet shifts seasonally, consisting primarily of arthropods and fungus after emerging from hibernation and fungus, moss, and pollen during mid-summer (July-August), with arthropods added again in September (Shenk and Sivert 1999a). The shift in diet along with shifts in mouse movements suggest that Preble's may require specific seasonal diets, especially with the physiological constraints imposed by hibernation (Shenk and Sivert 1999a).

Hibernation

Preble's is a true hibernator, usually entering hibernation in September or October and emerging the following May, after a potential hibernation period of 7 or 8 months. Adults are the first age group to enter hibernation because they accumulate the necessary fat stores earlier than young-of-the-year (Wunder and Harrington 1996). Adults reach weights that enable them to enter hibernation by the third week in August, whereas young-of-the-year typically enter hibernation in September and October (Meaney et al. in review). The earliest Preble's capture in Colorado was May 3 and the latest was October 27; both were captured at Rocky Flats Environmental Technology Site in 1995 (Bakeman 1997a). As with other subspecies of meadow jumping mouse, Preble's do not store food, but survive on fat stores accumulated prior to

hibernation (Whitaker 1963).

Meadow jumping mice dig their own hibernation burrows and are solitary hibernators. However, the separate hibernacula may be located close together (Whitaker 1972). Hibernation sites found for Preble's were located within 100 m (328 ft) of the 100-year flood plain of the main stream (T. Shenk, Colorado Division of Wildlife, unpublished data). One confirmed Preble's hibernaculum, located at Rocky Flats Environmental Technology Site, was found 9 m (29 ft) above the creek bed, in a dense patch of chokecherry and snowberry (Bakeman and Deans 1997). The nest was in leaf litter 30 cm (12 in) below the surface in coarse textured soil (M. Bakeman, Ensight Technical Services, pers. comm.). Two suspected hibernacula were found at this site when telemetry locations were stationary over several weeks in September. One was 76 m (250 ft) from the creek on a hill in chokecherry/hawthorn upland shrubs, and the other was 0.6 m (2 ft) from the edge of the water (T. Ryon, Greystone Consultants., pers. comm.). Four possible hibernacula, found by following radio-telemetered mice at the U.S. Air Force Academy, were located in the vicinity of coyote willow (*Salix exigua*) at 7, 12, 29, and 31 m (23, 39, 95, and 102 ft, respectively) from a creek bed (R. Schorr, Colorado Natural Heritage Program, unpublished data). Ten possible hibernacula in Douglas County were located between 1 and 78 m (3 and 256 ft) from either a main drainage or tributary (three sites at Woodhouse Ranch, six sites at Pine Cliff Ranch, and one at Maytag Property), and one was located at a distance of 750 m (2,460 ft) from the from the main drainage (Shenk and Sivert 1999a).

Behavior

Knowledge of a species' behavior is an essential component of developing a successful conservation program (Caro 1998, Gosling and Sutherland 2000), yet very little is known about the behavior of meadow jumping mice. Preble's is primarily nocturnal or crepuscular but also may be active during the day, when they have been seen moving around or sitting still under a shrub (Shenk 1998, M. Bakeman, Ensight Environmental., pers. comm.). Meadow jumping mice are not antagonistic toward one another (Whitaker 1972). Jumping mice compete with meadow voles and may be kept at low densities by these voles (Boonstra and Hoyle 1986). A meadow jumping mouse was killed by a meadow vole (*Microtus pennsylvanicus*) when the two were confined together (Quimby 1951).

Preble's construct day nests composed of grasses, forbs, sedges, rushes, and other available plant material. They may be globular in shape or simply raised mats of litter, and are most commonly above ground but also can be below ground (Ryon 2001, Bain and Shenk 2002). They are typically found under debris at the base of shrubs and trees, or in open grasslands (Shenk and Sivert 1999a, Ryon 2001, Schorr 2001). An individual mouse can have multiple day nests in both riparian and grassland communities (Shenk and Sivert 1999a, Schorr 2001). Preble's may abandon use of a day nest after approximately a week of use (Ryon 2001).

Little is known about the interaction of social behavior, social strategies, and survival in this subspecies. However, E. A. Preble (as cited in Warren 1942) described globular nests built above ground in late summer to be inhabited by two individuals, presumably a pair. Jones and Jones (1985) described lively social interactions in which several meadow jumping mice were

observed jumping into the air and squeaking in close proximity to one another; the authors then captured four of these mice at the base of the shrub where the behavior occurred, and suggested that they formed a gregarious unit. At Woodhouse Ranch in 1999 and 2000, three radio-collared Preble's came from different day-nest locations to meet at one particular spot every night for the month that their radio-collars were active (T. Shenk, Colorado Division of Wildlife, pers. comm.).

Habitat

Typical habitat for Preble's is comprised of well-developed riparian vegetation with adjacent, relatively undisturbed grassland communities and a nearby water source (Bakeman 1997b). Well-developed riparian vegetation includes a fairly dense combination of grasses, forbs, and shrubs; a taller shrub and tree canopy may be present (Bakeman 1997b). Preble's are typically captured in areas with multi-storied cover with an understory of grasses or forbs or a mixture thereof (Bakeman 1997b; Bakeman and Deans 1997; Meaney et al. 1997a, 1997b; Shenk and Eussen 1998; Schorr 2001). The shrub canopy is often willow (*Salix* spp.), although other shrub species, such as snowberry (*Symphoricarpus* sp.), chokecherry *(Prunus virginiana*), hawthorn (*Crataegus* sp.), Gambel's oak (*Quercus gambelli*), alder (*Alnus incana*), river birch (*Betula fontinalis*), skunkbrush (*Rhus trilobata*), wild plum (*Prunus americana*), lead plant (*Amorpha fruticosa*), dogwood (*Cornus sericea*), and others also may occur (Bakeman 1997b, Shenk and Eussen 1998).

Adjacent uplands used by the mouse are extremely variable, and range from open grasslands to ponderosa pine (*Pinus ponderosa*) woodlands (Corn et al. 1995, Pague and Grunau 2000). The montane riparian woodlands where Preble's has been found are dominated by Ponderosa pine, Douglas fir (*Pseudostuga menziesii*), spruce (*Picea pungens*), and occasionally aspen (*Populus tremuloides*), with lush and diverse understories of shrubs and forbs (Ruggles et al. 2001). Hayfields are used by Preble's in some situations (Meaney et al. 1997b, Bakeman and Meaney 2001). Additional areas used by Preble's include shrub patches set back from the drainage (T. Shenk, Colorado Division of Wildlife, unpublished data), and downed woody debris, which creates good cover for day nests (R. Schorr, Colorado Natural Heritage Program, unpublished data). Occasionally, riparian patches with thick cover are interspersed with more open patches which may provide important movement corridors between dense vegetation patches (Bakeman and Meaney 2001).

Preble's have rarely been trapped in uplands adjacent to riparian areas (PTI Environmental 1998, Corn et al. 1995, Meaney et al. 1996, Bakeman 1997a, Dharman 2001). However, radio-telemetry studies of Preble's movement patterns have documented individuals feeding and resting in adjacent uplands (Shenk and Sivert 1999b, Ryon 1999, Schorr 2001). These studies indicate that Preble's regularly use uplands at least as far out as 100 m (328 ft) beyond the 100-year flood plain (T. Shenk, Colorado Division of Wildlife, unpublished data, R. Schorr, Colorado Natural Heritage Program, unpublished data), and 243 m (794 ft) from the drainage (Ryon 1999). Since 1999, the FWS has recommended that projects within 92 m (300 ft) of the 100-year flood plain of rivers and streams, and projects that may have secondary impacts to such

areas be assessed for their potential to impact Preble's and its habitat. Preble's also can move over 1 km (0.6 miles) along streams within a 24-hour period, with maximum recorded movements of 1.6 km (1 mi) (Ryon 1999, Shenk and Sivert 1999a).

In a rangewide comparison of existing habitat data from Colorado, Clippinger (2002) found that subshrub cover and plant species richness are higher at most sites where meadow jumping mice are present versus where they are absent, particularly at 15 to 25 m from streams. In a study comparing Preble's capture locations on the Rocky Flats Environmental Technology Site and the U.S. Air Force Academy (Academy), the Academy sites had lower plant species richness at capture locations but considerably greater numbers of Preble's (Schorr 2001). It may be that the density of Preble's is not driven by the richness of plant species alone, but also by the density and abundance of riparian vegetation (Schorr 2001). However, there is concern about monocultures of vegetation (i.e. cultivated agriculture) and their effect on Preble's.

One definite and 14 possible Preble's hibernacula, or hibernation nests, have been located; they were all between 1 and 78 m (3 and 256 ft) from a main drainage or tributary (Bakeman and Deans 1997, Shenk and Sivert 1999a, R. Schorr, Colorado Natural Heritage Program, unpublished data). Hibernacula have been located under willow, chokecherry, snowberry, skunkbrush, sumac (*Rhus* sp.), clematis (*Clematis* sp.), cottonwoods (*Populus* sp.), Gambel's oak, thistle (*Cirsium* spp.), and alyssum (*Alyssum* sp.; Shenk and Sivert 1999a).

Hydrologic regimes that support Preble's habitat range from large perennial rivers such as the South Platte River (Armstrong 1972, Colorado Natural Heritage Program 1999b) to small ephemeral drainages only 1 to 3 m (3 to 10 ft) in width, as are found at Rocky Flats Environmental Technology Site (Bakeman and Deans 1997) and in montane habitats. Although Preble's commonly uses riparian vegetation immediately adjacent to a stream, other features that provide habitat for the mouse include seasonal streams (Bakeman 1997b), which are common in Colorado and southeastern Wyoming, low moist areas and dry gulches (T. Shenk, Colorado Division of Wildlife, unpublished data), agricultural ditches (Meaney et al. in review), and wet meadows and seeps near streams (Ryon 1996).

Flooding is a common and natural event in the riparian systems along the Front Range of Colorado, with major flooding events occurring at least once every 5 to 20 years (Follansbee and Sawyer 1948, U.S. Army Corp of Engineers 1984). Some of the most severe and frequent flooding events occur within Preble's habitat along the South Platte and Arkansas River drainages along the Front Range (Follansbee and Sawyer 1948). This periodic flooding helps to create a dense vegetative community by stimulating resprouting from willow shrubs and allowing forbs and grasses to take advantage of newly-deposited soil (Gregory et al. 1991). Changes to plant communities can be caused by regular flooding events, plant succession, native and nonnative herbivory (grazing or browsing), water table fluctuations, fire, and other natural and human-driven impacts (Gregory et al. 1991, Gordon et al. 1992, Busch and Scott 1995, Pague and Grunau 2000) and invasive noxious weeds (check citations for mention of invasives).

REASONS FOR LISTING AND THREATS TO RECOVERY

Several factors may have played a role in reducing the range and abundance of Preble's. The following items have been identified as potential threats to their populations and recovery. Much of the following discussion comes from the Preble's Science Team's Threat Assessment (Pague and Grunau 2000) and the rule listing the mouse under the ESA (63 FR26517).

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of the Species' Habitat or Range

Changes in habitats and their component plant communities affect the composition of the mammalian community found within them (Andersen et al. 1980, Honeycutt et al. 1981). Preble's is closely associated with riparian ecosystems that are relatively narrow and represent a small percentage of the landscape. If habitat for Preble's is destroyed or modified, populations in those areas will decline or be extirpated. The decline in the extent and quality of Preble's habitat is considered the main factor threatening the subspecies (Hafner et al. 1998, Shenk 1998). As stated in the rule listing the mouse under the ESA (63 FR 26517), habitat alteration, degradation, loss, and fragmentation resulting from urban development, flood control, water development, agriculture and other human land uses have adversely impacted Preble's populations. Conversion of habitats from native riparian ecosystems to commercial croplands and grazed rangelands was identified as the major threat to their persistence in Wyoming (Clark and Stromberg 1987, Compton and Hugie 1994).

Habitat fragmentation also limits the extent and abundance of Preble's populations. As populations become fragmented and isolated, it becomes more difficult for them to persist (Caughley and Gunn 1996). Smaller patches of habitat are unable to support as many Preble's as larger patches of habitat. If the threats to persistence are the same, larger populations are believed to be more secure from extinction than smaller ones (Primack 1998).

i. Habitat Conversion, Habitat Destruction, and Habitat Fragmentation Through Housing, Commercial, Recreational, and Industrial Construction

Residential, recreational, and commercial development, accompanied by highway and bridge construction, directly removes, reduces, alters, fragments, and/or isolates Preble's habitat to the point where populations no longer can persist. These factors may impact the subspecies by destroying its nests, food resources, and hibernation sites, by disrupting behavior, or by acting as barriers to movement. A study in Boulder County found that as the degree of proximity to urban environments increased, the number of small mammals captured decreased (Bock et al. 1998).

Despite numerous surveys, Preble's has not recently been found in the Denver and Colorado Springs metropolitan areas, and is believed to be extirpated from there as a result of extensive urban development. In recognition of the impact of urban development on Preble's populations, the FWS has established "block clearance" zones in the Denver metropolitan area, along Monument Creek through downtown Colorado Springs, and along the majority of Cottonwood Creek, El Paso County, Colorado, and its tributaries, where Preble's is no longer believed to exist and where no further surveys are needed to determine its absence.

ii. Hydrology Impairments and Ground Water Flow Alterations

Establishment and maintenance of riparian plant communities are determined by the interactions between surface water dynamics, groundwater, and river channel processes (Busch and Scott 1995). Changes in hydrology can alter the channel structure, riparian vegetation, and valley floor landforms (Gregory et al. 1991). Thus, changes in the timing and abundance of water may be detrimental to the persistence of Preble's in these riparian habitats due to resultant changes in vegetation. Such changes in hydrology may occur in many ways, but two of the more prevalent are the disruption of natural flow regimes below dams, and "boom and bust" runoff cycles in watersheds with increased areas of paved or hardened surfaces that preclude water percolation.

Similarly, depletion of groundwater via wells and water diversions also affects the vegetation within Preble's habitat. As groundwater supplies are depleted, more xeric plant communities replace the riparian vegetation. The conversion of these habitats from mesic, shrub-dominated systems to drier grass-dominated systems would preclude Preble's from these areas.

iii. Rock and Sand Extraction

Alluvial aggregate extraction may produce long-term changes to Preble's habitat by altering hydrology and removing riparian vegetation. In particular, such extraction usually removes or precludes the development of riparian shrub and herbaceous vegetation. Armstrong speculated that mining impacts the deposits of alluvial sands and gravels that may be important hibernation locations for Preble's (D. Armstrong, University of Colorado, pers. comm.).

iv. Bank Stabilization and Channelizing of Waterways

Bank stabilization, channelization, and other methods of hardening stream banks increases the rate of stream flow, straightens riparian channels, and narrows riparian areas (Pague and Grunau 2000). Creating impervious cement channels destroys riparian vegetation and precludes its reestablishment. Using riprap and other structural stabilization options to reduce erosion can destroy riparian vegetation and prevent or prolong its establishment. These impacts can alter the plant composition, soil structure, and physiography of riparian systems to the point that Preble's can no longer persist there.

v. Farming and Ranching Operations

Intensive haying and ditch maintenance operations may negatively impact Preble's by removing food and shelter resources. While it is believed that most haying operations that allow riparian vegetation to remain in place may be compatible with persistence of Preble's populations, further study is needed.

vi. Transportation Corridor Maintenance, Construction and Accidents

Transportation corridors frequently cross Preble's habitat and may negatively affect adjacent populations. As new roads are built and old roads are maintained, the habitat is destroyed and possibly fragmented. Roads also may act as barriers to dispersal. Train and truck accidents within riparian areas may release spills of chemicals, fuels and other substances that may impact the mouse or its habitat.

vii. Noxious Weeds

Invasive, noxious plants can encroach upon a landscape, displace native plant species and form monocultures of vegetation. This change reduces the abundance and diversity of native plants, and may negatively impact cover and food sources. The control of noxious weeds may entail large-scale removal of vegetation and mechanical mowing operations, which also may impact Preble's.

The tolerance of Preble's for invasive plant species is not well understood. Whether or not invasive plant species reduce Preble's persistence at a site may be due in large part to whether they create a monoculture and replace native species. There is concern about nonnative species such as Russian olive (*Elaeagnus angustifolia*) and leafy spurge (*Euphorbia esula*). Leafy spurge may be of particular concern, since it may form a monoculture, displacing native vegetation and thus reducing available habitat (Selleck et al. 1962). Within Larimer and Weld Counties of Colorado, Russian olive occurred in six (33 %) of the areas where no jumping mice were found, while it was absent in areas where jumping mice were captured (Shenk and Eussen 1998). However, Russian olive was present in Wyoming sites where jumping mice were captured (R. Taylor, True Ranches, pers. comm.).

viii. Recreational Trail Development and Use

Trail systems frequently parallel or intersect riparian communities within Colorado. The development of trail systems may impact Preble's by modifying its habitat, nesting sites, and food resources in both riparian and upland areas. Humans and pets using these trails may alter behavior patterns of Preble's and cause a decrease in survival and reproductive success. There was a 28% decrease (although not statistically significant, $p = 0.226$) in population density of Preble's adjacent to trails, compared with sites without trails along South Boulder Creek, Boulder County (Meaney et al. in press).

ix. Utilities and Ditch Construction and Maintenance

Many utility lines (sewer, water, communications, gas, electric, municipal water ditches) cross Preble's habitat. Current and future utilities right-of-ways through these habitats may represent a threat from habitat fragmentation via new construction, toxic chemical spills, and habitat disturbance during construction and periodic maintenance. However, utility corridors are currently short term disturbances, due to project review and reclamation required since listing in 1998.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Preble's is not collected for commercial or recreational reasons. Some collection of specimens may occur for scientific and educational purposes, but only through permits issued by the FWS. This factor is not considered a threat to the subspecies.

Factor C. Disease or Predation

i. Disease

As with most small mammals, Preble's carries parasites and diseases that may reduce vigor, curtail reproductive success, and cause death. There is no evidence that any disease has caused a significant impact to populations. A rare parasitic fly caused the only documented mortality due to parasitism (Schorr and Davies in press). Currently known parasites and disease are not considered to be a threat to this subspecies.

ii. Predation

Predation is a natural occurrence in Preble's populations, and would not normally be considered a threat. However, the increasing presence of humans near Preble's habitats may result in an increased level of predation that may pose a threat to the mouse. Striped skunks (*Mephitis mephitis*), raccoons (*Procyon lotor*), red foxes (*Vulpes vulpes*) and domestic and feral cats are found in greater densities in and around areas of human activity; all four of these species feed opportunistically on small mammals (Churcher and Lawton 1987, Rosatte et al. 1991). Therefore, Preble's populations that are near suburban settings are subjected to greater predation. The predation pressure from domestic cats can be particularly difficult to mediate since these predators will hunt regardless of their lack of a need to sustain themselves (Adamec 1976). Introduction of non-native aquatic species, such as bullfrogs, has resulted in additional predation on the subspecies. The fact that summer mortality is higher than overwinter mortality, as discussed under *Longevity and Mortality*, underscores the impact that predators can have on Preble's and other small mammals.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

The decline of Preble's is partly due to the lack or ineffectiveness of existing laws that could protect the mouse and its habitat. Various existing Federal laws, such as the Clean Water Act, the ESA (prior to listing of the subspecies), Federal Power Act, Fish and Wildlife Coordination Act, Food Security Act, and National Environmental Policy Act have not been effective in the past to protect occupied riparian habitat. The listing of Preble's (*Zapus hudsonius preblei)* under the ESA provides a level of protection that increases the likelihood of conserving the subspecies.

Considered threatened under the nongame provisions of the Colorado Division of Wildlife, Preble's can only be taken legally by permitted personnel for educational, scientific, or rehabilitation purposes. The Wyoming Game and Fish Department considers all meadow jumping mice (*Zapus hudsonius* sspp.) as "nongame species," which are protected under Wyoming Nongame Wildlife Regulations (1999). Although these Colorado and Wyoming State regulations prohibit the take of individual mice, they do not protect Preble's habitat.

Factor E. Other Natural or Manmade Factors Affecting the Species' Continued Existence

i. Pesticide and Herbicide Use

Pesticides and herbicides are used within the range of Preble's for pest control, weed control, and other agricultural purposes. These chemicals may poison Preble's directly, or be detrimental to the vegetation in its habitat. Overall, an integrated pest management approach (use of

biological, chemical and mechanical control) may help reduce the threat of chemicals, but allow for the control of unwanted species.

ii. Fire

Fire is a natural component of the Colorado Front Range and Wyoming foothill systems and *Z. h. preblei* habitat naturally waxes and wanes with fire events. Overall, fire may be one of the methods needed to maintain riparian, transitional, and upland vegetation within Preble's habitat. In a review of the effects of grassland fires on small mammals, Kaufman et al. (1990) found a positive effect of fire on *Z. hudsonius* in one study and no effect of fire on the species in another study.

Over the past several decades, as human presence has increased in and near Preble's habitat, significant effort has been made to suppress fires. Long periods of fire suppression may result in a build-up of fuel and result in a catastrophic fire. As with many natural catastrophes, fire can kill mice and alter habitat (Howard et al. 1959). Although there are no records of fire killing *Z. h. preblei*, it is possible that fire may take a limited number of individuals. Catastrophic fire in particular can alter habitat dramatically, changing the structure and composition of the vegetation communities such that Preble's may no longer persist. Precipitation falling in a burned area may degrade the subspecies' habitat by causing greater levels of erosion and sedimentation along creeks.

iii. Exotic Animals

Exotic animals that occupy riparian habitats may displace, prey upon, or compete with Preble's. Domestic cats have preyed upon the mouse in Colorado (Shenk and Sivert 1999a). Feral cats and house mice (*Mus musculus*) were common in and adjacent to historic capture sites where Preble's were no longer found (Ryon 1996). Preble's is 13 times less likely to be found at sites where house mice are present (Clippinger 2002). Bullfrogs also have been known to prey on Preble's (T. Shenk, Colorado Division of Wildlife, pers. comm.).

iv. Water Quality

The quality of the water in riparian habitats may affect the survival and abundance of Preble's. Point sources of pollution such as fuel and chemical waste spills or sanitary/sewer drains can degrade the water quality of an area. Nonpoint sources of pollution such as urban or agricultural runoff can affect riparian systems as well.

v. Alteration of Vegetation Succession

Flooding and fire events may temporarily impact Preble's by removing some riparian habitat. However, normal flooding and fire events help maintain the willow communities that provide suitable habitat for the subspecies. Increasing the paved surfaces within a water drainage can result in increased flood events and prevent the re-establishment of riparian communities.

vi. Stochastic Demographic, Genetic, and Environmental Effects

Stochastic, or random, changes in a wild population's demography, genetics, and environment can threaten its persistence (Brussard and Gilpin 1989, Caughley and Gunn 1996). A stochastic

demographic change such as a skewed age or sex ratio (for example, a sudden loss of adult females) could negatively affect reproduction, especially in a small population. Disruption in gene flow due to reduction and isolation of populations may create unpredictable genetic effects that could impact Preble's persistence in an area. While stochastic events are not known to be a threat to Preble's populations at this time, the likelihood of such events may increase as populations become smaller and more isolated in the future. Flooding is an example of a stochastic event that commonly occurs in Preble's habitat. An extreme flooding situation could eliminate an entire Preble's population in an affected stream reach or drainage. Habitat may be recolonized after such events if there are occupied, connected tributaries or mainstem stretches that were not flooded.

IMPEDIMENTS TO RECOVERY

Several additional factors exist that may hamper the potential for recovery of Preble's. These relate to the implementation of the plan, but are not in themselves threats to the mouse. Implementation of the recovery plan requires the ability to resolve factors threatening the subspecies and to protect sufficient habitat and populations for the taxon to persist over the long term, making the protection of the ESA unnecessary. There is limited funding and staff available to manage and protect habitat, even on public lands where protection should be most easily accomplished. Most habitat occurs on private lands and there is a lack of incentives available to assist private landowners in managing and protecting habitat. A lack of coordination of efforts between State and local regulatory bodies may result in conflicts in habitat management direction, but most conflicts can be resolved. Examples of conflict areas may be recreational development, flood control, wildland fire protection, and highway projects. Additional funding and attention from all involved parties will be needed to successfully implement this recovery plan.

MANAGEMENT AND CONSERVATION EFFORTS

Starting in the early 1990s, Federal, State, local, and private groups have worked to conduct research, habitat management, and conservation planning, which have formed the basis for the listing of the subspecies and development of this Recovery Plan.

Research

Research efforts for Preble's increased in the early 1990s. Research conducted by Armstrong et al. (1996, 1997), Bakeman (1997a), Meaney and Clippinger (1995), Meaney et al. (1996), and Ryon (1996) was compiled by Bakeman (1997b) into one document that provided the state of knowledge on Preble's habitat. Research also was conducted by Bruce Wunder of Colorado State University to help clarify the physiology and genetics of Preble's (Wunder and Harrington 1996, Wunder 1998). Many presence/absence surveys contributed to knowledge of the subspecies' distribution and can be found at the FWS offices, Colorado Natural Heritage Program (1999b), and Wyoming Natural Diversity Database. Recent research has focused on population demographics at a number of different sites (White and Shenk 2000, 2001). Other

studies include the impact of recreational trails (Meaney et al. in press), morphometric analyses (Conner and Shenk in review), radio-telemetry studies of movement patterns (Dharman 2001, Ensight Technical Services 1999, Ryon 1999, Shenk and Sivert 1999a, Schorr 2001), and nest descriptions (Ryon 2001, Bain and Shenk 2002). Most of the information gathered through this research appears in the Biology Section of this Plan.

Habitat Conservation

In order to conserve riparian habitat and Preble's populations, land easements and acquisitions have been purchased by non-governmental organizations, public agencies, and private land owners. Examples of these actions include, but are not limited to: acquisition of the Circle Ranch in Larimer County, Colorado, and the Greenland Ranch easement in Douglas County, Colorado. Also, the FWS, Colorado Division of Wildlife, Colorado Department of Transportation, U.S. Forest Service, U.S. Air Force Academy, F.E. Warren Air Force Base, U.S. Department of Energy, and others have entered into efforts to maintain and restore riparian habitats on private and public lands.

A limited amount of Preble's habitat is within public ownership or easement. The FWS should seek opportunities to protect Preble's habitat through habitat acquisition and/or conservation easements. Any FWS acquisitions or easements will be through willing sellers or cooperators. Acquisitions or easements may focus on protecting riparian habitats occupied or potentially occupied by Preble's, may include all or portions of designated recovery populations, or may add to and expand the size of adjacent designated populations. Acquisitions or easements may form portions of new FWS National Wildlife Refuges, as is the case with the new Rocky Flats National Wildlife Refuge, or may add to existing Refuges.

Conservation Planning

Prior to listing of Preble's, the Colorado Collaborative Planning Process explored the possibility of completing a conservation plan in order to preclude the need to list the subspecies. The Colorado Department of Natural Resources formed the Preble's Steering Committee and the Science Team. The Steering Committee helped coordinate communications, funding, and political and social issues related to Preble's. The Science Team collected information on the biology of the subspecies, identified threats, and began to explore the development of Preble's conservation strategies, including HCPs, from 1998-2000. As of 2002, six counties and several private landowners are developing HCPs. Based upon the science developed through conservation planning for this subspecies, the U.S. Air Force Academy completed the Cooperative Agreement and Conservation and Management Plan for Preble's on the U.S. Air Force Academy grounds (Grunau et al. 1999).

RECOVERY STRATEGIES AND GUIDING PRINCIPLES

The recovery planning approach is based upon the assumption that if certain criteria are met for certain existing populations, Preble's can be delisted. These criteria require that specific

populations are maintained in designated habitats distributed throughout the existing range, the populations and habitats are secure from decline due to the threats listed above, the populations are self-sustaining and persistent, a long-term management plan and cooperative agreement is completed, and there is effective public involvement.

When the recovery criteria are met, analysis of the five ESA listing factors (destruction of habitat, overutilization, disease or predation, inadequacy of existing regulatory mechanisms, and other natural or manmade factors affecting the subspecies' persistence) should indicate that protection of the subspecies under the ESA is no longer necessary.

It is believed that there are sufficient populations present today to allow recovery of the subspecies; however, many of these populations face threats to their future survival. Further analysis of the extent and stability of these populations, plus management of the threats to riparian habitat, is needed to achieve recovery.

Throughout the development of this Recovery Plan, the following Recovery Strategies (15) and Guiding Principles (7) for Preble's have been employed:

Recovery Strategies

The decline in the extent and quality of Preble's habitat is considered the main factor threatening the subspecies (Hafner et al. 1998, Shenk 1998). As stated in the rule listing the mouse under the ESA (63 FR 26517), habitat alteration, degradation, loss, and fragmentation resulting from urban development, flood control, water development, agriculture and other human land uses have adversely impacted Preble's populations.

In the development of the Recovery Plan, a number of strategies, approaches, criteria, guidelines, definitions, and processes were selected that are believed to address the threats to the subspecies. When these threats are lessened or eliminated, an analysis of the five factors should show the subspecies is no longer in need of protection under the ESA. A brief explanation of these collective strategies provide the background that guided the development of recovery strategies that appear under Section II of this plan.

1. Recovery Criteria Differences among North Platte, South Platte, and Arkansas Rivers
The known range of Preble's is spread over portions of three major river drainages that differ from each other in criteria for recovery (Section II, Table 1) for the following reasons:

a. Available information suggests that the extent of the range of Preble's in the North Platte and Arkansas River drainages is very different from the extent of the range in the South Platte River drainage. Two large populations (see Section II) are included within the South Platte River drainage because it incorporates much of the known Preble's range, the drainage is bisected by the metropolis of Denver, and there is no possibility of connection between the large populations.

b. The level of information on Preble's in the South Platte River and the Arkansas River drainages is much greater, and the range is better defined, than in the North Platte River drainage.

c. The threats that may affect Preble's populations in the North Platte River are less severe and immediate than the threats affecting populations in the South Platte and Arkansas River drainage.

d. There are fewer hydrologic units for distribution and assignment of recovery populations in the Arkansas and North Platte River drainages than in the South Platte River drainage.

2. Selection of Hydrologic Unit as the Scale for Recovery

Preble's is a riparian-associated subspecies; therefore, river drainages provide an appropriate geographic scale and unit for addressing their conservation. Species well-distributed across their historic range are less susceptible to extinction and more likely to reach recovery than species confined to a small portion of their range (Noss and Cooperrider 1994, Abbitt and Scott 2001). Distributing populations throughout different drainages reduces the risk that a large portion of the range-wide population will be negatively affected by any particular natural or anthropogenic event at any one time. Spreading the recovery populations across hydrologic units throughout the range of the subspecies also preserves the greatest amount of the remaining genetic variation, and may provide some genetic security to the range-wide population.

Disjunct or peripheral populations are likely to have diverged genetically from central populations due to isolation, genetic drift, adaptation to local environments, or some combination of these factors (Lesica and Allendorf 1995). Therefore, conservation of these outlying populations protects genetic diversity. Data on endangered mammals also shows that many species have declined from the centers of their ranges outward, which also suggests that protecting widely distributed populations is important (Lomolino and Channell 1995).

To address these conservation issues, hydrologic units (corresponding to stream or watershed size) were selected as the basis for determining appropriate locations for the recovery populations. The United States is divided and sub-divided into successively smaller hydrologic units, which are designated by hydrologic unit codes (HUCs) developed by the U.S. Geological Survey. There are 21 two-digit, 222 four-digit, 352 six-digit, and 2,150 eight-digit HUCs found within the United States. In this Plan, the distribution of recovery populations is based upon the 8-digit HUC. Preble's potentially and known occupied HUCs within the North Platte, South Platte and Arkansas River drainages are the geographic unit for designation of recovery populations (Figure 4).

3. Definition of Small, Medium, and Large Recovery Populations

Recovery population sizes were selected to provide a reasonably high probability of persistence for each individual population, as well as for the entire subspecies. The sizes were based upon general conservation biology theory regarding population viability, as well as input from biologists with knowledge of Preble's life history.

Conservation biology literature suggests various numbers of individuals that may be necessary to support long-term viability. The general rule of thumb used in conservation biology has been the 50/500 rule: isolated populations need to have a genetically effective population size of about 50 individuals for short term persistence, and a genetically effective population size of about 500 for long-term survival (Franklin 1980, Soule 1980). The genetically effective population size designates that part of the population in which all individuals have an equal probability of mating and having offspring. In most natural populations the effective population of breeding individuals is often much smaller than the total population size (CSIESA 1995). An effective population size of about 500 individuals translates into a total population size of several times this number (Lande and Barrowclough 1987, Lacy 1995).

Some biologists have questioned the adequacy of the 50/500 rules. Mangel and Tier (1994) indicate that the probability of environmental catastrophes greatly increases the need for larger populations. Lande (1995) estimated the need for a genetically effective population size of approximately 5,000 for long-term persistence, which may translate to a total population size of 10,000 to 20,000 individuals. However, the generalization that a population size in the low thousands is the smallest number of individuals needed for long-term persistence is widely accepted (Soule 1987, CSIESA 1995) and was used to guide the selection of populations for this Plan. For this Plan, recovery population sizes are defined as follows:

Large populations are self-sustaining, naturally occurring populations that demonstrate June abundance estimates of 2,500 adult Preble's, with no significant negative trend in percent occupancy (as defined in the Population Monitoring Plan) of sampling sites over a minimum of

Figure 4. Eight-digit Hydrologic Unit Codes (HUCs) in Colorado and Wyoming with Potential or Known Populations of Preble's Meadow Jumping Mouse (*Z. h. preblei*).

10 years (see task 1.2, Section II). Larger population sizes provide greater physical diversity of habitats and less vulnerability to natural catastrophic events, while reducing the per unit area management costs. Due to the size of the habitat required to support these populations, large populations should incorporate most of the landscape-level ecological processes associated with the subspecies.

Medium populations are self-sustaining, naturally occurring populations that demonstrate June abundance estimates of 500 to 2,499 adult Preble's, with no significant negative trend in percent occupancy (as defined in the Population Monitoring Plan) of sampling sites over a minimum of 10 years (task 1.2, Section II). Based upon conservation theory (Pimm et al. 1988, Noss and Cooperrider 1994, Meffe and Carroll 1997, Primack 1998), medium populations are at greater risk than large populations, but have a higher probability of persistence than small populations. For maximum protection of this subspecies, most medium populations identified by this plan should be as large as possible.

Small populations are defined as those that demonstrate a continued presence of Preble's within 4.8 km (3 mi) of connected stream habitat over 10 years. Although small populations are expected to be approximately 150 adults, no minimum population size is required for small populations. Small populations are intended to provide geographic distribution throughout the existing range, and are expected to conserve the existing range of genetic diversity in the subspecies.

The numbers identified above for large, medium, and small populations are based on the scientific literature, and represent "state-of-the-art" estimations. It must be recognized that these numbers may be altered in the future if changes are supported by new scientific information.

4. Number and Distribution of Recovery Populations

The distribution of Preble's recovery populations is designed to minimize threats due to the impacts of weather, disease, fragmentation, anthropogenic factors, loss of genetic diversity and other threats to the subspecies. At least one recovery population is required within each HUC within the existing range of the taxon (Section II), except where no Preble's population currently exists and no habitat is present. Three size categories of recovery populations are designated: small, medium and large (see Section 3, above).

To reach recovery, it is essential to have at least the following arrangement of recovery populations in each major river drainage within the range of Preble's:

A. North Platte Drainage. One large and two medium populations in three separate HUCs, as well as three small populations within each of the remaining two HUCs within the North Platte River drainage.

B. South Platte Drainage. Two large and three medium populations in five separate HUCs, as well as three small populations within each of the remaining six HUCs within the South

Platte River drainage.

C. Arkansas River Drainage. One large population, as well as three small populations in each of the remaining two HUCs within the Arkansas River drainage.

All locations with known populations or potential suitable habitat were identified and information on the size of and ownership of the habitat, and its juxtaposition to other populations was considered in designating large, medium, or small populations. If a large recovery population is designated in a particular HUC, no other recovery populations are required in that HUC. HUCs without a designated large recovery population were evaluated for the potential presence of medium populations. If a medium population appeared to be present within the HUC, it was designated as a recovery population. The number of designated medium populations per drainage correlates to the amount of assumed historical habitat within that drainage (Table 1). At least three small populations are required in any HUC that does not have a designated medium or large recovery population, except those HUCs, when adequately surveyed, that are without an existing Preble's population. One medium population may replace three small populations in any HUC; however, in some HUCs only small populations will be achieved.

As with definition of population sizes in strategy 3 above, future new scientific information may support altering the number and distribution of populations necessary for recovery. Therefore, this strategy may need re-evaluation and adaptation to new information. It is important that a recovery plan recognizes the need to incorporate new scientific information as it arises and supports implementation of recovery through adaptive management.

We believe it is important to maintain small populations of Preble's in the HUCs identified. However, we do not know precisely where the range of the Preble's ends. Some of the identified HUCS may actually be found to occur outside the Preble's range or no longer contain Preble's populations. Therefore, if a HUC is found not to contain any currently existing Preble's populations, no recovery populations will be designated for that HUC.

5. Guideline for Estimating Stream Miles Required for Recovery Sites

The associated habitat lengths for the defined size classes of populations were developed with input from researchers with direct knowledge of Preble's populations and habitat. The habitat lengths for a particular category of population size are considered minimum miles of a network of connected streams whose hydrology supports riparian vegetation, provides Preble's habitat, and includes mainstem drainages and tributaries.

In order to provide a guideline for the length of riparian habitat required for large, medium and small populations, an average density of mice per kilometer or mile was needed. Abundances for a specified length of stream have been estimated for the subspecies in Colorado using capture-recapture techniques (Otis et al. 1978, White et al. 1982, White and Burnham 1999). Data were collected in June, providing estimates of population abundance during the post-hibernation period but prior to the inclusion of young-of-the-year.

A known bias in capture-recapture studies from trapping transects or lines is that the traps tend to attract mice from some unknown distance away from the trapping transect (White and Shenk 2001). Furthermore, study areas have unequal lengths of stream reaches trapped. Therefore, simple density estimates of the number of mice divided by stream length is biased high, more so for shorter transects than for longer ones. To remove this bias, a correction factor was developed using radio-telemetry data to estimate the proportion of time radio-collared mice spent within the original trapline once the traps were removed (White and Shenk 2001). Data from six study sites with radio-collared Preble's were used to estimate this correction factor (called "*p*") for population estimates from linear traplines or grids. Corrections were applied to all study areas with the function relating (*p*) to trapline length (L) developed from these data. The mean estimate of mice per mile of stream from 9 study sites, 1998 to 1999, was 53 mice/mi (33 mice/km; standard error = 8 mice/mi or 5 mice/km, sample size = 15 sites), with a range of 6 to 107 mice/mi (4 to 67 mice/km, White and Shenk 2000). The addition of new sites and additional years of data will change the above estimate. Changes in sample sites and the addition of 2 more years of data (2000-2001), for a total sample size of 25 sites, provided a mean of 44 mice/mi (27 mice/km; standard error = 6 mice/mi or 4 mice/km), and a range of 3 to 107 mice/mi (2 to 67 mice/km) (T. Shenk, Colorado Division of Wildlife, unpublished data, R. Schorr, Colorado Natural Heritage Program, unpublished data, C. Meaney, University of Colorado, unpublished data, T. Ryon, Greystone Consultants, unpublished data, M. Bakeman, Ensight Technical Services, unpublished data, and M. Fink, ?unpublished data).

Based upon the current mean density of 44 mice/mi (standard error of 6 mice/mi), the following provides guidelines for estimated stream miles for large and medium recovery populations, and required miles for small populations:

Large populations (June abundances of 2,500 individuals or greater) will likely need a 57-mile (45 to 78 mi or 72 to 126 km) network of connected streams whose hydrology supports riparian vegetation and provides Preble's habitat; this will include the mainstem plus tributaries. This current estimate of miles to maintain 2,500 mice is based upon the mean number of mice that occur per stream mile as estimated from current data (1999-2001), and may not necessarily apply to a specific site due to variations in habitat quality. The intent is to protect enough stream miles of habitat to support the population goal of 2,500 mice.

Medium populations (June abundances of 500 individuals or greater) will likely need an 11-mile (9 to 16 mi or 14 to 26 km) network of connected streams whose hydrology supports riparian vegetation and provides Preble's habitat; this will include the mainstem plus tributaries. This current estimate of miles to maintain 500 mice is based upon the mean number of mice that occur per stream mile as estimated from current data (1999-2001), and may not necessarily apply to a specific site due to variations in habitat quality. For maximum protection of this subspecies, most medium populations should occupy stream habitats that exceed the minimum to support 500 mice.

Small populations (defined as those showing at least continued presence of Preble's) must have at least 4.8 km (3 mi) of connected stream habitat.

It must be emphasized that the recovery goal for large and medium populations is numbers of mice, not numbers of stream miles inhabited. Thus, enough stream miles need to be protected to insure that numeric population goals for large and medium populations can be maintained. Because the figure of 44 mice/mi is a mean for the current Preble's research populations, at least some populations of any particular size are likely to show a lower density and, therefore, would need a larger stretch of habitat in order to meet population recovery goals. Alternatively, some sites may support higher densities of mice than the estimated mean, and could meet population recovery goals with fewer stream miles.

6. Selection of Emergent Preble's for Estimating Population Abundance

Emergent animals are individuals that have survived winter and emerged from hibernation. This segment of the population was selected because it represents the initial number of animals available for reproduction in the current year. Basing conservation strategies on segments of the population present later in the breeding season (July-September) may inflate estimates of the number of individuals that will survive and reproduce. Although the use of emergent mice for sampling purposes does not compensate for all the differences between effective and actual population size, it does help minimize the difference between the two, since all emergent adults are potential breeders and the generation overlap is not as significant as it would be later in the summer.

7. Delineation of Preble's Habitat

Preble's habitat includes riparian systems, the intervening slopes between riparian and upland communities, and upland grasslands (Shenk and Sivert 1999a, Schorr 2001). See Habitat section, Part I, for data on use of uplands adjacent to streams. The width of Preble's habitat is defined as the 100-year flood plain plus 100 m (328 ft) on both sides of the creek. Final habitat delineations for each recovery site will be approved by FWS. However, alternatives to the 100-year flood plain rule will be considered if:

(1) The area delineated provides all the necessary resources for the mice to nest, breed, find cover, travel, feed, and hibernate; i.e., for long-term survival.

(2) The area delineated includes the three contiguous geomorphological components used by Preble's: alluvial flood plain, transition slopes, and pertinent uplands (grasslands for feeding and suitable hibernation sites).

Shenk (unpublished data) observed summer movements in excess of 100 m (328 ft), but in most instances Preble's upland habitat use was within 100 m of the 100-year flood plain delineation. Most presumed hibernation sites also were located within 100 m of the 100-year flood plain delineation of the main stream.

8. Self-sustaining Populations as the Measure of "Recovery"

For this Plan, recovery populations are defined as self-sustaining, naturally functioning populations that are not maintained by "stocking"or captive breeding. Translocations and captive breeding may be difficult and can present potentially high risks, and should only be

considered as a last resort for maintaining a population or as a means to maintain genetic diversity in FWS-approved site-specific Threat Abatement Management Plans.

Restoration of individuals to previously occupied areas, without an understanding of why the area no longer supports the subspecies, would likely result in resources (e.g., animals, time, and money) being lost to establish reintroduced populations that may meet the same fate as the original population that occupied the area. Furthermore, restocking areas with individuals genetically dissimilar from the individuals in the original population does not protect genetic variability.

9. Selection of Public Lands Over Private Lands as Areas for Preble's Recovery

Selecting public lands as areas for recovery may ensure the implementation of timely and effective land management for the mouse. Where possible, recovery sites are designated on public lands because the likelihood of maintaining stable populations is greater on public lands. Managing land for a common purpose and ensuring consistency in land management practices is easier on larger public lands than on a host of smaller private parcels. Also, designating recovery populations on public property minimizes and/or avoids the potential conflict between private landowners' land management strategies and those strategies recommended for conservation of Preble's; such conflict avoidance may increase support for achieving recovery. Lastly, many public lands have natural resource management strategies in place to conserve the mouse or its habitat.

10. Protect Lands Not Designated as Recovery Sites

Protecting additional habitat for Preble's populations will ensure that the subspecies reaches recovery more quickly. Although a set number of large, medium, and small populations will be designated as recovery populations, a greater chance of achieving recovery is possible by protecting additional populations and habitat where they currently exist. Preble's populations may fluctuate greatly in size, but recovery will only be achieved by ensuring that populations are stable or increasing over many years. Therefore, it may be advantageous to protect additional non-designated recovery populations as insurance in the event that one or more of the designated populations are not stable or increasing. The non-designated yet stable or increasing populations could substitute for recovery populations that are not stable or increasing. Also, by protecting more populations than are necessary for recovery, the threat to the subspecies as a whole from a catastrophic event is minimized. Although several recovery populations may become extirpated due to a catastrophic event such as a flood or hazardous waste spill, recovery may still be uncompromised because there are additional non-designated populations to replace the lost ones.

11. The Need for Additional Research

Previous research on Preble's taxonomy, distribution, demography, ecology, and habitat has been essential in informing the best approaches to its conservation. These descriptive studies have been helpful in understanding the subspecies' biology and suggesting why it uses certain habitats. Research designed to determine cause-and-effect relationships between the mouse and its habitat needs to be conducted. Without an understanding of how habitat factors affect populations, it will be more difficult to manage habitats to ensure the persistence of this

subspecies.

Much additional research is still needed, both descriptive and experimental. This includes research on the systematics, range, and distribution of the mouse; identification of management practices that enhance habitat and populations; identification of threats to the persistence and distribution of populations; further refinement of suitable habitat criteria; and development of threat abatement strategies for habitat. Some specific examples of needed research to facilitate recovery include, but are not limited to, projects identified in Appendix B (Research).

12. Use of Adaptive Management

Adaptive management is a process by which policy decisions are implemented within a framework of scientifically-driven experiments to test predictions and assumptions inherent in management plans. There is still much about Preble's biology and management of habitat that is not well understood. A well-designed adaptive management program may answer some of these questions and be used to modify existing management strategies. Adaptive management should be a strong consideration in the development of the site-specific Threat Abatement Management Plans.

13. Single Species Focus

Due to time constraints, the development of this plan focused on a single species strategy for recovery of Preble's within the North Platte, South Platte and Arkansas River drainages of Wyoming and Colorado. Although the actions recommended by the Plan are focused on Preble's, the protection of populations and habitat for this subspecies may benefit other listed and declining species within riparian habitats of Wyoming and Colorado. At some time in the future, a multi-species plan for declining Wyoming-Colorado Front Range species may be considered.

14. Genetic Management

The goal of genetic management within this Plan is to preserve and conserve the range of unique ecological and behavioral characteristics of the subspecies that are presumed to exist on a population by population basis. Work completed to date on mitochondrial DNA (Riggs et al. 1997) indicated that Preble's is a distinct genetic "group." Additional research needs to be conducted on the molecular genetics (mitochondrial and nuclear DNA) of the species and subspecies of jumping mice. This research will improve the understanding of the genetic differences between species and subspecies of jumping mice, variation between isolated populations, any evidence of interbreeding between species, populations with the most genetic diversity, and those populations experiencing inbreeding problems. The Team may consider completing a genetics management plan in the future, based upon information obtained through the completion of genetic research proposed by this Plan.

15. Delisting Process

Section 4 of the ESA governs the listing, delisting, and reclassification of species, the designation of critical habitat, and recovery planning. Regulations implementing listing, delisting, reclassification, and critical habitat designation are codified at 50 CFR 424.

The process of delisting a species (or subspecies), is essentially the same as that of listing: a proposed rule describing the justification for the action is published in the Federal Register, a public comment period is opened (including public hearings if requested), and within 1 year of the proposal, either a final rule delisting the species or a notice withdrawing the proposed delisting is published in the Federal Register.

In considering whether to delist a species, the same five factors considered in the listing process are evaluated:

1. The presence or threatened destruction, modification, or curtailment of the species' habitat or range.
2. Overutilization for commercial, recreational, scientific, or educational purposes.
3. Disease or predation.
4. The inadequacy of existing regulatory mechanisms.
5. Other natural or manmade factors affecting the species' continued existence.

It is believed that there are currently sufficient Preble's populations that should they persist into the future, the subspecies' survival will be assured. However, there are substantial threats to many of the populations that, if left unabated, may cause their decline or extirpation in the future. Therefore, this recovery plan focuses on designating populations of sufficient size, number and distribution that will need to be managed to into the future and protected from threats. The current number, size, and distribution of Preble's population that currently exist are believed to meet recovery criteria

The abatement of threats relating to criteria one through four, identified within Part II of this Recovery Plan, are believed to be adequate for delisting Preble's. When these threats are lessened or eliminated for each recovery population, an analysis of the above factors should show the subspecies is no longer in need of protection under the ESA.

Guiding Principles

The following principles provided guidance to the recovery team during development of this plan:

1. Management by River Drainage

Because Preble's populations are physically separated in three different drainages, and the threats to the recovery populations differ in type and intensity between these drainages, Preble's will be most effectively managed by considering each of the following drainages separately:

1. North Platte River (Wyoming)
2. South Platte River (small area in Wyoming, but mainly Colorado)
3. Arkansas River (Colorado)

2. Research

Many important aspects of Preble's biology and management are not known. Thus, continuing research in conjunction with adaptive management is crucial.

3. Monitoring and Adaptive Management

Designated Preble's recovery populations and habitats will be monitored for a period of time to be determined by the approved Population and Habitat Monitoring Protocols. The results of such monitoring efforts and their implications should be evaluated within an adaptive management framework, and the management goals should be readjusted accordingly. This process should continue until management efforts allow the achievement of self-sustaining populations. Unless scientific evidence points to the contrary, the recommended initial management strategy for each area occupied by Preble's is to continue the existing land uses at current levels.

4. Local Involvement

The plan encourages all aspects of local involvement, particularly by those entities that own or manage lands on which Preble's populations may exist. Examples of entities that should be involved with the recovery of Preble's include State wildlife management agencies, State park and natural resource agencies, State land boards, county and city open space programs, public water boards, water conservation districts, private land owners, and other elements of State, county, and local governments.

5. Cooperative Management

Numerous agencies, land owners, and organizations (listed above) have responsibility for lands that contain Preble's habitat. These entities need to continue to be involved in cooperative recovery efforts, and cooperative management among these should be fostered wherever possible.

6. Incentives

Incentives should be developed to encourage participation, build partnerships, and foster cooperation with recovery efforts. These can include Preble's recovery funds, tax incentives at the Federal, State, or county level to encourage active conservation measures on private lands, or the establishment of an award/reward system for participation in recovery programs.

7. Education Programs

Education programs that focus on Preble's populations and habitat protection can benefit recovery objectives. Education programs are encouraged, and should focus on the loss of habitat near urban centers.

PART II: RECOVERY

Objective

The objective of this recovery plan is to delist the Preble's.

Summary of Four Criteria for Delisting of Preble's

Preble's will be considered recovered and eligible for delisting when it is demonstrated that:

1. Four large and five medium wild, self-sustaining populations of Preble's exist that are widely distributed across the North Platte, South Platte, and Arkansas River drainages; and three small populations exist in each sub-drainage (HUC) that contains suitable Preble's habitat and is not occupied by a large or medium population (Figure 5, Table 1).

Large populations are defined as those that demonstrate June abundance estimates of at least 2,500 adult Preble's, with no significant negative trend in percent occupancy (as defined in the Population Monitoring Plan) of sampling sites over a minium of 10 years (see Task 1.2.1).

Medium populations are those that demonstrate June abundance estimates of 500 to 2,499 adult Preble's, with no significant negative trend in percent occupancy (as defined in Population Monitoring Plan) of sampling sites over a minium of 10 years (see Task 1.2.1).

Small populations must show at least continued presence of Preble's over a minimum of 10 years (as defined in the Population Monitoring Plan), and must have at least 3 miles of connected stream habitat. One medium population may replace three small populations in any HUC.

Note: Population monitoring will be conducted according to the Recovery Team's accepted Preble's Population Monitoring Plan (Task 1.2.1).

The recovery populations will be distributed among the following river drainages:

A. North Platte Drainage. One large and two medium populations in three separate HUCs, as well as three small populations within each of the remaining two HUCs within the North Platte River drainage.

B. South Platte Drainage. Two large and three medium populations in five separate HUCs, as well as three small populations within each of the remaining six HUCs within the South Platte River drainage.

C. Arkansas River Drainage. One large population, as well as three small populations in each of the remaining two HUCs within the Arkansas River drainage.

Information is currently lacking on the presence of existing Preble's populations and suitable habitat in some HUCs. They have been included in these criteria on the presumption that at least a small population occurs there. HUCs that are determined upon further surveying to be without an existing Preble's population will be removed from these criteria.

2. Sufficient habitat of each designated Preble's recovery population is protected and managed to sustain the subspecies (see Task 2).

3. **Threats to Preble's populations are eliminated, minimized, or reduced in accordance with site-specific Threat Abatement Management Plans to ensure the conservation and survival of the recovery populations.**

4. **A long-term adaptive management plan and cooperative agreement for the management of Preble's and the habitat upon which it depends is completed with the goal of maintaining the designated recovery populations at self-sustaining levels after delisting (Task 4.0).**

Distribution of Designated Recovery Populations within River Drainages

Table 1 lists the specific large and medium populations that have been designated as necessary for recovery in the North Platte, South Platte, and Arkansas River drainages.

Figure 5. Location of Currently Designated Large and Medium Sized Preble's Meadow Jumping Mice Recovery Populations within the North Platte, South Platte, and Arkansas River Drainages.

Table 1. Locations of Designated Recovery Populations, 2002.

MAJOR DRAINAGE	8-DIGIT HUC	GENERAL LOCATION
North Platte		
1 Large	Lower Laramie	Chugwater Creek
2 Medium	Horse	Horse Creek
	Glendo Reservoir	Cottonwood Creek
3 Small	Middle North Plate	To be determined
3 Small	Middle North Platte/Scottsbluff	To be determined
South Platte		
2 Large	Poudre	North Fork Poudre River
	Upper South Platte	West Plum Creek
3 Medium	Middle South Platte	Cherry Creek
	Big Thompson	Buckhorn Creek
	North Saint Vrain	South Boulder Creek
18 Small	Crow Creek	To be determined
	Crow Creek	To be determined
	Crow Creek	To be determined
	Lone Tree	To be determined
	Lone Tree	To be determined
	Lone Tree	To be determined
	Upper Lodgepole	Middle Lodgepole Creek
	Upper Lodgepole	Upper Middle Lodgepole Creek
	Upper Lodgepole	To be determined
	Clear Creek	To be determined
	Clear Creek	To be determined
	Clear Creek	To be determined
	Kiowa	To be determined
	Kiowa	To be determined
	Kiowa	To be determined
	Bijou	To be determined
	Bijou	To be determined
	Bijou	To be determined
Arkansas		
1 Large	Fountain	Monument Creek/Air Force Academy
0 Medium	N/A	N/A
6 Small	Chico	To be determined
	Chico	To be determined
	Chico	To be determined
	Big Sandy	To be determined
	Big Sandy	To be determined
	Big Sandy	To be determined

Note: HUCs listed as “to be determined” have the potential to hold Preble’s populations but have

not been confirmed.

STEP DOWN OUTLINE AND TIMELINES

TASK #	DESCRIPTION	TIMELINE
1.0	**Wild, Self-Sustaining Populations**	
1.1	*Complete selection, confirmation, and delineation of designated Preble's recovery populations*.	
1.1.1	Maintain a data base of all Preble's locations.	Start, year 1
1.1.2	Survey populations and assess size and extent.	Start, year 1
1.1.3	Designate remaining recovery population sites.	End, year
1.1.4	Notify property owners within designated recovery sites.	Start, year 1
1.1.5	Delineate all recovery population sites.	Start year 1
1.2	*Monitor all designated Preble's recovery populations.*	
1.2.1	Develop a peer-reviewed Population Monitoring Plan.	Immediate
1.2.2	Monitor designated large and medium recovery populations.	After delineation
1.2.3	Monitor designated small recovery populations.	After delineation
1.3	*Conduct population-related research.*	
1.3.1	Conduct research on Preble's taxonomy	Ongoing
1.3.2	Conduct research on distribution of Preble's populations.	Ongoing
1.3.3	Design and conduct studies on Preble's demography.	Ongoing
1.3.4	Conduct research on the ecology of Preble's.	Ongoing
1.3.5	Conduct threat abatement research.	Ongoing
2.0	**Habitat**	
2.1	*Map the length and width of delineated Preble's habitat.*	After delineation
2.2	*Monitor habitat of all designated recovery populations.*	
2.2.1	Develop a peer-reviewed Habitat Monitoring Plan.	Immediate
2.2.2	Monitor habitat of recover populations.	After delineation
2.3	*Conduct research on Preble's habitat.*	
2.3.1	Identify habitat used by Preble's.	Ongoing
2.3.2	Conduct research on effects of habitat features.	Ongoing
2.3.3	Evaluate effects of habitat management.	Ongoing

TASK #	DESCRIPTION	TIMELINE
3.0	**Threat Abatement**	
3.1	*Abate threats to designated recovery populations.*	
3.2	*Identify and prioritize threats to recovery populations.*	
3.3	*Develop and implement Threat Abatement Management Plans.*	
3.3.1	Maintain the effects of ecological processes.	Immediate
3.3.2	Develop and implement abatement strategies for multiple sites.	Immediate
3.4	*Protect and conserve non-designated recovery populations.*	
3.4.1	Protect and manage all populations on Federal lands.	Immediate
3.4.2	Protect and conserve non-designated populations on public land.	Immediate
3.4.3	Protect and conserve non-designated populations on private lands.	Immediate
3.5	*Develop and provide economic and social incentives*.	
3.5.1	Encourage recovery funding.	Immediate
3.5.2	Create tax incentives.	
3.5.3	Create awards and rewards system.	
3.6	*Conduct research to evaluate effects of threat abatement strategies*.	
3.6.1	Evaluate impacts of non-native predators.	Ongoing
4.0	**Continued Conservation Following Delisting**	
4.1	*Develop a long-term delisting Preble's management plan*.	Future
4.2	*Prepare a delisting Preble's cooperative agreement*.	Future
5.0	**Organization and Communication Strategies**	
5.1	*Maintain a Preble's Recovery Team*.	Continuing
5.2	*Establish a Governance Committee*.	Immediate
5.3	*Establish Site Conservation Teams*.	
5.3.1	Coordinate Site Conservation Teams.	Immediate
5.4	*Provide updated information on status of recovery populations*.	Immediate
5.5	*Develop and implement a public information strategy*.	Immediate
6.0	**Implementing Laws, Regulations, and Authorities**	
6.1	*Promote compliance and enforcement*.	Immediate
6.2	*Enforce existing laws and agreements*.	Immediate
6.3	*Utilize existing program and funding support*	
6.3.1	Identify and manage populations on BLM, NPS, and FS lands.	Immediate
6.3.2	Utilize EPA grants.	Immediate
6.3.3	Access NRCS programs to conserve Preble's.	Immediate
6.3.4	Evaluate impacts of 404 permits.	Immediate
6.3.5	Reduce impacts from federally-funded highway projects.	Immediate

Figure 6. Recovery Plan Flow Chart for a summary of tasks and timelines.

II. STEP DOWN NARRATIVE

1.0 Population Management

1.1 Complete Selection, Confirmation and Delineation of Designated Large, Medium, and Small Preble's Recovery Populations. Federally owned lands were the first designated as recovery sites for Preble's. Other lands in public or conservation ownership determined, in coordination with the appropriate land managing agency to be suitable for a recovery population, will also be given priority consideration. All required large and medium recovery populations within the existing range of Preble's in the North Platte, South Platte and Arkansas River drainages have been designated (Table 1). However, some small recovery populations must still be designated with local stakeholder involvement (Task 1.1.3). The boundaries of all recovery populations should be delineated within 3 years of the approval of the recovery plan. *(We need to discuss this sentence-do we want to include a timeframe?)*

1.1.1 Maintain a Database and Map of All Known Preble's Locations. A preliminary map of known Preble's locations has been developed, but will need to be updated as additional information on populations becomes available. The FWS will maintain and update the database of Preble's locations in Colorado and Wyoming. Results of all trapping and other documentation of Preble's occurrence will be reported annually as required in permits provided to surveyors by the Service under Section 10(a)(1)(A) of the Act. Annual reporting is a standard requirement of Section 10 (a)(1)(A) permits. Maps and information on Preble's populations will be accessible on the FWS Region 6 web-site http://mountain-prairie.fws.gov.

1.1.2 Survey Populations and Assess Their Size and Extent. Surveys of potential small recovery sites are needed to determine Preble's presence, approximate population size, and distribution. This information is necessary to be able to finalize Preble's recovery population designations.

Additional surveys to determine presence and distribution of Preble's are needed in the following HUCs to determine if Preble's populations are present:

- Chico and Big Sandy HUCs of the Arkansas drainage;
- Bijou, Kiowa, Lone Tree, Crow, Upper Lodgepole and Clear Creek HUCs in the South Platte drainage; and
- Middle N. Platte River-Casper, Glendo Reservoir, and Middle N. Platte River
- Scottsbluff HUCs in the North Platte drainage.

Within other HUCs, additional surveys may prove useful for providing options during the designation of recovery populations (Task 1.1.3) and when recovery populations are delineated. (Task 1.1.5). Where appropriate, newly discovered populations can be nominated as replacement or alternative recovery populations, as long as they meet the

Recovery Criteria.

1.1.3 Designate Remaining Recovery Population Sites.

Local governments and/or Site Conservation Teams (Task 5.3) have the opportunity to complete designation of three small recovery populations in each of the following HUCs within 3 years: Chico and Big Sandy HUCs of the Arkansas River drainage; Bijou, Kiowa, Clear Creek, Crow, Lone Tree, and Upper Lodgepole HUCs within the South Platte; and Middle North Platte-Casper, Middle North Platte-Scottsbluff within the North Platte (Table 1). If a HUC is found to support only one or two small populations, then those populations will be designated and designation of additional populations will not be required in that HUC. If a HUC is found not to contain any remaining Preble's populations, no populations will be designated for that HUC.

If Preble's are present within a HUC, and recovery populations are not designated within 3 years of the acceptance of this plan, the FWS will designate the remaining recovery populations. If new populations are discovered, alterations in designations within a HUC, can be made as appropriate with FWS approval.

1.1.4 Notify Property Owners. Information on location of recovery populations will be provided to private landowners. All landowners will be notified that their property may be within the boundaries of a designated Preble's recovery site. In order to effectively monitor and manage designated recovery populations and habitat, landowner buy-in is necessary. The FWS, with the assistance of the Site Conservation Teams and local governments, will notify private land owners prior to recovery site delineation.

1.1.5 Delineate All Recovery Population Sites. Local governments and/or Site Conservation Teams have the opportunity to delineate the boundaries of recovery populations (large, medium, and small) within 3 years of acceptance of this recovery plan. For this plan, the process of delineation will involve mapping the boundaries of the population sites. Final delineations will be approved by the FWS. If site boundaries are not delineated within 3 years of the acceptance of this plan, the FWS will coordinate with local governments to complete the delineation within one year taking into account local conservation efforts.

Ditches may serve as connectors within recovery sites. Designated recovery population sites can include ditches, or connecting ditches if affected landowners and affected water rights holders agree to the inclusion and management of the ditches for Preble's recovery.

1.2 Monitor All Designated Preble's Recovery Populations. Monitoring of designated recovery populations is needed to determine their existing size and trend according to the Preble's Population Monitoring Plan. Other monitoring methodologies may be

considered in the future, if they are found by the FWS to be scientifically valid in determining population trend. If positive or negative trends are documented, site-specific Threat Abatement Plans (Task 3.3) can be adapted to promote recovery. Results of the monitoring will be provided to the FWS and/or the Recovery Team, and made available to the public.

1.2.1 Develop a Peer-Reviewed Preble's Population Monitoring Plan to Estimate Population Trends in Each Designated Recovery Site. A Population Monitoring Plan was developed by experts in population monitoring to assess current population status, and to initiate monitoring of population trends. This Plan may be modified or updated as new scientific information becomes available. The Population Monitoring Plan is available on the FWS website at http://mountain-prairie.fws.gov. This task has been completed.

1.2.2 Monitor Designated Large and Medium Recovery Populations. Designated large and medium recovery populations will be monitored for June (pre-breeding) population sizes and trends according to the Population Monitoring Plan. Monitoring needs to begin within 1 year of delineation of the Preble's recovery population. For each of the designated recovery populations, monitoring results will be used in the development and implementation of Threat Abatement Plans using adaptive management (Task 3.3).

1.2.3 Monitor Designated Small Recovery Populations. All designated small recovery populations will be monitored at a minimum for presence/absence according to the Population Monitoring Plan. Monitoring needs to begin within 1 year of delineation of the Preble's recovery population. Results of the monitoring will be used in the development and implementation of Threat Abatement Plans using adaptive management (Task 3.3).

1.3 Conduct Research on the Taxonomy, Distribution, Demography, and Ecology of Preble's Populations. Because relatively little is known about Preble's, research is needed on the taxonomy, distribution, demography, and ecology of the subspecies. The primary goals of this research program should be to enhance understanding of Preble's biology and to assess how land management practices affect Preble's population viability. Information gained from these studies will facilitate recovery by improving the ability to identify the distribution and range of Preble's, to identify management practices that enhance Preble's populations, and to identify and abate threats to the persistence and distribution of populations. See Appendix B for additional research detail.

1.3.1 Conduct Research on Preble's Taxonomy. Develop and evaluate morphological, genetic and systematic techniques to identify Preble's and its relationships to other taxa. This will enable clarification of range, distribution and population genetics.

1.3.2 Conduct Research on Distribution of Preble's Populations. Additional research is

needed to further identify the distribution of Preble's. This will provide the information necessary to maintain populations throughout the range, and identify ecological limits for the subspecies.

1.3.3 Design and Conduct Studies to Provide Information on the Demography of Preble's. Information on demographic parameters such as survival, reproduction, and movement patterns, as well as trends in these parameters, is needed for future management. Research could be conducted at any of the designated recovery sites; however, to facilitate gathering of long-term information, priority should be given to continuing or building on past research in the following areas: Maytag Property, U.S. Air Force Academy, Rocky Flats (Rock, Walnut, and Woman Creeks), South Boulder Creek, Woodhouse Property, Dirty Woman Creek (El Paso County), and East Plum Creek (Castle Rock).

1.3.4 Conduct Research on the Ecology of Preble's Populations. Design and conduct studies to identify the important ecological factors affecting Preble's populations. For example, research interaction between Preble's and other native and non-native small mammals is needed.

1.3.5 Conduct Research to Identify and Assess Threats and Threat Abatement Strategies to Preble's Populations. Evaluate effects of population management techniques and threat abatement strategies on the status, distribution, and demography of Preble's.

2.0 Habitat

2.1 Map the Habitat for Delineated Preble's Recovery Populations.

It is essential that both the length and width of the habitat in each designated recovery population be mapped to ensure that sufficient Preble's habitat is conserved and managed along the length and width of the stream to provide the necessary habitat components for the subspecies' survival in each recovery population. The length of the habitat will be set by the population delineation (Task 1.1.5). The width of habitat will be defined as the 100-year flood plain plus 100 meters on both sides. Alternatives to the 100-year flood plain rule will be considered, if the area provides all the necessary resources for Preble's to nest, breed, have cover, travel, feed, and hibernate. Final habitat delineations must be determined by the FWS as sufficient to meet recovery criteria.

All Preble's occupied habitat on Federal lands, whether associated with a designated recovery population or not, will be mapped. A preliminary map of the designated large, medium and small recovery populations has been developed, but it will need to be updated as delineation of recovery populations (Task 1.1.5) and mapping of habitat occurs. The FWS will maintain and update this database. Maps and other information on Preble's populations will be accessible through the FWS web-site. Habitat mapping will be completed by and/or coordinated with government land owners, local governments and/or

Site Conservation Teams/HCP groups, and willing private landowners.

2.2 Monitor Habitat of All Designated Preble's Recovery Populations. All designated recovery populations will be monitored to determine trends in habitat quantity and quality, according to a Preble's Habitat Monitoring Plan. Other monitoring methodologies may be considered in the future, if they are found by the FWS to be scientifically valid in determining trends in habitat quality and quantity. If positive or negative trends are documented, site-specific Threat Abatement Management Plans (Task 3.3) can be adapted to promote recovery. Results of the monitoring will be kept by the FWS, presented at Recovery Team meetings, and made available to the public.

2.2.1 Develop a Peer Reviewed Preble's Habitat Monitoring Plan. A Habitat Monitoring Plan is being developed by experts in Preble's habitat and will need to be applied to monitor the habitat of each designated recovery population. Development of this Preble's Habitat Monitoring Plan will provide a means to assess current habitat conditions and monitor habitat trends.

2.2.2 Monitor Habitat of All Recovery Population Sites. Monitoring needs to begin within 1 year of delineation of the designated Preble's recovery population sites, and be consistent with the Habitat Monitoring Plan. For each of the designated recovery populations, monitoring results will be used in the development and implementation of a Threat Abatement Plan using adaptive management (Task 3.3).

2.3 Conduct Research on Preble's Habitat. Research is needed to enhance understanding of Preble's habitat and how land management practices affect Preble's population viability. Information gained from this research will facilitate recovery by improving the ability to define and quantify Preble's habitat, identify management practices that enhance Preble's habitat, and develop threat abatement management strategies for Preble's habitat. See Research Appendix B for additional research detail.

2.3.1 Identify and Describe Habitat Used for Nesting, Breeding, Cover, Travel, Feeding, Dispersal, and Hibernation. Site-specific and landscape habitat features include, but are not limited to--stream reach, vegetation composition and structure, landscape context (e.g., connectivity with other potential sites, topography, geomorphology), spatial relationship between these features, soil type, extent of habitat, elevation, hydrology (water quality and quantity), and distance to nearest open water.

2.3.2 Design and Conduct Studies to Provide Information on the Effects of Habitat Features (Listed Above) on the Demography of Preble's. Demographic parameters include density, over-summer survival and hibernation survival, recruitment, reproduction, population structure (age and sex ratios), immigration and emigration rates.

2.3.3 Evaluate Habitat Management Techniques. Evaluate effects of habitat management techniques and threat abatement strategies on maintenance and enhancement of habitat and on distribution and demography of Preble's populations.

3.0 Threat Abatement.

3.1 Abate Threats to Designated Recovery Populations. Threats are sources of stress to populations, species, ecological communities, or ecosystems. Threats may be direct or indirect; direct threats may include any source of stress within the habitat while indirect threats may include any activity adjacent to habitat but having an effect on that habitat. Threats need to be eliminated, minimized, or reduced as necessary to achieve population and habitat recovery criteria. Actions necessary to accomplish recovery through abatement of threats will be addressed in the Threat Abatement Plans developed for each designated recovery population. Threat Abatement Plans should be developed and implemented by Preble's Site Conservation Teams, in coordination with the Governance Committee.

To facilitate threat abatement, the Governance Committee (Task 5.2) should provide political support for implementation of this Plan through developing agreements, evaluating progress, establishing funding priorities and expediting communication and cooperation between the private and public sectors. At the local level, the Site Conservation Team (Task 5.3) should be tailored to each individual recovery site, and should include a wide range of stakeholders, private landowners and agencies.

3.2 Identify and Prioritize Threats to Recovery Populations. For each designated recovery site, Preble's Site Conservation Teams (Task 5.3) need to first identify threats, then eliminate, minimize or reduce the identified threats. Site-specific threats include any or all of the five listing factors from the ESA. Examples of potential threats within these five listing factors are listed in Section 1, Reasons for Listing and Threats to Recovery. Threats listed below are adapted from the Conservation Planning Handbook for the Preble's Meadow Jumping Mouse (Pague and Grunau 2000), and also appear in more detail in Section I. Threats are not ranked in any order of priority, and some threats may increase with the level of intensity. (County wants priorities developed by Collaborative Planning Process to be used Bruce checking on this?).

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of the Species' Habitat or Range.

- Habitat conversion, habitat destruction, and habitat fragmentation through housing, commercial, recreational, and industrial construction.
- Hydrology impairments and ground water flow alterations.
- Fragmentation of habitat and corridors.
- Rock and sand extraction.
- Bank stabilization and channelizing of waterways.
- Farming and ranching operations.
- Travel corridor maintenance, construction, and accidents.
- Noxious weeds.
- Recreational trail development and use.
- Utilities and ditch construction and maintenance.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes.

Factor C. Disease or Predation.
- Increased predation or competition by exotic species or enhanced natives.
- Disease.

Factor D. The Inadequacy of Existing Regulatory Mechanisms.
Check on listing package and list Patty to do.

Factor E. Other Natural or Manmade Factors Affecting the Species' Continued Existence.
- Pesticide and herbicide use.
- Fire.
- Exotic animals.
- Water quality.
- Alteration of vegetation succession.
- Stochastic demographic, genetic, and environmental events.

3.3 Develop and Implement Comprehensive, Site-Specific Threat Abatement Management Plans. For each designated recovery population, a Site Conservation Team (Task 5.3) needs to develop and implement a site-specific Threat Abatement Management Plan to protect, manage and monitor the population and habitat. The Preble's Habitat and Population Monitoring Plans will be used for this purpose. Each Threat Abatement Plan will address the threats specific to that site (Task 3.2), and may be modified as necessary based upon research and adaptive management. If current management practices at a recovery site do not appear to pose threats that would preclude meeting recovery criteria on that site, these practices can be maintained.

Threat Abatement Management Plans will be designed to eliminate, minimize, or reduce those threats to levels that will achieve and maintain population and habitat criteria, and sustain Preble's at the site.

Threat Abatement Management Plans should be completed within 1 year of delineation of the recovery population boundaries, and submitted for review and approval by the Recovery Team and FWS. The Threat Abatement Plans will be incorporated into the Long-Term Management Plan (Recovery Criteria 4, Task 4.1) at delisting.

3.3.1 Maintain the Effects of Ecological Processes That Support Preble's and its Habitat. Preble's habitat has developed in a dynamic system that includes seasonal flooding, periodic drought, occasional fire, and a complex array of other environmental factors. Preble's habitat may best be maintained by ensuring that the natural processes that have maintained the habitat and populations of the designated recovery sites be allowed to continue. However, where this is not possible, alternative management actions (such as controlled burns) may be necessary to simulate the effects of natural processes.

3.3.2 Develop and Implement Threat Abatement Strategies That Benefit Multiple Recovery Sites. Coordination between the Recovery Team and the Site Conservation Team(s) should allow assessment of threats common to multiple recovery sites and facilitate development of cross-site strategies. Examples of cross-site strategies could including grazing recommendations, utility easement management, regional HCP initiatives, and funding opportunities. These strategies also may be applied to non-designated population sites to promote conservation of the subspecies. Development of regional HCPs should include specific management strategies that will not preclude recovery of the subspecies, or have net negative impact to Preble's habitat within designated recovery sites. All HCPs should be consistent with the goals and activities of site-specific Threat Abatement Management Plans developed for designated recovery populations (Task 3.3).

3.4 Protect and Conserve Non-designated Preble's Populations and Their Associated Habitats as Part of a Threat Abatement and Conservation Reserve for this Subspecies. Protection of non-designated populations preserve the genetic diversity across the range of the subspecies, provide research sites, and provide replacement or alternative recovery populations if unforeseen problems develop within designated recovery sites.

3.4.1 Protect Non-Designated Populations on Federal Lands. Protect and manage all non-designated Preble's populations and their habitat on Federal lands, and utilize Federal Programs to support conservation and recovery of Preble's. Section 7 of the ESA mandates that all Federal agencies shall utilize their authorities to conserve listed species on their lands. To implement Preble's recovery, Federal agencies are responsible to protect <u>all</u> Preble's populations on Federal lands, abate threats, and where biologically appropriate, restore and/or improve habitat on their lands to enhance Preble's populations. These include, but are not limited to--lands under the jurisdiction of the Department of Energy, Department of Defense (Air Force and Corp of Engineers), Department of Agriculture, and the Department of Interior.

Some Federal sites, including Rocky Flats (Rock, Walnut and Woman Creeks), Warren AFB, and the Air Force Academy, have a history of Preble's research and should continue to be used for research in order to facilitate gathering long-term information on Preble's habitat and ecology. (See Tasks 1.3 & 2.3). Those research sites not

designated as Preble's recovery populations may become substitute recovery populations if they meet recovery site criteria. In the event that a designated site does not meet recovery criteria, research sites may be substituted, if approved by the FWS.

Preble's conservation is a high priority of the newly established Rocky Flats National Wildlife Refuge. (Add discussion of CCP or anything? Check with Refuges)

A variety of Federal agencies (Department of Transportation, Environmental Protection Agency (EPA), Corps of Engineers (COE), Department of Agriculture, FWS, Natural Resources Conservation Service (NRCS), and others) conduct, fund, or permit activities on non-Federal land that may benefit or adversely impact Preble's. Each Federal agency should review its activities and authorities, and ensure that they support recovery objectives. While special emphasis should be placed on designated recovery populations, the same principles apply to any area supporting Preble's populations. Need specific tasks for specific agency actions?

3.4.2 Protect and Conserve Non-designated Preble's Populations and Their Habitat on State and Local Public Lands and by local public agencies. State agencies such as, but not limited to, the Colorado Division of Wildlife, Colorado Division of Parks and Outdoor Recreation, the Colorado State Land Board, Wyoming Game and Fish, Wyoming State Parks and Historic Sites, Wyoming Land Board, and county and municipality open space programs all manage lands known to support Preble's. These agencies have authorities that can be used to identify and protect non-designated Preble's populations, to abate threats, seek funding, and where biologically appropriate, to restore and/or improve Preble's habitat on these lands. Cooperative agreements or other appropriate mechanisms should be developed to protect and conserve Preble's and its habitat on these lands.

Because water management actions can affect Preble's habitat, public water boards, water conservation districts and other water management entities should evaluate how current management might affect Preble's, determine what actions should be taken to minimize impacts or improve conditions, and implement actions to support Preble's recovery.

3.4.3 Protect and Conserve Non-Designated Preble's Populations and Their Habitat on Private Lands. Private land owners are encouraged to protect and conserve Preble's on their land, and should be aware of the protections and prohibitions on take of listed species provided by the ESA. Until Preble's is delisted, Section 9 of the ESA prohibits the take of Preble's resulting from actions undertaken on all lands, including lands associated with designated and non-designated Preble's populations. Activities conducted on private lands that result in take of Preble's could include, but are not limited to, actions that modify habitat and reduce Preble's populations. However, the FWS has adopted a 4(d) rule (October 1, 2002) that removes prohibitions on take of Preble's resulting from certain activities. (cite in lit). In addition, with a Section 10 permit from the FWS, a private landowner may incidentally take Preble's and alter or remove habitat through development of a HCP or in joining in a HCP developed by the State or local community. For additional information see (Task ?? On hcps), or the FWS HCP web-site.

3.5 Develop and Provide Incentives to Abate Threats and Conserve Preble's and its Habitat. Encourage the development of Federal, State, and county incentive programs for conservation of the subspecies, and its habitat for private and public land owners. Build partnerships and collaborative processes among the public and private entities to leverage resources and achieve economies of scale.

3.5.1 Encourage the Development of Preble's Recovery Funds. These funds may be provided by Federal, State, and local governments, as well as private sources. All federal, state, and local agencies should investigate methods of funding implementation of Preble's recovery.

3.5.2 Support Efforts to Create Tax Incentives on Federal, State, and/or County Levels to Encourage Active Conservation Measures to Recover the Subspecies. Tax incentives could recognize possible loss of use or value of private property caused by designation and requirements of a Preble's Recovery Site Plan. Examples:

- Federal tax benefits to land owners of designated recovery sites.
- Tax credits of up to 100% for expenditures for furthering the recovery of Preble's.
- Provide for a property tax credit for private property or a portion thereof that is managed to promote recovery of Preble's.
- Deductions from the gross estate of a decedent in an amount equal to the value of real property subject to designation as a recovery site.

3.5.3 Support Efforts to Establish a System of Awards and Rewards for Participation in Voluntary and Cooperative Preble's Recovery Site Designation, Monitoring and Conservation. Examples of award and reward programs may include:

- Encourage the development of Federal, State, and/or county grants for Preble's Recovery Sites.
- Provide Transfer of Development Rights that are equivalent to the current county zoning.

- Streamline, reduce, or eliminate regulations and administrative paperwork to expedite conservation and management of recovery sites. Like what?

3.6. Conduct Research to Evaluate Effects of Threat Abatement Strategies. Evaluate impacts of threats on the status, distribution, and demography of Preble's populations, as identified in 3.2 and section 1, and the effectiveness of threat abatement strategies. Information gained from threat abatement research will facilitate recovery by identifying and quantifying threats, and will help in developing threat abatement management strategies. See Research Appendix, for additional research detail.

4.0 Continued Conservation of Preble's Following Delisting.

4.1 Develop a Long-term Management Plan To Be Implemented after Delisting. As required in Recovery Criteria #4, a long-term management plan will need to be prepared to ensure that self-sustaining recovery populations are maintained, This plan should incorporate information obtained during implementation of recovery tasks and identify actions to be implemented after the subspecies is delisted. This management plan will be developed in cooperation with the Recovery Team, Site Conservation Teams, the Governance Committee, agencies, and other interested parties. Records will be maintained on recovery activities to provide pertinent information in the development of the long-term management plan, (Task 5.4).

The management plan should ensure that adequate regulatory mechanisms and management programs remain in existence after delisting, such that populations of Preble's are maintained into the future. The long-term management plan must be reviewed and approved by the FWS.

The plan will need to provide pertinent biological and management information for use in maintaining Preble's populations into the future and identify how populations will continue to be monitored and what conditions may warrant relisting of the subspecies. The plan also should address future interagency cooperation and agency responsibilities and cooperative agreements established in Task 4.2.

The plan should be developed and approved by all parties with jurisdiction over Preble's recovery populations before the proposed delisting. The delisting plan should contain at least the following information:

I. Biology
  A. Systematics
    1. Population genetics
    2. Taxonomy
  B. Ecology
    1. Distribution.
    2. Habitat use

3. Food preferences
4. Demography.
5. Hibernation.
6. Behavior.
7. Interactions with other species

II. Present Status of Preble's
A. Brief history of recovery and recovery strategies.
B. List of current Preble's populations.
C. Population and habitat trend monitoring data.
D. Status of Threat Abatement Plans.

III. Analysis of Listing Factors, 1998 to Present (Delisting)
A. The presence or threatened destruction, modification, or curtailment of the species' habitat or range.
B. Overutilization for commercial, recreational, scientific, or educational purposes.
C. Disease or predation.
D. The inadequacy of existing regulatory mechanisms.
E. Other natural or manmade factors affecting the species' existence.

IV. Future Management Goals and Objectives
A. Conservation Management.
1. Future population, habitat and threat abatement objectives.
2. Population and habitat monitoring.
3. Connection of Isolated populations.
4. Genetic monitoring.
5. Research.

V. Implementation Strategies
A. List of future Preble's conservation activities, year to be complete, and responsible parties.

4.2 Prepare a Cooperative Agreement for Implementation of the Long-Term Management Plan. A Cooperative Agreement between the Service and major conservation partners to implement the long term management plan will be needed to define the role of the management parties in maintaining populations of Preble's. The cooperative agreement can incorporate smaller cooperative agreements that may have been developed for individual recovery populations, and needs to be approved by the FWS prior to delisting.

5.0. Organization and Communication Strategies.

The formulation of the Governance Committee and Site Conservation Teams will help guide and implement this Plan at regional and local levels.

5.1 Maintain a Preble's Recovery Team. A Recovery Team and/or recovery workgroups should be maintained to assist in implementation of this Plan. Following the FWS approval of this Recovery Plan, the Recovery Team should meet as necessary to monitor Plan implementation and meet with Site Conservation Teams, the Governance Committee, and other conservation partners.

5.2 Establish a Governance Committee. If recovery of Preble's is to be achieved, it must take place within a landscape that is largely dominated by human activities. Overall, organization and communication strategies will be important between agencies, local governments, private landowners and citizens within Wyoming and Colorado to achieve the objectives of the Plan. A Governance Committee should be formed to assist with the oversight and implementation of this Recovery Plan with duties that include:

- Clarify responsibility and accountability
- Identify and secure funding of the recovery plan
- Facilitate communication and cooperation
- Conflict resolution
- Encourage and develop cooperative agreements
- Encourage and support progress toward achievement of the Recovery Plan
- Monitor progress
- Help establish Site Conservation Teams
- Participate in developing the long-term management plan prior to delisting

A main priority will be to identify and secure funding for implementing this approved Recovery Plan.

The Governance Committee should be formed from business and industry leaders, directors and officials from Federal, State, and local governments, and others involved in the management and conservation of this subspecies. In addition to their role in securing funding, the Governance Committee should provide political support for this Recovery Plan through developing agreements, evaluating progress, establishing funding priorities and facilitating communication and cooperation between the private and public sectors. Due to the importance of this level of coordination, the Governance Committee should be formed by the Regional Director, FWS, Region 6, within 6 months of the signing of the Recovery Plan.

5.3 Establish Preble's Site Conservation Teams. Local governments, in conjunction with the Recovery Team and the Governance Committee, have the opportunity to establish

these teams. These teams may be tailored to the individual site, and participation may include a wide range of stake holders, including private landowners and agencies. If teams are not established within 1 year of Recovery Plan approval, the FWS and Governance Committee will take the lead in establishing the Site Conservation Teams.

These teams will work directly with the FWS to delineate the boundaries of the designated recovery sites, develop the Threat Abatement Management Plans for each designated recovery sites (Task 3.3), and complete/administer the task of monitoring populations and habitat as directed by the Preble's Population and Habitat Monitoring Plans (Tasks 1.2 and 2.2). The Preble's Site Conservation Teams may work with more than one designated recovery population, and could be closely tied to existing county Habitat Conservation Plan groups. These teams also will participate in developing the long-term management plan and agreement for Preble's prior to delisting (Task 4.1 &4.2).

To ensure implementation of Recovery Tasks and to facilitate information sharing and coordination among participating organizations, the Recovery Team will hold meetings attended by all Site Conservation Teams (or a representative) as needed.

5.4 Provide Updated Information on Status of Recovery Populations. All parties managing, monitoring, conducting research and surveying for Preble's populations will need to provide written reports to the FWS. Activities conducted under Section 10(a)(1)(A) permits will, as standard for such permits, be required to submit annual reports. This information will need to be compiled by the FWS and added to the FWS web-site.

5.5 Develop and Implement a Public Information and Communication Strategy for a Wide Range of Audiences. Provide information on Preble's ecology, conservation, threats and threat abatement strategies to increase public awareness and understanding. Information should also be provided on protection of stream corridors on a landscape level. Develop strategies, in addition to placing information on agency websites, for distributing this information to a wide range of audiences. .

6.0 Implementing Laws, Regulations, and Authorities.

6.1 Promote Compliance and Enforcement of ESA Laws and Regulations Related to Preble's. Private landowners and local agencies need to be provided information on ESA regulations. Specific information on regulations applicable to the private sector and non-Federal agencies, can be found on the FWS web-site or from local FWS offices; refer to Section 9 of the ESA.

Section 7
Section 9

6.2 Enforce Laws (Federal, State, Local) and Other Agreements Protecting Preble's Populations and Their Habitat. Enforcement needs should be coordinated between Federal, State, and local agencies. Sufficient resources to conduct law enforcement activities relating to Preble's enforcement and conservation are needed. The effectiveness of Federal, State, and local enforcement efforts in protecting Preble's populations and conserving Preble's habitats within designated recovery populations, areas protected under the provision of HCP's and areas covered by other permits, easements, or agreements needs to be monitored and assessed.

6.3 Utilize Program and Funding Support. Federal agencies should use existing programs and funding to conserve existing Preble's populations, and implement this plan.

6.3.2 Utilize Environmental Protection Agency Section 516 Grants to Conserve Prebles. The EPA Section 516 Grants are available to inventory water quality and restore aquatic habitats on non-Federal lands and can provide incentives for Preble's conservation. The EPA should request grants to be submitted for restoration/conservation of Preble's habitat and should give high priority for funding these grants.

6.3.3 Access NRCS Programs to Conserve Preble's. The NRCS has appropriations in WHP and EQUIP programs that are available to provide landowners means to stabilize soils and improve water quality along stream systems. The NRCS should give high priority to funding restoration of riparian habitats in their WHP and EQUIP programs within the designated recovery populations. The NRCS also should provide technical assistance to landowners to maintain Preble's habitat in riparian areas. Currently, NRCS is providing technical assistance and FSA is providing funds to assist landowners in constructing tile drains, cementing irrigation ditches, and channelizing streams, all of which removes Preble's habitat. The NRCS should withdraw support of such projects where negative impacts to Preble's may occur NRCS should prioritize support through the CRP program to restore habitats within designated recovery populations.

6.3.4 Evaluate Impacts of COE 404 Permit Programs. The COE provides permits for wetland filling under Section 404 of the Clean Water Act. The COE must review every 404 permit application for potential impacts to the Preble's and should not provide permits for such actions unless impacts have been modified or reduced through consultation with the FWS. The COE should deny all fill permits for actions within designated recovery populations unless the impacts are small or have been eliminated or reduced to minimal levels. The COE also should provide funding to support management of populations at Chatfield State Park.

6.3.5 Federal Highway Administration/Colorado Department of Transportation/Wyoming Department of Transportation. Construction and maintenance of highways conducted by Colorado Department of Transportation (CDOT) and Wyoming Department of Transportation (WDOT) and funded by the Federal Highway Administration (FHWA) can impact riparian zones occupied by Preble's. The FHWA should review all projects they fund and ensure that impacts to Preble's have been eliminated, reduced to a minimal level, and/or mitigated. Establishment of mitigation banks should be evaluated to increase opportunities for protection and enhancement of designated recovery populations. The CDOT and WDOT should review their projects and ensure that they identify potential impacts to Preble's and that they incorporate measures to modify or reduce these impacts early in the design phase.

III. IMPLEMENTATION SCHEDULE

In Section III of this Plan, tasks from Section II have been assigned an estimated cost, priority number and task duration.

Where possible, tasks are ordered in descending priority, at lease in the sense that one or more tasks may have to be started or completed before the other tasks can be accomplished. However, it should be apparent that no linear hierarchy can suitably express the complex interrelationships between tasks.

Some tasks likely will take considerable time to complete, and some are going to be much more difficult to accomplish because they involve more diverse interest groups. Tasks that are mostly or solely within the jurisdiction of governmental agencies are listed before other, similar tasks involving private entities because the former should put the focus of recovery actions on public lands and agencies

Definition of the priority numbers:

Priority 1. An action that must be taken to prevent extinction or to prevent a species from declining irreversibly in the foreseeable future.

Priority 2. An action that must be taken to prevent a significant decline in species populations or habitat quality or some other significant negative impact short of extinction.

Priority 3. All other actions necessary to meet the recovery objective.

Definition of task durations:

Continual. A task that will be implemented on a routine basis once begun.

Ongoing. A task that is currently being implemented and will continue until action is no longer necessary.

Unkown. Either task duration or associated costs are not known at this time.

Key to Acronyms used in the Implementation Schedule:

All	**Possible combination Federal, state and local listed below**
AF	**U.S. Air Force (Warren AFB, Academy)**
BLM	**Bureau of Land Management**
CDOW	**Colorado Division of Wildlife**
COE	**Corp of Engineers**
CSU	**Colorado State University**
DOE	**Department Of Energy, Rocky Flats**
GC	**Governance Committee**
HCP's	**Habitat Conservation Plans**
Local	**Local governments**
NWR	**National Wildlife Refuge**
NRCS	**Natural Resource Conservation Service**
Museum	**Denver Museum of Nature and Science**
Private	**Private land owners**
Pops.	**Populations**
RT	**Recovery Team**
SCT	**Site conservation team(s)**
TBD	**To be determined**
TNC	**The Nature Conservancy**
USFS	**Forest Service**
USAFA	**U.S. Air Force Academy**
USFWS	**U.S. Fish and Wildlife Service**
WG&F	**Wyoming Game and Fish Department**

Implementation Schedule for Preble's Meadow Jumping Mouse. Draft 26 July 2001, updated 11 December 2003

Priority Number	Task Number	Task Description	Task Duration	Minimum List Of Potential Partners	Total Costs	Costs ($1,000) Year 1	Year 2	Year 3	Year 4
	1.0	Populations of Preble's							
	1.1	Complete selection & delineation of recovery populations							
2	1.1.1	Preble's database	Ongoing	USFWS, CO & WY	20	5	5	5	5
2	1.1.2	Identify existing small pops: assess size & extent	3 Years	CDOW, WGF, Local, Private, AF, FS	600	200	200	200* may be part of HCP's	
2	1.1.3	Finalize population criteria & designate sites	3 Years.	USFWS, FS, CDOW, WGF, SCT. SCT partners will vary by site and may include federal, state, local and private, see 5.3.	TBD by year 2				
2	1.1.4	Notify Property Owners	3 Years	USFWS, WGF, CDOW, Local, SCT	15	5	5	5	
2	1.1.5	Delineate all recovery population sites	4 Years	USFWS, Local, SCT, FS	310	10	50	150	100
	1.2	Monitor all recovery populations							

2	1.2.1	Develop a Preble's population monitoring protocol	Ongoing, funded in 2003 and included in Plan	USFWS, CDOW, WGF, CSU, USAFA	20 includes costs from 2003	10			
2	1.2.2	Monitor designated large medium recovery populations	Ongoing	USFWS, FS SCT, CDOW, WGF, USAFA, Local, Private	2,000	200	300	500	1,000* Costs likely to be near this level for 6 more years
2	1.2.3	Monitor designated small recovery populations	Ongoing	USFWS, FS, Warren AFB, CDOW, WGF, Local, Private, SCT	included in 1.2.2				
	1.3	Preble's Research							
	1.3.1	Taxonomy Research							
3	1.3.1.1	Live animal field taxonomy	1 Year	All	10	10			
3	1.3.1.2	Morphology of *Z. h., campestris & Z. h. luteus*	1 Year	All	25	25			
3	1.3.1.3	Develop genetic markers for *preblei, princeps, luteus & campestris*	Ongoing, project initiated in 2003	Museum, WGF, USFWS, DOE	180 includes funds from 2003	100			
3	1.3.1.4	Variation among *preblei* populations	3 Years	All	part of 1.3.1.3				
3	1.3.1.5	Systematic & molecular genetic studies	3 Years	All	10			10	

	1.3.2	Distribution Research							
2	1.3.2.1	Define elevational & ecological boundaries of *preblei*	2 Years	All	200			100	100
2	1.3.2.2	Distributional relationship of *preblei, princeps, luteus & campestris*	2 Years	All	could be included with 1.3.2.1 at minimal increase				
2	1.3.2.3	Develop non-invasive methods of collection	2 Years	All	100	50*	50*		
	1.3.3	Design & conduct studies on demography							
2	1.3.3.1	Estimate survival density & their trends	3 Years	All	75 per site per year (min 3 sites)				
2	1.3.3.2	Determine factors affecting demographics of 1.3.3.1	3 Years	All	Costs included in 1.3.3.1				
2	1.3.3.3	Dispersal behavior	3 Years	All	75 per site per year (min 3 sites)				
2	1.3.3.4	Preble's behavior & physiology	2-3 Years	All	50 per site per year				
	1.3.4	Ecology Research							
2	1.3.4.1	Impacts of non-native small mammals	2 Years	All	50 per site per year				
3	1.3.4.2	Impacts of *princeps on preblei*	2 Years	All	45 per site per year (min 3 sites)				
	2.0	Habitat							

2	2.1	Map the length and width of habitat of designated recovery populations	4 Years	USAFA, USFWS, CDOW, WGF, Local, SCT, Private	1,300	100	200	500	500
	2.2	Monitor habitat of all designated recovery populations							
2	2.2.1	Develop a Preble's habitat monitoring protocol	Ongoing, project funded In 2003	USAFA	90 includes costs from 2003	10			
2	2.2.2	Monitor habitat of all recovery populations	Continual	USFWS, FS, BLM, AF, CDOW, WGF, Local, SCT, Private	1,000	50	50	450	450
	2.3	Conduct research on Preble's habitat							
	2.3.1	Identify and describe Preble's habitat							
2	2.3.1.1	Habitat influence on Preble's survival and density	2 Years	All	Funding included in 1.3.3.1				
2	2.3.1.2	Habitat influence on Preble's dispersal	3 Years	All	Funding included in 1.3.3.3				
2	2.3.1.3	Habitat influence on hibernation survival	2 Years	All	Funding included in 1.3.3.1				
	2.3.2	Effects of habitat on demography							

2	2.3.2.1	Effects of cover on Preble's density	3 Years	All	75 per site per year (min 3 sites)				
2	2.3.2.2	Influence of shrub density and open water on Preble's movement & survival	3 Years	All	Costs included in 2.3.2.1				
2	2.3.2.3	Influence of upland vegetation on Preble's movement/survival	3 Years	All	Included in 1.3.3.1				
	2.3.3	Evaluate habitat management techniques							
3	2.3.3.1	Evaluate different grazing techniques on Preble's demography	3 Years	All	75 per site				
	3.0	Threat Abatement							
	3.1	Abate threats to designated recovery populations							
2	3.2	Identify threats to recovery populations	Continual	USFWS, SCT, CDOW, WGF, Local, FS, USAFA	Costs included in 3.3				
1	3.3	Develop and implement threat abatement management plans	Continual	SCT, GC	TBD by year 2				
1	3.3.1	Maintain effects of ecological processes	Continual	SCT,GC	Costs included in 3.3				
3	3.3.2	Develop abatement strategies for multiple sites	Continual	SCT,GC	Costs included in 3.3				
	3.4	Protect and conserve non-designated recovery sites							
2	3.4.1	Protect and manage all populations on federal lands	Ongoing	USFWS, AF, FS, BLM	TBD by year 2				

2	3.4.2	Protect and conserve populations on state and local public lands	Ongoing	CDOW, WGF, Local	TBD by year 2				
2	3.4.3	Protect and conserve populations on private lands	Ongoing	Private, IRS	Possible future funding available under task 3.5				
	3.5	Develop and implement economic and social incentives							
3	3.5.1	Encourage development of recovery funds	Continual	USFWS, GC CDNR, SCT, Recovery Team, WGF, Local, DOI, Congress, State Legislature	TBD				
3	3.5.2	Create tax incentives	Continual	Local, State, Congress	TBD				
3	3.5.3	Create awards and rewards system	Continual	USFWS, CDOW, WGF, Local, CDNR	TBD				
	3.6	Evaluate effects of threat abatement strategies							
2	3.6.1	Evaluate impacts of non-native predators	2 Years	All	60 per site per year				
	4.0	Long-Term Plans							
3	4.1	Preble's Management Plan	Immediately prior to delisting	All	TBD				

3	4.2	Delisting Coop Agreement	Immediately prior to delisting	All	TBD				
	5.0	Organization and Communication Strategies							
	5.1	Maintain a Recovery Team	Ongoing	USFWS	80	20	20	20	20
2	5.2	Governance Committee	Continual	USFWS, FS, CDOW, WGF, Local, Private	TBD				
2	5.3	Conservation Teams	Continual	USFWS, Local, CDOW, WGF, SCT, RC, GC	TBD				
3	5.4	Update Preble's information	Ongoing	All	20	5	5	5	5
3	5.5	Public information system	Ongoing	USFWS, Local, CDOW, WGF, AF, FS, BLM, NRCS	200	50	50	50	50
	6.0	Compliance and Enforcement	Ongoing		800	200	200	200	200
2	6.1	Promote compliance and enforcement							
2	6.2	Enforce existing laws		USFWS, COE, CDOW, WGF, FS, BLM, Local	200	50	50	50	50