Comments on Preble's Meadow Jumping Mouse Delisting Proposal

(Listed in order received. Dates are those on comments.)

Reopened Comment Period

29. 2/6/06 Mark Lusch, Cheyenne, WY

30. 2/18/06 Tom and Mary Ann Cunningham, Green Mountain Falls, CO

31. 2/18/06 Bruce Roberts, Monument CO

32. 2/20/06 Mitchell Baldwin

33. 2/21/06 Oliver A. Richardson

34. 2/22/06 Robert B. Hoff, Colorado Springs, CO (see 1 and 6 above)

35. 2/22/06 Colleen Miller

36. 2/21/06 Linda Samelson, Colorado Springs, CO

37. 2/26/06 Jennifer K. Frey, Frey Biological Research, Radium Springs, NM

38. 2/25/06 Nick Ordon, Falcon, CO

39. 3/1/06 Unsigned, Colorado Springs, CO

40. 3/9/06 Leslie Barstow, Golden, CO

41. 3/9/06 Peter Bray, Portland, OR

42. 3/9/06 Donna Miller, Golden, CO

43. 3/13/06 Daryl E. Mergen, Colorado Springs, CO

44. 3/31/06 Ronald W. Opsahl, Staff Attorney, Mountain States Legal Foundation, Lakewood, CO (See 7 above)

45. 3/31/06 C. J. Rapp, Littleton, CO

46. 4/4/06 Ken Faux, Greenwood Village, CO (see 18 above)

47. 3/31/06 Ken Hamilton, Executive Vice President, Wyoming Farm Bureau Federation, Laramie, WY

48. 3/31/06 Renee C. Taylor, Environmental Coordinator, True Ranches, LLC, Casper, WY (see 12 above)

49. 4/13/06 Robert E. Arlen, Science Faculty, University of Phoenix, Casper, WY

50. 4/17/06 Sandra A. Eddy, Aurora, CO

51. 4/18/06 Kent Holsinger, Hale Friesen, LLP, Denver, CO. On behalf of Colorado Water Conservation and Development

52. 4/28/06 Robert A, Schorr, Zoologist, Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO

53. 4/28/06 Eric Hallerman, Professor, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA

54. 5/11/06 Sacha Vignieri, Center for Study of Evolution, University of Sussex, Brighton, UK

55. 5/15/06 Jonathan Dowling, Assistant Vice President, Wyoming Contractors Association, Cheyenne, WY

56. 5/1/06 Sallie Clark, Chair, Board of County Commissioners of El Paso County, Colorado Springs, CO

57. 5/16/06 Sylvia M. Fallon, Conservation Genetics Fellow, Natural Resources Defense Council

58. 5/17/06 Don Britton, Manager, Wheatland Irrigation District, Wheatland, WY

59. 5/17/06 Dale Moore

60. 5/18/06 Carron Meaney (Meaney and Co.; Reasearch Associate, DMNS; Curator Adjoint, University of Colorado Museum), Thomas Ryon (Wildlife Biologist and Certified Ecologist), Mark Bakeman (President, Ensight Technical Services Inc.) and Anne Ruggles (Bear Canyon Consulting), CO

61. 5/18/06 Tina Comerford, Wheaton, IL

62. 5/17/06 Niel A. "Mick" McMurry, Shareholder, Sybille Ranch LLC, Cheyenne, WY

63. 5/18/06 Rob Roy Ramey, II, Nederland, CO

64. 5/18/06 Jim Magagna, Executive Vice President, Wyoming Stock Growers Association, Cheyenne, WY

65. 5/18/06 Erin Robertson, Staff Biologist, Center for Native Ecosystems, Denver CO. On behalf of: Jeremy Nichols, Conservation Director, Biodiversity Conservation Alliance, Denver, CO and Nicole Rosario, Conservation Director, Forest Guardians, Santa Fe, NM (See 23 above)

66. 5/18/06 Patrick J. Crank, Attorney General, State of Wyoming, Cheyenne, WY

67. 5/19/06 Cheryl Matthews, Director, Douglas County Division of Open Space and Natural Resources, Castle Rock, CO (See 19 above)

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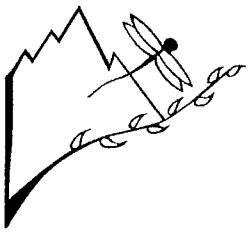

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SENT BY EMAIL, FAX AND U.S. MAIL

18 May 2006

Dear Susan,

Center for Native Ecosystems, Biodiversity Conservation Alliance, and Forest Guardians provide these comments on the proposed delisting of the Preble's meadow jumping mouse (*Zapus hudsonius preblei*). We have already submitted extensive comments regarding the status of the Preble's meadow jumping mouse and Bear Lodge meadow jumping mouse (*Zapus hudsonius campestris*) and hereby incorporate by reference every comment ever submitted to the USFWS by our groups, whether individually or collectively, that relates in any way, no matter how remote, to the species1.

The Service has received comments from the scientific community that show that the data used in the listing rule were not in error, and, in fact, remain true today, namely:

- the Preble's meadow jumping mouse is a distinct subspecies,
- the Preble's meadow jumping mouse is not abundant,
- the Preble's meadow jumping mouse has a very narrow global distribution,
- habitat for the Preble's meadow jumping mouse is limited,
- threats to the Preble's meadow jumping mouse have not been eliminated, and
- threats to the Preble's meadow jumping mouse are expected to increase.

The King *et al.* (2006) study, Vignieri *et al.* (2006 - attached), the many peer reviews that the Service has in its files now regarding the delisting proposal itself as well as on the various versions of the Ramey study and of the King study, comments by other geneticists like Sylvia Fallon and Tom Quinn, comments by on-the-ground researchers like Rob Schorr and Carron Meaney et al., the data that were in the Service's files at the time of listing, and simply direct experience of the effects of Front Range growth all corroborate these findings, and indicate that Endangered

Species Act listing is still warranted for the mouse.

The proposed delisting rule states:

> At this time, we view Ramey *et al.* (2004) as the best scientific and commercial information available regarding the taxonomy of the Preble's and Bear Lodge meadow jumping mouse. Within the next year, the Service expects additional genetics information (*i.e.*, nuclear DNA results) that will verify (or refute) the conclusions of Ramey *et al.* The peer reviews of the report suggested a majority (8 out of 14) either support or lean toward supporting the taxonomic conclusions of Ramey *et al.* (2004). Therefore, on the basis of the lack of distinct genetic and morphologic differences between the putative subspecies, we conclude that Preble's is likely not a valid subspecies of meadow jumping mice (*Zapus hudsonius*). Based on the above conclusion, we find that the petitioned action is warranted because the original listing of Preble's as a subspecies of meadow jumping mouse was in error. Accordingly we propose to delist or remove Preble's fr *om the List of Endangered and Threatened Wildlife in 50 CFR 17.11. (70 Fed. Reg. 5409 (Feb. 2, 2005)*

As we have indicated in our past comments, the proposed rule was not correct that Ramey et al. (2004) constituted the best available science, since the scientific community had already noted multiple serious flaws in that study. We also have documented how the Service's assertion that the majority of the reviewers would support synonymization was incorrect. Now there are two peer-reviewed studies that again show that Ramey *et al.*'s conclusions are not valid (King *et al.* (2006) and Vignieri *et al.* (2006)). Ramey's research can no longer be considered best available science, not only because the King and Vignieri studies are more current, but because they are more rigorous in terms of study design. These two studies have refuted Ramey's conclusions, and therefore the Service's finding. If the Service intends to continue to pursue delisting, it must now demonstrate that it has compelling reason to think that either a) another part of the data used in the original listing was in error, or b) the recovery objectives have been met. If the Service uses a new reason to pursue delisting (including a new form of data error), it must publish a new proposed rule and provide additional opportunity for public comment on that reason for delisting.

The standard used in the 1996 petition management guidance for delisting based on recovery is as follows: "The responsible Service will make a 'warranted' finding if the status review provides convincing information to conclude that the species has achieved the recovery objectives for reclassification or delisting" (pp. 16-17, emphasis added). The current draft of the recovery plan (November 5, 2003) provides these recovery objectives:

> 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 minimum 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 minimum 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). (pp. 31-33)

The current recovery plan represents the best available science as to what is needed to delist the mouse based on having achieved recovery objectives, and thus sets the bar for what is required to prevent the extinction of the mouse. Clearly, the delisting petitions do not present a "convincing" case that the above objectives have been met. Instead, the delisting petitions merely attempt to establish which HUCs are known to be occupied based on individual captures.

For the Service to delist the mouse based on having achieved recovery/absence of threats, it must be able to demonstrate that the population objectives in #1 above have been met (including 10-year trend objectives, which cannot even have been assessed yet let alone met), that each of those populations is afforded management status that will achieve #2, that site-specific Threat Abatement Management Plans have been completed and implemented in a manner that achieves the required results in #3, and that a long-term management plan that will remain in effect post-delisting has been adopted. None of these four steps has been achieved yet; therefore, delisting now is terribly premature.

The recovery plan "provides guidelines for estimated stream miles for large and medium recovery populations, and required miles for small populations" (p. 24) which work out to 45-78 stream miles per large population, 9-16 miles per medium population, and at least 3 miles per small population. The plan emphasizes that "the recovery goal for large and medium populations is numbers of mice, not numbers of stream miles inhabited" (p. 25), but this gives a general idea of the "network of connected streams whose hydrology supports riparian vegetation and provides Preble's habitat" (p. 25) that would need to be managed under a protected status to achieve #2 and #3 above. The delisting petitions provide no evidence that this has been achieved.

The recovery plan is clear that even if Preble's meadow jumping mouse populations are currently large enough and well-distributed enough to meet the above objectives, threats have not yet been abated to the degree that protection is no longer required. There has been no significant change in this situation since the plan was drafted, nor since the mouse was first listed under the Act. The plan states:

> 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 into the future and protected from threats....When those threats are lessened or eliminated for each recovery population, an analysis of the above factors [the five listing factors] should show the subspecies is no longer in need of protection under the ESA. (p. 29)

The Service has not yet analyzed whether these objectives have been met, let alone demonstrated that there is "convincing" information in its possession that this is the case. Therefore, the Service may not finalize delisting now, and must provide this evidence along with any future proposed delisting rule if it desires to delist based on recovery/failure to meet any listing criterion.

The recovery plan provides details on necessary components of the long-term management plan that would be required prior to delisting, and is clear that "The plan should be developed and approved by all parties with jurisdiction over Preble's recovery populations before the proposed delisting" (p. 51), and that the long-term plan "must be reviewed and approved by the FWS" (p. 51). We are not aware of ongoing work on any such plan, and without this, the Service cannot delist based on having achieved the recovery objectives. The current proposed delisting absent a long-term management plan was permissible only because the Service believed that it had listed the mouse using data that showed it was in a unique taxon and then later learned that the mouse was identical to mice with a much larger distribution that were not threatened with endangerment. Now that the taxonomy at the time of listing has been upheld by multiple studies, the Service cannot demonstrate that current and future threats have been removed and thus listing is no longer warranted unless it completes this long-term plan and all managers of recovery populations approve its implementation.

The Service may attempt to claim that rather than taxonomic data error, the original listing was in error in regards to whether the mouse met any of the listing criteria. Those of us watching the daily urbanization of the Front Range or riparian degradation in the rangelands of Wyoming cannot understand how the Service could make an assertion like this, but the Service is also claiming now that Gunnison sage grouse populations have remained stable over the past 50 years, so we understand that the Service may attempt to use a rationale divorced from reality. It is important to understand that the standard that the Service must use involves Threatened status rather than Endangered status, and that threats must only be present in "a significant portion of the range" (16 U.S.C. § 1532(20)). We have discussed these ongoing threats throughout our past comments, and offer some more information below.

The best available science shows the Preble's meadow jumping mouse and its habitat remain threatened in several ways throughout all or a significant portion of the species' range, clearly demonstrating the mouse either needs to remain listed as a threatened species or uplisted to endangered in order to prevent its extinction in the reasonably foreseeable future. As Smith et al. (2004 – see attached) state, "[T]he extant ecological threats to these [Preble's meadow jumping mouse] populations have not been successfully abated at this time to prevent further decline and endangerment of the species" (p. 29).

Urban development, or development related to the growth of human population centers, remains a serious and growing threat to the Preble's meadow jumping mouse. Directly, urban development destroys and degrades riparian habitat that may support populations (USFWS 1998). Indirectly, urban development can lead to harmful runoff that can scour stream channels and reduce riparian habitat, introduce contaminants into streams, lead to the introduction of nonnative predators, such as domestic cats and dogs, and increase human disturbance within riparian habitats (USFWS 1998, 2003a).

Extensive urban development is reported to have already contributed to the extirpation of the Preble's in the Denver and Colorado Springs metropolitan areas (USFWS 2003a, 2003b). The USFWS (2003b) states, "Since at least 1991, the Preble's has not been found in Denver, Adams, or Arapahoe Counties in Colorado. Its absence in these counties is likely due to urban development, which has altered, reduce, or eliminated riparian habitat (Crompton and Hugie 1993; Ryon 1996)" (p. 70525). Urban development is also linked to declines in other areas of the Front Range (USFWS 1998, 2003a). The USFWS has consistently identified urban development in the Front Range region of Colorado, as well as portions of southeastern Wyoming, as the most serious threats to the species (USFWS 1998, 2003a, 2003b). Furthermore, since the Preble's meadow jumping mouse was listed as threatened in 1998, not a shred of scientific information has been produced indicating that the negative impacts of urban development have been reversed in any portion of the range of the species. As a threshold matter, no scientific information indicates that habitat conditions for the Preble's have improved since 1998, indicating that listing as threatened remains warranted. In fact, the best available scientific information shows that the threat of urban development is not subsiding in the slightest, but in fact is increasing enormously.

Data from the U.S. Census Bureau shows that every major population center in the Front Range Region of Colorado and southeastern Wyoming grew between the years 1990 and 2000, many by over 25%. And, between the years 2000 and 2003, virtually all major population centers grew, several by over 5%. Growth rate data from the U.S. Census Bureau strongly indicates that urban development continues to pose a significant threat to the Preble's meadow jumping mouse and its habitat throughout a significant portion of its range.

Population centers within the range of the Preble's meadow jumping mouse and growth rates (US Census Bureau 2006).

City	2003 Population Size	Area (square miles)	Growth Rate, 2000-2003	Growth Rate, 1990-2000
Arvada, CO	101,972	33	-0.3%	13.8%
Aurora, CO	290,418	142	5.3%	24.6%
Boulder, CO	93,051	24	-1.7%	10.0%
Broomfield, CO	42,169	27	7.6%	53.3%
Cheyenne, WY	54,374	21	2.2%	5.6%
Colorado Springs, CO	370,448	186	2.6%	27.5%
Denver, CO	557,478	153	0.7%	18.6%
Englewood, CO	32,762	7	3.3%	6.1%
Fort Collins, CO	125,740	47	5.9%	33.5%
Greeley, CO	83,414	30	8.3%	27.2%
Lakewood, CO	142,474	42	-1.2%	14.2%
Littleton, CO	40,599	14	0.6%	19.4%
Longmont, CO	79,556	22	11.9%	36.2%
Loveland, CO	56,436	25	11.5%	34.9%
Northglenn, CO	32,943	7	4.3%	15.7%
Westminster, CO	103,391	32	2.4%	36.1%
Wheat Ridge, CO	32,782	9	-3.4%	11.9%

Data from the U.S. Census Bureau and the Colorado Water Conservation Board also shows massive population growth has continued and will continue within virtually all counties within the range of the Preble's meadow jumping mouse. Between 2000 and 2004 alone, Adams, Douglas, Elbert, and Weld Counties in Colorado grew by over 10%. Projected population growth rates will exceed 25% by 2030 for all counties within the range of the Preble's meadow jumping mouse. Five counties—Adams, Douglas, Elbert, Larimer, and Weld—will grow by over 50%, with Weld County projected to grow by as much as 116% by 2030.

County Growth Rate, 2000-2004 (Davis et al. 2004, U.S. Census Bureau 2006)

County	State	Population (2004)	Growth Rate, 2000-2004	Growth Rate, 1990-2000	Projected Population Size in 2030	Projected Growth Rates
Adams	CO	389,857	11.5%	37.3%	693,540	78%
Arapahoe	CO	522,812	7.0%	24.6%	662,486	27%
Boulder	CO	278,917	3.1%	29.3%	374,921	34%
Denver	CO	556,835	0.6%	18.6%	753,720	35%
Douglas	CO	237,963	35.4%	191.0%	439,585	85%
Elbert	CO	22,488	13.2%	106.0%	40,544	80%
El Paso	CO	554,574	7.3%	30.2%	801,721	45%
Jefferson	CO	526,351	0.2%	20 .2%	709,958	35%
Larimer	CO	268,872	6.9%	35.1%	441,904	64%
Weld	CO	219,257	21.2%	37.3%	473,275	116%
Laramie	WY	85,296	4.5%	11.6%	N/A	N/A

Population growth data strongly indicates that the high quality riparian habitat that the Preble's meadow jumping mouse relies upon for its survival not only remains threatened, but will become increasingly threatened in the coming years. Indeed, population growth is inextricably linked to urban development, including the construction of homes, industrial centers, and roads. For instance, housing densities have increased in terms of area and magnitude in all Front Range counties, corresponding to increased population sizes and growth (Theobald 2005). As Holmes and Vilsack (undated) report:

> Commercial and suburban development in the Front Range continues to threaten riparian habitat. As new residences rise in floodplains and directly bordering river corridors, calls have come from homeowners for channelization and flood control. Municipalities have complied with these demands, straightening and cementing streams, completely destroying the willow overstory and grass and forb understory necessary for cover (p. 19).

Urban development has imperiled riparian habitats along the Front Range, making such habitats high conservation priorities (Theobald et al. 1998).

Even the USFWS (2003a) itself has stated, "Given the overlap of the Preble's range with an area of extensive and rapid urban development along the Colorado Front Range, it is likely that significant losses of Preble's populations have occurred and may continue to occur" (p. 37279).

Population growth and concomitant development has indeed been linked to declines in riparian habitat along streams in the Front Range. In a study of the effects of development and population growth on riparian habitats along near Boulder Creek and the Cache la Poudre River, Miller et al. (2003) found that urban development had a profound and far-reaching negative impact on riparian habitats, even where development does not directly disturb such habitats. The authors state:

> Even though our study sites were relatively free of buildings and paved surfaces (except trails), we observed declines in native trees and shrubs, a more open understory, reduced ground cover, higher tree density, and greater canopy closure as development intensified in the surrounding landscape (p. 1055).

Given that the Preble's meadow jumping depends upon dense understory vegetation, native shrubs, and ground cover, the findings of Miller et al. (2003) strongly indicate that development has had and continues to have a profound and far-reaching negative impact on the Preble's and its habitat throughout the Front Range. As growth and development increase, so too will the threats facing the Preble's and its habitat.

Additionally, water developments, such as dams and diversions, have greatly altered stream hydrology throughout the range of the Preble's meadow jumping mouse. The USFWS (1998) states, "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" (p. 26525). Compton and Hugie (1993) report that management of water for commercial and residential use tends to channelize and isolate water resources, and has reduce in size and fragmented riparian habitats used by Preble's. The best available science continues to indicate that water developments have destroyed and/or degraded habitat for the Preble's meadow jumping mouse and continue to pose threats to the species.

Demand for water from streams within the range of the Preble's meadow jumping mouse is also expected to increase as populations continue to grow, posing threats to the Preble's and its habitat. According to Davis et al. (2004), water demand in the South Platte River basin is expected to increased by 61.9% and demand in the Arkansas River basis is expected to increase by 45.3%. The best available science strongly indicates that, as demand for water increases, the threats to the Preble's and its riparian habitat will also increase.

The Service's own stats on projects that have been allowed via ITPs are also eye-opening. Since the Preble's mouse was listed in 1998, the U.S. Fish and Wildlife Service has permitted 128 projects involving "take" of mice. The Service has granted "take" of 2,021 acres of habitat for the mouse. These figures do not include additional projects that disturbed habitat for the mouse but involved a federal nexus (like an Army Corps of Engineers permit) and employed mitigations that the Service deemed adequate to avoid "adverse effect".

The following list represents the Front Range reservoir projects with potential Preble's meadow jumping mouse conflicts:
1. Rueter-Hess (Parker Water and Sanitation District): now proposed for expansion
2. Seaman Reservoir (City of Greeley): Greeley wants to expand the capacity of the reservoir, and this would involve inundation of designated Critical Habitat. Rather than working with FWS, Greeley chose to sue over the Critical Habitat designation. It is possible the expansion would be approved if other benefits can be worked in, like enhancing other mouse habitat through targeted releases.
3. Halligan Reservoir (City of Fort Collins): Fort Collins wants to expand the capacity of the reservoir, and there is mouse habitat above and below the reservoir now. Fort Collins is working with FWS on this. The Corps may approve the expansion if benefits like targeted releases to enhance downstream habitat are included.
4. Glade Reservoir (Northwern Water): This is a potential alternative to Seaman/Halligan expansion. There are mouse downstream from the main site under consideration for construction, but this is unlikely to be a major issue. Highway 287 would have to be realigned.
5. Chatfield Expansion (Colorado Water Conservation Board): Proposed changes in holding patterns could result in raising the pool level by up to 12 feet, which would flood mouse habitat. Wetlands would also be flooded so permits would be required anyway. Part of this would involve designated Critical Habitat along the South Platte.

While the threats present along the urban corridor of the Front Range should more than meet the standard for threatened endangerment within a significant portion of the subspecies' range, even in Wyoming, the Preble's remains threatened by a host of factors. As Smith et al. (2004) state, "[T]he extant ecological threats to these [Preble's meadow jumping mouse] populations have not been successfully abated at this time to prevent further decline and endangerment of the species" (p. 29).

Overgrazing, in fact, remains a threat to the Preble's meadow jumping mouse in Wyoming. On the Pole Mountain Unit of the Medicine Bow National Forest in Albany County, Wyoming, the U.S. Forest Service has consistently allowed forage utilization standards set forth in the 2003 Medicine Bow National Forest Revised Land and Resource Management Plan to be violated, even in areas designated as critical habitat in the Lodgepole Creek drainage and other areas considered suitable Preble's meadow jumping mouse habitat. According to the U.S. Forest Service there are "chronic problems" with forage utilization violations (USFS 2004 – see attached).

To limit livestock impacts, the 1985 Forest Plan established a "forage utilization standard" for grazing in the Medicine Bow National Forest. This standard was also adopted through the 2003 Revised Medicine Bow National Forest Land and Resource Management Plan (USFS 2003) The relevant utilization standard for the Pole Mountain area restricts the amount of available forage to between 45 to 55 percent of the vegetation (USFS 1998, 2003).

According to the USFS (1998), the Preble's meadow jumping mouse and its habitat if this standard is "monitor[ed] and enforce[d]" (Appendix 5, p. 6).

The Forest Service is required to monitor for compliance with this standard at several representative sites, or "key areas," within each allotment (USFS 1998, 2003, 2004). A "key area" is defined as a relatively "small portion of the range, which because of its location, grazing or browsing value, and/or use, serves as an indicative sample of range conditions, trend or degree of use seasonally" (USFS 2004).

Unfortunately, these forage utilization standards have not been protecting the Preble's meadow jumping mouse and its habitat. Rather, these standards have been repeatedly exceeded over the last several years. Between 1999 and 2004, "a number of allotments and key areas were utilized beyond the 55% level," with some areas ranging as high as 88%, even in suitable habitat for the Preble's meadow jumping mouse (USFS 2004). In mouse critical habitat, forage utilization rates have repeatedly exceeded the 55% level (USFS 2004). Violations of forage utilization standards continued in 2005 as well. The best available scientific information strongly indicates that overgrazing of domestic livestock continues to destroy and/or degrade habitat for the Preble's meadow jumping mouse.

Therefore, for all of the reasons above, the Service must not finalize delisting based on the current delisting proposal. If the Service chooses to continue to pursue delisting, it must re-propose delisting using a different reason besides taxonomic data error and allow comment on that proposal.

Sincerely,

Erin C Robertson

Erin Robertson
Staff Biologist

on behalf of:

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1 For the purposes of this incorporation, we hereby also reference any and all comments submitted by the Biodiversity Legal Foundation. In addition, for the purposes of this incorporation by reference, comments include, but are not limited to, written letters and their attachments, meeting notes, phone conversation notes, facsimiles, e-mails, and petitions.

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05/18/2006 06:54 PM

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Mistaken view of taxonomic validity undermines conservation of an evolutionarily distinct mouse: a response to Ramey *et al.* (2005)

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In a study self-defined in its introductory paragraph as an effort to roll back US Endangered Species Act (US-ESA) protection for a geographically isolated and currently recognized subspecies, in order to avoid misallocating financial and logistical resources, Ramey *et al.* (2005; hereafter REA) proposed to synonymize the threatened Preble's meadow jumping mouse *Zapus hudsonius preblei* with two currently unlisted subspecies, the prairie jumping mouse *Zapus hudsonius intermedius* and the Bear Lodge meadow jumping mouse *Zapus hudsonius campestris*. They stated a priori that their intention was to reach a conclusion that would be 'in the best interest of biodiversity conservation' and they subsequently argued that the data they presented in support of their recommended synonymy were cast in a light of unbiased hypothesis testing (REA). Despite these stated claims, they dismissed the geographic isolation of this population as unimportant, ignored most of the diagnostic characters initially cited in the taxon's original description by Krutzsch (1954), concluded without data or citation a lack of ecological distinctiveness of this population, and finally misinterpreted the morphological and molecular data they presented.

Zapus hudsonius preblei is currently a recognized taxon and a legally protected subspecies, thus, we regard its geographic and genetic isolation, occurrence in an ecoregion distinct from that of conspecifics (Chapman *et al.*, 2004), and formally described distinctive phenotypes of pelage and skull shape (Krutzsch, 1954) as operative hypotheses that must be explicitly disproven for synonymy to be accepted. REA proposed synonymy of *Z. h. preblei* based on four main lines of evidence – ecological differentiation, cranial morphology and analyses of mitochondrial DNA and nuclear microsatellites – and implied that their study should serve as a model of a 'conceptually sound and consistent methodological approach' for evaluating the genetic basis for listing under the US-ESA. We find that despite the potential for objective interpretation, REA reached conclusions that were neither justified by the narrow scope of their study nor supported by the data they presented. Instead, we argue that their own data support the current classification of *Z. h. preblei* as a separate evolutionary unit and a genetically distinguishable subspecies.

It is impossible to predict future patterns of speciation; thus, in our efforts to preserve biodiversity, we must seek to maximize evolutionary potential through the protection of populations on separate evolutionary trajectories (O'Brien & Mayr, 1991; Hey *et al.*, 2003). Given that the most important aspect of preserving biodiversity is protecting evolutionary potential, we are concerned that the erroneous application and interpretation of morphometric, genetic and ecological information presented by REA in an effort to subsume an evolutionarily distinctive population will not only undermine efforts to conserve this taxon but also serve as a misleading precedent applied to broader conservation programs.

Ecological analysis

REA dismissed the isolation of *Z. h. preblei* from conspecific populations, particularly *Z. h. campestris*, as merely 160 km, yet, this 160-km swath of non-habitat separating the

northern Front Range foothills from the Black Hills foothills is the widest separation between any two subspecies of *Zapus hudsonius* (Cryan, 2004) and as such constitutes a sufficient 'primary isolating mechanism' to stop or significantly reduce gene flow, a necessary criterion for the definition of a subspecies (Whitaker, 1970; O'brien & Mayr, 1991). Additionally, it has previously been established that substantial environmental differences occur between the ranges of each of these subspecies. *Z. h. preblei* is restricted to the grama–buffalo grass association, whereas *Z. h. campestris* is found in wheatgrass–needlegrass or grama–needlegrass–wheatgrass associations (Küchler, 1970). The inarguably different environments of these disjunct populations (Chapman *et al.*, 2004; Cryan, 2004) make it likely that, in the absence of significant gene flow, ecological phenotype has diverged between them. Given this geographic and environmental separation, we argue that the potential for ecological differentiation among these populations is high.

REA ignored this most conservative expectation and assumed that a lack of studies to test specifically for ecological differentiation among subspecies is equivalent to an actual lack of ecological differentiation. Further, while REA (pp. 330–331, 339–340) represented their ecological analysis as a 'method' with 'results,' they presented nothing that could be interpreted as a 'test' of 'ecological exchangeability.' REA claimed to have 'examined the literature' for evidence of ecological differences between subspecies, but they neither provided detailed methods for the selection and evaluation of articles nor supported their assertion with *any* type of statistical analysis. REA admit their 'absence of evidence' is not 'evidence of absence'; their conclusion of 'ecological exchangeability' is an unsupported opinion.

A search covering 1965–2005 on the ISI Web of Knowledge (http://portal17isiknowledge.com) produced only six studies (Bain & Shenk, 2002; Schorr & Davies, 2002; Brook, Zint & De Young, 2003; Conner & Shenk, 2003; Meaney *et al.*, 2003; Ramey *et al.*, 2005), including REA, for '*Zapus hudsonius preblei*' or 'Preble's meadow jumping mouse,' none of which tested ecological phenotype, and no studies for '*Zapus hudsonius campestris*,' '*Zapus hudsonius intermedius*' or their respective common names. Clearly, the question of ecological exchangeability among these subspecies simply has not been posed. The lack of peer-reviewed publications on the ecology of *Z. hudsonius* subspecies (e.g. life-history characteristics, population dynamics and viability, and habitat selection; Cryan, 2004) indicates that solid research on these populations is needed before *any* conclusions can be reached about their ecological distinctiveness or exchangeability. We reject REA's claim that they conducted a test for ecological exchangeability and stress that until the question of ecological exchangeability is investigated directly, this line of inquiry is uninformative as to the question of divergence among these taxa.

Morphometric analysis

Krutzsch (1954) described 11 characters that distinguished the disjunct population of *Z. hudsonius* along the Colorado (CO) and Wyoming (WY) Front Ranges from its most similar conspecific, *Z. h. campestris* of the Black Hills–Missouri Plateau, five of these were qualitative descriptions of pelage and six were skull characteristics. The six skull characters included interorbital breadth, size and shape of auditory bullae, width and shape of incisive foramina, and degree of inflation of the frontal region. REA examined none of the pelage characters, and of the nine cranial measurements REA examined, only one – interorbital breadth – was among the six cranial characters actually cited by Krutzsch as distinguishing *Z. h. preblei* from *Z. h. campestris*. Of the cranial metrics REA used, five included greatest length of skull (GLS) or measures highly correlated with GLS, and the other four were measures of skull breadth. Interestingly, of the 36 pairwise Pearson correlation coefficients among these nine variables, 26 were significant at $P<0.001$ (two-tailed α, Minitab, 1996; raw data from U.S. Fish and Wildlife Service (USFWS, 2004).

No univariate or multivariate analysis of these metrics could possibly have resolved the incisive foramina, auditory bullae or frontal inflation size/shape characters cited by Krutzsch (1954) as constituting 'considerable differences.' Therefore, REA have conducted an incomplete test of the morphologic hypothesis put forth by Krutzsch. Importantly, the sole univariate character cited by Krutzsch that REA did examine, interorbital breadth, was found to be narrower in *Z. h. preblei* than in *Z. h. campestris*, as described in the definitive findings (Krutzsch, 1954). Thus, the small fraction of Krutzsch's morpho-taxonomic hypothesis actually tested by REA confirmed Krutzsch's initial findings of distinctiveness for *Z. h. preblei*. Oddly, their conclusions imply the opposite. REA apparently viewed a multivariate statistical test of a standard set of morphologic variables, although incomplete and intercorrelated, as a substitute for attempting to quantify the specific shape differences noted by a trained morpho-taxonomist. One should not expect such an arbitrary, hypothesis-free approach to resolve subspecies relationships (Gift & Stevens, 1997; Poe & Wiens, 2000); examples of the failure of this blind approach abound, even when comparing full species (e.g. Poole, Carpenter & Simms, 1980; Zink 1988; e.g. Barratt *et al.*, 1997).

Molecular genetic analyses

Mitochondrial DNA

Although mtDNA is still occasionally used as the sole locus in phylogenetic studies, it is accepted that if doing so, sequence length should be maximized as any single locus will be subject to variation of d, the number of substitutions per site, and this variation will be reduced as the number of sites sequenced per gene is increased (Arbogast *et al.*, 2002). A much more accepted and accurate approach for obtaining a gene genealogy (gene tree) reflective of the true lineage genealogy ('species' tree), however, is the inclusion of multiple independent loci (Edwards & Beerli, 2000). The examination of divergence patterns across multiple loci decreases

the coalescent variation (the stochastic variance in gene divergence times which arises due to genetic drift; Arbogast *et al.*, 2002) and thus vastly improves the estimate of the true history of a lineage. When only a single locus is used to construct a phylogeny, discordances between this single locus gene tree and the actual species tree will be expected due to ancestral polymorphism and incomplete lineage sorting (Maddison, 1997; Arbogast *et al.*, 2002). These processes are expected to be even more pronounced in recently diverged lineages and those with structured populations (Wakeley, 2000, 2001), as would be expected in this habitat-specific subspecies group. Despite these well-understood expectations, REA used only a single, short [346 base pairs (bp)] region of the mtDNA control region to test for divergence among the *Z. hudsonius* subspecies group and then treated the patterns of divergence observed within this single region as equivalent to the patterns of divergence among the subspecies.

We caution that the mtDNA data presented by REA should be viewed as preliminary. However, we find that in their current state they are nonetheless consistent with the expectation of incomplete lineage sorting and are indicative of divergence among the subspecies examined. Although bootstrap support for the split between the *Zapus hudsonius luteus*/*Zapus hudsonius pallidus* and *Z. h. preblei*/*Z. h. campestris*/*Z. h. intermedius* clades was high, support was quite low for REA's terminal clades ($\leq$ 50–68%); thus terminal branching patterns within this phylogeny should be considered hypotheses with little support (we note in particular that terminal branch support for clades that grouped *Z. h. preblei* with *Z. h. campestris* appeared to receive support of <52%). Nonetheless, all individuals identified a priori as *Z. h. preblei* grouped within a single clade. REA put forth reciprocal monophyly (Moritz, 1994*b*) as the sole criteria for accepting divergence among subspecies; however, given the expectation of incomplete lineage sorting, this requirement was overly stringent, and it being the sole criteria for acceptance of divergence increased the likelihood that REA would conclude that no differences exist among subspecies. Notably, and consistent with an understanding that incomplete lineage sorting can complicate the understanding of phylogenetic history, Moritz (1994*a*) modified his proposal of reciprocal monophyly with the suggestion that significant, but not necessarily absolute, separation of alleles among populations is an appropriate indicator of the presence of distinct, taxonomically recognizable entities.

Although we find the current phylogeny generated by REA to be preliminary, the marked differences in haplotype frequencies observed among the five subspecies clearly support divergence. In order to further explore the pattern of haplotype frequencies among the different subspecies, we designated each observed haplotype (from REA) to the subspecies within which it occurred with the highest frequency (calculated from Appendix 2 of REA); for example, all L and L/PAL haplotypes were assigned as '*luteus* haplotypes' (with frequencies in *Z. h. luteus* of 1.00), although they also occur in *Z. h. pallidus* and *Z. h. campestris* at much lower frequencies (0.059 and 0.129, respectively; Table 1). 'Contaminant' haplotypes may result from incomplete lineage sorting, migration from adjacent subspecies or misidentification of individuals at subspecific boundaries. Although both incomplete lineage sorting and migration of individuals from adjacent subspecies would be expected, other cases of supposed 'contamination' more likely result from misidentification of individuals. For example (Appendix 2 of REA), three individuals of '*Z. h. intermedius*' from Harding Co. in north-western South Dakota (Fig. 1) with the C5/INT13 haplotype (designated as a '*campestris* haplotype') are mapped by REA (their fig. 4) as occurring within the range of *Z. h. campestris*, and two individuals of '*Z. h. pallidus*' from Clay Co. in extreme south-eastern South Dakota (Fig. 1) with the PAL1/INT15 haplotype (designated as an '*intermedius* haplotype') are the only '*Z. h. pallidus*' found within the range of *Z. h. intermedius*, north of the Missouri River. Even if we assume these individuals were correctly assigned to subspecies, *Z. h. preblei*, *Z. h. luteus*, *Z. h. intermedius* and *Z. h. pallidus* exhibited low frequencies of 'contaminant' haplotypes of all types, whereas *Z. h. campestris* contained an admixture of haplotypes (Table 1, Fig. 1).

Table 1 Frequency of subspecies characteristic haplotypes (assigned to subspecies based on highest frequency of occurrence) within five subspecies of *Zapus hudsonius*

	Subspecies				
Haplotype	*Preblei*	*Luteus*	*Intermedius*	*Pallidus*	*Campestris*
Preblei	**1.000**				0.226
Luteus		**1.000**		0.059	0.129
Intermedius			**0.915**	0.059	0.258
Pallidus			0.021	**0.882**	
Campestris			0.064		**0.387**

The frequency at which each subspecific haplotype is found within each subspecies is shown in boldface along the diagonal; squares indicate ancestral haplotypes shared likely due to incomplete lineage sorting; ovals indicate results of possible migration or mistaken subspecific identification (based on geographic location).

The unique admixture of haplotypes in *Z. h. campestris* may indicate a previously more widespread distribution (allowing retention of ancestral haplotypes), may simply reflect that subspecies' geographic position adjacent to three other subspecies (opportunities for migration and misidentification), or a combination of both factors. Notably, no contaminant haplotypes were found in *Z. h. preblei*, and although '*preblei* haplotypes' were also found in the highly admixed *Z. h. campestris*, the haplotype frequency differences between these subspecies were striking (Fig 1, Table 1 and REA fig. 3). This pattern of significant haplotype frequency differences occurring in conjunction with a lack of reciprocal monophyly for two closely related lineages is consistent with the process of incomplete lineage sorting wherein ancestral polymorphism of haplotypes is retained across divergent lineages at low frequencies (Avise, 2000). Such incomplete sorting of haplotypes is not only expected theoretically, but has also been well documented in a wide

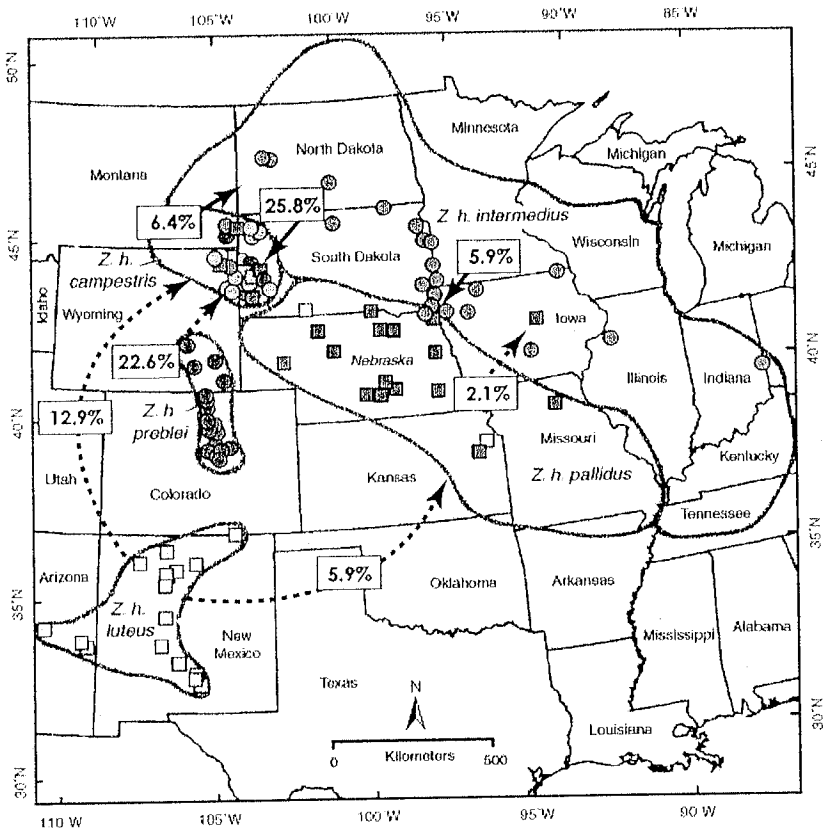

Figure 1 Distribution of mtDNA haplotypes among five subspecies of *Zapus hudsonius*. Squares = *pallidus-luteus* lineage, circles = *intermedius-campestris-preblei* lineage (from fig. 3 of Ramey *et al.* 2005). Colors (modified from the original figure) indicate haplotype assignment to subspecies (see text and Table 1). Percentages of haplotypes characteristic of one subspecies and found in another are indicated within boxes next to arrows. Solid arrows indicate probable migration or mistaken subspecific identification of samples; dotted arrows indicate probable shared-ancestral haplotypes due to incomplete lineage sorting.

variety of organisms, including taxa that are clearly separate biological species (Avise, 2000).

Given the availability of rapid DNA sequencing technology, universal primers for mtDNA amplification and numerous nuclear loci for mammals (48 reported by Yang & Nielsen, 1998), the short sequence of the single mtDNA locus used by REA represents a minimal effort toward revealing patterns of divergence in this group and should be observed as only a preliminary foray into its true evolutionary history. Many studies investigating similar questions of lineage divergence have used much higher standards and these should be viewed as more solid models for taxonomic investigation. For example, Roca *et al.* (2001) used 1732 bp from four nuclear DNA genes to separate African forest elephants from savannah elephants as separate species. Culver *et al.* (2000) used 891 bp of mitochondrial DNA and 10 DNA microsatellites to collapse 15 historically recognized subspecies of puma into six subspecies, and Jones *et al.* (in press) used 1900 bp of combined mitochondrial and nuclear DNA sequences and 10 DNA microsatellites to distinguish populations of endangered freshwater mussels as either species or subspecies. These studies also used geography, life history, behavior and morphology to corroborate their findings. Given the strength of the arguments for the use of multiple loci in phylogenetic studies and the prevalence of numerous studies demonstrating much higher standards of data inclusion, the single-locus, short sequence approach used by REA should be viewed as precursory and most certainly should not be presented as an adequate basis for the making of taxonomic decisions regarding a listed taxon.

The taxa investigated by REA clearly violate an assumption of the MDIV test for gene flow among subspecies, the assumption of equal effective population size (N_e). Nevertheless, if we assume their estimates are generally accurate, the degree of gene flow between *Z. h. preblei* and *Z. h. campestris* is very low, an unscaled rate of 0.000033 to 0.0000032 individuals per generation. This rate does not qualify as homogenizing gene flow. Natural hybridization among well-differentiated species can occur at rates higher than this (e.g. Campton & Utter, 1985; Arnold, 1992; Roques, Sevigny & Bernatchez, 2001), and low levels of gene flow do not preclude local adaptation (Broggi *et al.*, 2005). Although complete introgressive hybridization

(i.e. hybrid swarms) may exclude hybridized populations from the units considered for listing under the US-ESA (Allendorf *et al.*, 2004), REA quite clearly demonstrate that this level of introgression is *not* occurring among *Z. h. preblei* and other subspecies.

Microsatellites

Similar to the analysis of mtDNA sequence data, REA used too few loci in the microsatellite analysis to ensure high resolution. Smouse & Chevillon (1998) state that 'large numbers of polymorphic loci' are required 'to assign individuals to their correct population' and emphasize that there is a positive relationship between the number of populations in question and the number of loci required to place individuals correctly. In initially describing the STRUCTURE method used by REA, Pritchard, Stephens & Donnelly (2000) were unable to acquire a clear estimate for K (the number of populations represented within the sample) with their simulated dataset using five polymorphic loci. Further, they concluded that 'the accuracy of assignment depends on... the number of loci [which will affect the accuracy of q_{MAX} (likelihood of assignment of an individual to a given cluster)].' Although locus availability is often a problem, as of 2003 there were at least eight additional microsatellite loci for *Zapus* spp. (Vignieri, 2003) available for use by REA.

Given the expected low resolving power of the microsatellite data, REA's results are surprisingly strong in support of differentiation of *Z. h. preblei* from the other subspecies. F_{ST} values that are significantly different from zero indicate that gene flow among the compared populations is limited enough to result in genetic divergence. F_{ST} values observed among *Z. hudsonius* subspecies were significant for all pairwise comparisons, indicating that variation in allele frequencies among subspecies was greater than that within subspecies (Wright, 1951; Weir & Cockerham, 1984); thus the subspecies are genetically diverged. Although REA argue that their observed F_{ST} values are low (0.07–0.16), they are well within the range generally observed among subspecies in mammals (gray wolf 0.168, Roy *et al.*, 1994; African buffalo 0.059, Van Hooft, Groen & Prins, 2000; jaguar 0.065, Eizirik *et al.*, 2001). Further, REA report high per-locus polymorphism and high values of within-population heterozygosity, H_S (0.69–0.94). Considering the value of F_{ST} can be no larger than $1-H_S$ (Hedrick, 1999), even with complete differentiation, the highest absolute F_{ST} we would expect for the loci used by REA ranges from 0.06 to 0.31, and thus the F_{ST} values observed among subspecies are relatively high.

Strong support for differentiation among subspecies is also found in the STRUCTURE analysis. Although resolving power with five loci is limited, q_{MAX} for both *Z. h. preblei* populations was quite high ($q_{MAX} = 0.85$ for the northern population and 0.86 for the southern population). All other subspecies had lower q_{MAX} values, including *Z. h. luteus* (0.67), whose distinctiveness REA do not question. Similarly, correct assignment proportions for both northern (42.9%) and southern (54.5%) populations of *Z. h. preblei* were considerably higher than those observed in any other subspecies, including *Z. h. luteus* (only 21.9% of individuals correctly assigned). Additionally, 95% of the northern population and 94% of the southern population of *Z. h. preblei* were assigned to two clusters (2 and 5) that had very few individuals assigned from any of the other subspecies (REA table 6). Given the low resolving power of the loci used by REA, the relatively high proportion of correct assignment observed in *Z. h. preblei* populations provides further strong evidence of differentiation.

Use and Interpretation of AMOVA

REA used AMOVA as a measure of distinctiveness of *Z. h. preblei*, and set the criterion that there must 'be greater molecular variance among than within subspecies.' Results from mtDNA sequences showed that 18.5–37% of variation was found between subspecies, and microsatellite data indicate that 7.5–9% of variation occurred between populations. Although the authors do not present a significance value for the AMOVA test, they claim that *Z. h. preblei* fails these tests of genetic uniqueness. However, the within-population component of total genetic diversity may exceed the between-population component even when comparing separate species. For example, Leibers, Helbig & De Knijff (2001; using mtDNA sequence data) found that only 26.8% of the total diversity among gull populations resides among acknowledged species. Using microsatellite data, Grobler *et al.* (2005) found that only 29.2% of the total variation among blue and black wildebeest populations occurs between species. Thus, it is not necessarily expected that an AMOVA-based analysis of subspecies, or even species, will reveal more diversity among than within subspecies. The criterion used by REA was dubious at best, and the conclusion drawn from failure to meet this criterion is not valid.

Conclusion

The definition of taxonomic groups has long been an area of contention. Species concepts are abundant and continuously debated (a recent count listed 24; Mayden, 1997), and concepts of subspecies are even less well defined. Given the uncertainty present in both the definition of taxonomic status and the identification of such, in our efforts to preserve biodiversity we should be striving to protect populations of organisms that are on separate evolutionary trajectories rather than debating taxonomic definitions (Waples, 1991; Hey *et al.*, 2003). This desire has been expressed in both the literature and the intent of government policy where evolutionarily significant units (ESUs) and distinctive population segments (DPSs) have been identified as groups worthy of protection. Within the US-ESA, species are defined as 'any subspecies of fish or wildlife or plants, and any *distinct population segment* of any species of vertebrate fish or wildlife which interbreeds when mature' [16 U.S.C., Sec. 1532(16)] and it states that the definition of such groups should be determined based 'solely on the best

available science.' Clearly, the intent of conservation policy is to protect populations identified, in a scientifically rigorous way, as evolutionarily distinctive. Given the clarity of this intention, we find REA's recommendation of synonymy of *Z. h. preblei* curious and unjustified.

We firmly believe that no single approach should be used as a 'taxonomic litmus test' for taxa of conservation concern. However, for cases where such testing is appropriate, we offer a simple alternative hypothesis-testing approach based on the understanding that conservation of biodiversity requires conservation of groups that are evolutionarily distinct. Given this goal, we can address questions of conservation units based on this null hypothesis: These populations of individuals represent a readily interbreeding, undifferentiated unit with shared adaptations and a common evolutionary trajectory. What we are truly interested in revealing is whether there is *any* evidence that a given group is evolutionarily unique and therefore an important component of global biodiversity. Considering the data on *Z. hudsonius* subspecies presented by REA and other published information on the taxa and their environments we have discussed, we find the null hypothesis, that this group represents one readily interbreeding, undifferentiated unit, can be rejected, and the alternate hypothesis, that the populations currently classified as subspecies represent unique evolutionary entities, can be accepted across *all* of REA's informative lines of evidence. Gene flow between these disjunct subspecies is exceedingly low; there is evidence that *Z. h. preblei* is diverged in morphology and strong evidence that it is substantially diverged in mtDNA haplotype frequencies and microsatellite allele frequencies and allelic distribution.

Because REA assert a challenge to the Preble's meadow jumping mouse's current classification as a subspecies, the burden of proof is upon them to provide clear, solid evidence that this taxon is not evolutionarily distinct and thus its subspecific classification is unwarranted. Contrary to REA's stated conclusions, we find no evidence supporting their extreme recommendation of synonymy and instead conclude that their evidence offers further support for the classification of *Z. h. preblei* as a unique subspecies and a distinct evolutionary unit worthy of the protection it is currently afforded. Finally, we caution that vague questions of 'taxonomic validity' can undermine the intent to protect evolutionarily distinct units and we urge that this study not be considered a precedent for evaluation of validity in taxa of conservation concern.

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SPECIES ASSESSMENT FOR PREBLE'S MEADOW JUMPING MOUSE (*ZAPUS HUDSONIUS PREBLEI*) IN WYOMING

prepared by

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Introduction

"Following the Preble's listing as a threatened species in 1998, knowledge about its distribution, habitat requirements, abundance, and population dynamics has grown substantially. However, much of the biology and ecology of the Preble's is still not well understood"(USFWS 2003b).

The management of Preble's meadow jumping mouse (Preble's; *Zapus hudsonius prebeli*) is a high priority for natural resource professionals in southeast Wyoming and north-central Colorado. It is currently listed as Threatened under the U.S. Endangered Species Act (Act; USFWS 1998), and discrete units of critical habitat necessary for the subspecies' recovery have been designated by the USDI Fish and Wildlife Service (Service; USFWS 2003b). New land use regulations designed to enhance recovery within critical habitat units have the potential to alter traditional uses of natural resources throughout the subspecies' range.

The scientific controversy surrounding the conservation and management of jumping mice in southeast Wyoming is whether or not the species meadow jumping mouse, *Z. hudsonius*, and the subspecies Preble's meadow jumping mouse, *Z. h. preblei*, are distinct and valid taxa here. Unfortunately there are no straightforward criteria with which to evaluate the validity of within-genera taxa. It has long been recognized that biological diversity at this level exists as a continuum, with gradations (as opposed to quanta) of difference between individuals, populations, and races. The traditional taxonomic system forces the identification of artificially discrete units along that continuum. In this context, no single trait can adequately partition the continuum, necessitating a "weight of evidence" approach that considers multiple traits (e.g., morphology, genetics) to define within-genera taxa (DeWeerdt 2002).

Two recent petitions to remove the Preble's meadow jumping mouse from the federal list of threatened and endangered species, and recent genetic findings (Ramey et al. 2004) have prompted the Mountain-Prairie Region of the Service to initiate a status review of the Preble's (USFWS 2004). Because of the similarity in steps taken by the Service to prepare a 12-month finding on a petition to de-list a species, and the 5-year review of the listing action, these efforts will be conducted simultaneously. Within the next calendar year (through 03/31/05) the Service is scheduled to rule whether Preble's should remain listed or be proposed for delisting.

Natural History

Morphological Description

Genus *Zapus*

The following generally describes individuals of both *Z. hudsonius* and *Z. princeps*. A small rodent with hind legs much longer than forelegs. The tail is longer than the body, sparsely haired, and darker above than below. Eyes are midway between the nose and the ear. Ears are dark but edged with white. There are 18 teeth, with upper incisors having distinct grooves on their outer faces. Cheek pouches are absent. Fur on the back is yellow olive-brown with scattered, long, black-tipped hairs which create a faint dorsal stripe. The sides are light yellow-brown, and the belly is white to light buff. Young tend to have softer, lighter fur than adults. Adult pelage appears rather coarse (Long 1965, Armstrong 1972, Clark and Stromberg 1987, Fitzgerald et al. 1994, USFWS 2002a).

The general appearance of jumping mice is relatively unique; it is difficult to confuse them with other rodents in Wyoming. The extremely long tail and large hind feet are especially good characters for recognizing jumping mice. Woodland jumping mice (*Napeozapus insignis*) are very similar in appearance, but do not occur within ca. 500 mi of Wyoming (Figure 1).

Species - *Zapus hudsonius*

The following dimensions are in addition to the above description of individuals in the genus *Zapus*. Adult measurements: total length 180-220 mm; head and body length <89 mm; tail 115-136 mm; hind foot 28-31 mm; ear 11-16 mm; weight 12-22 g (Clark and Stromberg 1987, Compton and Hugie 1993). In addition, incisive foramina <4.6 mm; palatal breadth at last molariform tooth <4.2 mm; condylobasal length usually <20.3 mm; and maxillary toothrow usually <3.7 mm (Whitaker 1972).

When specimens from distant sites are compared, known *Z. hudsonius* are on average smaller in several gross body dimensions than known *Z. princeps* (e.g., Hall 1981, Jones 1981, Schorr 2001). For several years it was thought that total body length and other gross dimensions were reliable indicators of species identity within the suspected range of *Z. h. preblei* (e.g., Clark and Stromberg 1987). However, it has since become clear that there is substantial overlap in these measurements between purported *Z. hudsonius* and purported *Z. princeps* from this region. This, coupled with essentially indistinguishable pelage and body shape, has lead most mammalogists in the region to conclude that no external morphological character can be used to classify specimens from here into 2 distinct taxa.

Using multivariate analysis techniques, Conner and Shenk (2001) compared precisely-measured skull dimensions of *Zapus* specimens from low elevations (purported *Z. hudsonius*) to those of *Zapus* specimens from high elevations (purported *Z. princeps*) in northcentral Colorado and southeast Wyoming. At a sub-millimeter scale, low-elevation skulls were significantly and consistently smaller than those from high elevations. Also, known *Z. hudsonius* typically possess an anterior median tooth fold (Kilngener 1963), and many of the low-elevation *Zapus* with small skulls identified by Conner and Shenk (2001) also had this character. These results support the

contention that there are 2 *Zapus* taxa in the region that are separated by skull size and elevation in a manner predicted by general knowledge of *Z. princeps* and *Z. hudsonius*.

However, some data suggests that this separation is less apparent in the North Platte and extreme northern South Platte river basins than in areas to the south. Conner and Shenk (2001) documented a steady decline in the size of high-elevation *Zapus* skulls when moving north from Colorado into southern Wyoming; i.e., although still statistically significant, the elevation-dependent difference in skull dimensions was less in Wyoming than in Colorado. Furthermore, some *Zapus* specimens recently captured at mid-elevations (ca. 7200') in the North Platte River basin in Wyoming have large skulls, suggesting *Z. princeps*, but also possess an anterior median tooth fold, suggesting *Z. hudsonius*. Preliminary analyses of other recently-captured specimens from southeast Wyoming indicate that individuals with large skulls and no tooth folds (suggesting *Z. princeps*) were captured within a few meters of individuals with small skulls and present tooth folds (suggesting *Z. hudsonius*; C. Meaney and C. Jones, personal communication; Denver Museum of Nature and Science).

Subpecies *Zapus hudsonius preblei*

Compared to *Z. h. campestris* and *Z. h. pallidus*, *Z. h. preblei* is described as slightly smaller and duller in color, with a less distinct dorsal band and fewer black-tipped hairs (Krutzsch 1954).

As discussed above, there are no external morphological characters that can reliably classify specimens of *Zapus* from southeast Wyoming to species. Therefore, for live specimens that cannot be resolved to species, it is unreasonable to expect external morphology to reliably indicate subspecies; i.e., uncertainty at the species level would propagate to the subspecies level.

Even for prepared specimens tentatively classified as *Z. hudsonius*, external morphology is likely to be an inexact indicator of subspecies because distinctions at this level are qualitative and

usually require subjective evaluation; e.g., ochraceous upper parts for Z. *h. preblei* versus "brighter ochraceous (and more blackish) upper parts" for Z. *h. campestris* (Long 1965). Although some *Zapus* from Wyoming and surrounding states may match the description of a particular subspecies quite well, most are likely to span the descriptions of 2 or more of the 5 subspecies in the region. This is probably especially true in and near areas where the subspecies co-occur and interbreed (e.g., the contact zone between Z. *h. campestris*, Z. *h. pallidus*, and Z. *h. intermedius* in northwest South Dakota; Figure 2).

Krutzsch (1954) first established the subspecies Z. *h. preblei* in southeast Wyoming and northcentral Colorado based on comparisons of precisely-measured body dimensions of prepared museum specimens. In a subsequent re-analysis using a larger sample of specimens, Jones (1981) concluded that although Z. *hudsonius* in this area were geographically isolated, there was insufficient morphological evidence to support their subspecific status, or indeed the subspecific status of any Z. *hudsonius* population.

Taxonomy and Distribution

Genus *Zapus*

North America supports 2 genera of jumping mice: *Napeozapus* and *Zapus*. Only the latter occurs in the state and vicinity of Wyoming (Hall 1981, Whitaker 1999a, Whitaker 1999b, Cranford 1999, Gannon 1999; Figure 1). A similar genus, *Eozapus*, occupies eastern Asia (Krutzsch 1954).

Species *Zapus hudsonius*

The genus *Zapus* includes 3 species. Two of these, the western jumping mouse, Z. *princeps*, and the meadow jumping mouse, Z. *hudsonius*, occur within the state and vicinity of Wyoming (Figure 1; Figure 2). The more common and westerly-distributed Z. *princeps* generally occurs

along streams and in mesic upland vegetation in montane and subalpine zones, occasionally ranging into foothills and even prairie zones along stream courses. The more easterly-distributed *Z. hudsonius* is rarer in this region, occurs in riparian zones in prairie and foothills environments, and occasionally ranges into montane areas along stream courses (Quimby 1951, Krutzsch 1954, Long 1965, Armstrong 1972, Whitaker 1972, Hall 1981, Clark and Stromberg 1987, Fitzgerald et. al. 1994, Cranford 1999, Whitaker 1999a).

Subspecies *Zapus hudsonius preblei*

E.A. Preble made the first scientific collection of *Z. hudsonius* in this region at a site near present day Loveland, Colorado, in 1899 (Preble 1899). Early specimens of *Z. hudsonius* from southeast Wyoming and northern Colorado were classified as *Z. h. campestris* (e.g., Warren 1910, Cary 1911). This trinomial is currently reserved for the Bear Lodge meadow jumping mouse, a separate subspecies now thought to occur only in the Black Hills region (Whitaker 1999a; Figure 2). Krutzsch (1954) first described the subspecies *Z. h. preblei* in southeast Wyoming and northern Colorado.

Mammalogists currently recognize 5 subspecies of *Z. hudsonius* in the vicinity of Wyoming (Whitaker 1999a, Hafner et al. 1981, Morrison 1992; Figure 2). Only *Z. h. preblei* and *Z. h. campestris* are thought to occur in the state (southeast and northeast corners, respectively). Three subspecies (*Z. h. intermedius*, *Z. h. campestris*, *Z. h. pallidus*) are regarded as contiguous (i.e., interbreed regularly along the boundaries of their respective distributions) and essentially represent the westernmost extent of the continuous distribution of *Z. hudsonius* in the United States (Hall 1981, Whitaker 1999a). The remaining 2 subspecies, *Z. h. preblei* and *Z. h. luteus*, are thought to be Pleistocene relicts completely isolated from each other and other *Z. hudsonius* subspecies (Hafner et al. 1981, Jones 1981, Morrison 1992, Hafner 1997; Figure 1, Figure 2).

Biogeography

Genus *Zapus*

Genera immediately ancestral to *Zapus* and *Napeozapus* are known from North American sites dating to the early Pliocene. *Zapus* in its current form has been relatively widespread in North America since the early Pleistocene, when the continent was occupied by at least Z. *hudsonius* and 2 other, now-extinct species. *Napeozapus* is thought to have achieved its current form in the mid-Pleistocene. Diversification of early *Zapus* into the 3 extant species likely occurred during repeated geographic isolation of eastern and western groups during Pleistocene glaciations. The eastern isolate generated Z. *hudsonius*, whereas the western isolate generated Z. *trinotatus* and Z. *princeps* (Krutzsch 1954). The current interglacial has allowed Z. *hudsonius* and Z. *princeps* to come into close contact, including broad zones of sympatry in the northern U.S. and southern Canada and narrower zones of sympatry along the Rocky Mountain front in New Mexico, Colorado, and Wyoming (Figure 2). Such "re-contact" between the 2 species is assumed to have occurred during earlier interglacial periods as well, alternating in cycle with isolation during glacial periods.

Species - *Zapus hudsonius*

During the late Pleistocene (ca. >10,000 years ago) the eastern slope of Southern Rocky Mountains and adjacent lowlands supported more cool and mesic grassland suitable for Z. *hudsonius*, presumably leading to larger and more widespread populations of the species here. At this time Z. *princeps* was probably isolated to the west of the Rocky Mountains in the Great Basin and adjacent regions. The warming and drying of the western United States during the early Holocene shifted mesic grassland, and thus the main center of occurrence of Z. *hudsonius*, to the north and east; Z. *h. campestris* now occupies the periphery of this shifted range (Figure 2).

However, pockets of suitable habitat remained along the Southern Rocky Mountain front, allowing disjunct populations to persist here. Through the combined forces of founder effect, genetic drift, and adaptation, these disjunct populations are thought to have diverged to the subspecies level and now exist as *Z. h. luteus* and *Z. h. preblei* (Hafner et al. 1981, Jones 1981, Morrison 1992, Hafner 1997). The Holocene climatic amelioration presumably also allowed *Z. princeps* to move east onto the Rocky Mountains to its present position (Figure 2).

It is generally accepted that *Z. princeps* occurs at higher elevations than *Z. hudsonius* in Colorado and Wyoming. The former species is thought to primarily occupy subalpine and montane zones, with peripheral extensions into foothills and possibly even prairie environments along riparian corridors. In contrast, *Z. hudsonius* is thought to primarily occupy prairie riparian environments, with peripheral extensions into the foothills and montane zones along riparian corridors. This pattern obviously suggests zones of *Z. princeps* X *Z. hudsonius* co-occupation along mountain-front riparian systems.

Zones of co-occupation are likely to be rather narrow along the Front Range of Colorado, where the abrupt mountain front and high terminal elevations can be expected to sharply divide prairie and montane biota. Some areas of likely sympatry between *Z. hudsonius* and *Z. princeps* along the Front Range are currently being studied (e.g., Trout Creek, Douglas County, Colorado; Schorr 1999).

Importantly, the biogeographic situation changes rather markedly in the extreme northern South Platte River basin (ca. Cache La Poudre River and points north) and North Platte River basin. A large area of sympatry between *Z. hudsonius* and *Z. princeps* in northern Colorado and southeast Wyoming has been suspected, if not conclusively demonstrated, by mammalogists for quite some time (e.g., Long 1965, Armstrong 1972). The major mountain range here, the Laramie

Mountains, has a rather gradual east slope (leading to much interdigitation of prairie, foothills, and montane biota), a low crest (<7500' in many places), and is bisected by a major river system (Laramie River) that connects large areas of mixed grass prairie on either side of the range. These factors suggest that the zone of co-occupation may be quite broad along the Laramie Mountains and that this range is not a western barrier to *Z. hudsonius*. Since 1998 the USDA Forest Service and other field workers have captured several suspected *Z. hudsonius* between 7500 - 8500 ft elevation in the Laramie Range (WYNDD, unpublished data).

Also, four capture locations to the west of the Laramie Range in Wyoming bear mentioning in this context:

1. A *Zapus* specimen captured in the Snowy Range (southwest Albany County, Wyoming) in the 1970's was originally identified as *Z. hudsonius*, but then was subsequently relabeled *Z. princeps* based on the relatively high elevation of the capture location. However, preliminary results using the methods of Conner and Shenk (2001) suggest that this specimen may in fact be *Z. hudsonius* (C. Jones, Denver Museum of Nature and Science, personal communication). It is assumed that the specific identity of this specimen is currently being investigated more thoroughly.
2. In summer 2000, WYNDD zoologists captured several *Zapus* on the floor of the Laramie Valley (central Albany County, Wyoming; ca. 7200'). These individuals were taken from a cottonwood-willow riparian corridor bordered by mixed grassland, several miles from the nearest montane forest; such habitat suggests *Z. hudsonius* rather than *Z. princeps*. It is assumed that the specific identity of these specimens is currently being investigated with methods of Conner and Shenk (2001), and that tissue from these specimens will be included in ongoing genetic analyses (Ramey et al. 2002).
3. In summer 2002 WYNDD zoologists captured several *Zapus* spp. along the Laramie River ca. 30 mi north of the town of Laramie, Wyoming (ca. 7100'). These individuals were taken in a grass- and willow-dominated riparian corridor bordered by mixed grassland, several miles from the nearest montane forest; such habitat suggests *Z. hudsonius* rather than *Z. princeps*. Preliminary results using the methods of Conner and Shenk (2001)

suggest that some of these specimens may be *Z. hudsonius*; oddly, others in this group (which were all captured within several meters of one another) appear to be *Z. princeps* (C. Meaney and C. Jones, Denver Museum of Nature and Science, personal communication). It is assumed that tissue from these specimens will be included in ongoing genetic analyses (Ramey et al. 2002).

4. In summer 2002 WYNDD zoologists captured several *Zapus* spp. at Hutton Lake National Wildlife Refuge, ca. 12 mi southwest of the town of Laramie, Wyoming. These individuals were taken in a grass- and reed-dominated wetland bordered by mixed grassland, several miles from the nearest montane forest; such habitat suggests *Z. hudsonius* rather than *Z. princeps*. Preliminary results using the methods of Conner and Shenk (2001) suggest that some of these specimens may be *Z. hudsonius* (C. Meaney and C. Jones, Denver Museum of Nature and Science, personal communication). It is assumed that tissue from these specimens will be included in ongoing genetic analyses (Ramey et al. 2002).

If further analyses continue to suggest that some of these specimens are *Z. hudsonius*, the suspected range of the species in southeast Wyoming may need to be extended west to include the drainage basins of the Upper Laramie River, Little Laramie River, Rock Creek, and possibly Medicine Bow River.

Subspecies *Zapus hudsonius preblei*

The uncertainty regarding the species level taxonomy of *Zapus* in southeast Wyoming makes it difficult to accurately portray distributions of subspecies here. As currently understood, presumed *Z. h. preblei* have been documented in both the North Platte and South Platte river basins of Wyoming, with collection sites as far north as the town of Douglas, west to the town of Boxelder, and east to the vicinity of Slater (Figure 3). The crest of the Laramie Mountains is generally regarded as the western boundary of *Z. h. preblei* in Wyoming. However, as discussed above, this may be untenable and further analyses may show the western boundary of *Z. h. preblei* farther to the west in Wyoming.

It is generally accepted that *Zapus* in southeast Wyoming are geographically isolated from populations to the north (*Z. h. campestris*) and east (*Z. h. pallidus*) because the intervening shortgrass prairie is too dry and sparsely-vegetated, even on the borders of streams, to provide suitable habitat (Figure 2). However, there have been very few surveys for *Zapus* in these intervening areas. Also, habitat suitability for *Zapus* has been increasing in these areas over the past century, largely due to the westward progression of gallery forests (Choate and Reed 1986, Knopf 1986, Knopf and Samson 1996), and both Choate et al. (1991) and Frey (1992) have demonstrated recent westward expansions in the ranges of *Z. h. intermedius* and *Z. h. pallidus*. These trends suggest increasing likelihood of connectivity between *Zapus* in southeast Wyoming and populations to the north and east. Connectivity between these populations could have two major management implications: (1) increased effective population size and genetic diversity, possibly reducing the risk of local extinction, and (2) erosion of any unique genetic and morphological characters currently maintained in the populations.

In summer 2000, *Zapus* surveys were performed on the USDA Forest Service Thunder Basin National Grassland on streams in the headwaters of the Cheyenne River. No *Zapus* were found (T. Byer, USDA Forest Service, personal communication). In summer 2002, *Zapus* surveys were performed at 6 sites in Goshen County, Wyoming, again with no *Zapus* captured. These efforts lend direct support to the geographic separation of *Zapus* in southeast Wyoming from *Z. h. campestris* and *Z. h. pallidus*. More such surveys are needed in these areas to corroborate these initial findings.

It is important to note that separation between *Z. hudsonius* subspecies is also an issue in southern Colorado where *Z. h. preblei* and *Z. h. luteus* approach each other. Indeed, this is another area where *Z. princeps* come into close contact, and possibly sympatry, with *Z. hudsonius*. The

issues of range overlap, potential hybridization, and taxonomic clarity explored above for *Zapus* in southeast Wyoming may have parallels in southern Colorado.

Habitat Requirements

General

Genus *Zapus*

All members of *Zapus* and *Napeozapus* show strong affinities for heavily-vegetated habitats in proximity to open and flowing water (Whitaker 1972, Whitaker 1999a, Whitaker 1999b, Cranford 1999, Gannon 1999). *Napeozapus* prefer forested and woodland habitats and are rarely found elsewhere; in contrast, *Zapus* commonly occupies grass and forb-dominated wetlands as well as wooded sites. Fungi may be more important in the diet of *Napeozapus* than *Zapus*, with the latter genera depending more on seeds and vegetation. Members of both genera hibernate for approximately half the year (Whitaker 1999b).

Species *Zapus hudsonius*

The general life history of *Z. hudsonius* has been described by several authors (e.g., Long 1965, Armstrong 1972, Whitaker 1972, Clark and Stromberg 1987, Fitzgerald et al. 1994, Whitaker 1999a), as has similar information for *Z. princeps* (e.g., Long 1965, Armstrong 1972, Clark and Stromberg 1987, Fitzgerald et al. 1994, Cranford 1999). The major distinction between the 2 species in this region appears to be elevation of occurrence: the distribution of *Z. princeps* is primarily montane, whereas that of *Z. hudsonius* is centered on prairie. Both species are strongly associated with riparian habitats. However, *Z. princeps* is known to range relatively frequently into uplands in montane and subalpine areas, whereas *Z. hudsonius* rarely strays from riparian zones in prairie environments (but see discussion of *Z. hudsonius* upland forays in Shenk and Sivert 1999, Ryon 1999, Schorr 2001). It is difficult to know whether this stems from an intrinsic

biological difference between the taxa or is simply due to the fact that high elevation uplands are more mesic than prairie uplands.

Aside from elevation of occurrence, *Z. princeps* and *Z. hudsonius* are ecologically very similar in this region, although it must be recognized that there is a relative paucity of comparative field studies. There is no indication that these species diverge in life history traits to any substantial degree; with the currently limited knowledge base, it appears that within-species variation in most ecological traits may be as great as between-species variation.

Subspecies *Zapus hudsonius preblei*

The basic ecology of *Z. h. preblei* has been outlined by several authors (see USFWS 2002a). All purported subspecies of *Z. hudsonius* in Wyoming and surrounding states are strongly associated with riparian habitats. It is assumed that *Z. h. campestris*, *Z. h. pallidus* and *Z. h. intermedius* range more into uplands than either *Z. h. preblei* and *Z. h. luteus*, but that this may be a function of climate (uplands are more mesic and heavily-vegetated in the Black Hills and central Great Plains relative to the Rocky Mountain front) rather than intrinsic differences in the subspecies' biology. Variations in food habits, hibernacula, reproductive characteristics, and other traits may all similarly vary with geography. Clippinger (2002) suggests physiognomy, or vegetation structure, predicts Preble's presence or absence better than any particular plant species. As is the case with full species of *Zapus*, there is a general lack of field studies that compare subspecies. Current information suggests no great degree of ecological divergence between subspecies.

Breeding

There are no unique breeding habitat requirements of Preble's, beyond the characteristics of general summer range. Historically, grass nests of meadow jumping mice have been described as

day nests, maternal nests, or chambers. Quimby (1951) described nests of jumping mice as requiring some form of protective substrate, such as a hollow log or tree, or placement underground. Nests in eastern Colorado (n=5) were close to streams (3.1 m ± 4.0 *SE*), and had shrub and a thick grass cover component (Ryon 2001). Ryon surmised that day nests are commonly above ground, and maternal nests are more substantial underground dwellings.

Winter

The species winter habitat is not different from breeding habitat, hibernating in flood-safe areas of riparian zones from mid-October to early May (USFWS 2002a). Confirmed or suspected hibernaculum (n=15) have been documented between one and 78 m from either a main drainage or tributary. Clippinger (2002) cites studies which have detected active hibernaculae over 300 m away from riparian corridors. The Service recovery plan (2002) reports hibernacula located under willow (*Salix* spp.), chokecherry (*Prunus virginiana*), snowberry (*Symphoricarpus* spp.), skunkbrush (*Rhus trilobata*), sumac (*Rhus* spp.), clematis (*Clematis* spp.), cottonwoods (*Populus* spp.), Gambel's oak (*Quercus gambelli*), thistle (*Cirsium* spp.), and alyssum (*Alyssum* spp.). Attributes were described from an excavated hibernaculum at Rocky Flats, which was found 9 m (30 ft) above the stream bed, in a dense patch of chokecherry and snowberry (Bakeman and Deans *in* USFWS 2003b). There is an inherent structural complexity to hibernacula; in this case, the nest was constructed of leaf litter 30 centimeters (12 in) below the surface in coarse textured soil.

Area Requirements

Trapping success is generally low outside of the riparian floodplain; however, ecological studies of Preble's have confirmed feeding and nesting behavior in upland habitats to distances of 100m from the 100-year floodplain boundary (Ryon 1999). Travel in riparian corridors has been measured to upwards of 1.6 km (1 mi.) in a single evening (Ryon 1999, Shenk and Sivert *in*

USFWS 2003b). Density and abundance were studied over a two year period in Colorado (White and Shenk 2000 *in* USFWS 2003b), wherein riparian shrub cover, tree cover, and amount of available open water nearby where characterized as good predictors of Preble's densities. Per linear km of occupied stream habitat, abundance varied from 4 to 67 mice (6-110 mice per mi), and averaged 33 mice (53 mice per mi). Mean habitat width during the breeding season was on average 215 ± 9.0 m (T. Shenk, Colorado Division of Wildlife, pers. comm. *in* Meaney et al. 2003). Based on the occurrence of 22.7 to 85.6 animals per linear km, an approximate mean density equals 1.1 to 4.0 mice/ha.

Landscape Pattern

Hydrolgic regimes that support the meadow jumping mouse are varied in size and landscape context. Perennial rivers and streams, as large as the South Platte river, or those as small as montane creeks one to three meters in width, provide suitable habitat. The Service (2002) reports a variety of lentic and lotic systems in Colorado and southeastern Wyoming with available meadow jumping mouse habitat; such as, ephemeral streams, low moist areas and dry gulches, agricultural ditches, and wet meadows and seeps near streams.

The pattern of associated habitats within the matrix of hydrologic features appears to be critical to Preble's distribution. Although critical thresholds for specific habitat types are undetermined, the matrix is most commonly represented by well-developed plains riparian vegetation, associated grassland communities, and a nearby water source (USFWS 2002a). Within these broad descriptive classes, consistent habitat attributes include multi-storied cover, consisting of a shrub canopy with an understory of dense grasses and forbs. In a multivariate comparison of vegetation between Preble's capture sites and non-capture sites, there was a high degree of similarity of the vegetation within 15 m of the waters edge. However, at distances of greater than

15 m, breadth and diversity of cover type were greater at capture sites. Higher species richness, subshrub cover and forb cover were common characteristics of occupied Preble's habitat (Clippinger 2002). Neighboring upland communities are highly variable, from open grasslands to woodlands of Ponderosa Pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*), spruce (*Picea pungens*), and occasional aspen (*Populus tremuloides*; USFWS 2002a). At the landscape scale, riparian areas with higher percentages of shrubs and subshrubs with adjacent forested land support Preble's (Clippinger 2002).

Clippinger (2002) provides evidence that the Preble's is an indicator of environmental integrity, integrity which in ecological terms means, "...a system (at whichever scale one choses) with a complete set of biotic components (native species), its vegetational structure intact, a landscape in which there is opportunity for species to move unencumbered by anthropogenic structures, and a relatively normal hydrographic regime." Ecological processes of integrated habitats would include flooding, which adds new soils into a system, encourages regeneration of native shrubs such as willows, and influences establishment of dense vegetative communities (Gregory et al. *in* USFWS 2002a), herbivory, fire, and hydrological impoundments such as beaver dams.

Movement and Activity Patterns

Daily Activity

Preble's often utilize the security of heavy cover by day, such as day nests in dense riparian vegetation, venturing further into adjacent grasslands at night to forage. Activity patterns are predominantly nocturnal or crepuscular, however daytime observations are not uncommon. Quimby (1951) noted that daytime observations of Preble's were most common on damp, overcast days.

Day Nests

The Preble's constructs 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 can also be found below ground. They are typically located under debris at the base of shrubs and trees or in open grasslands (Ryon 2001). An individual mouse can have multiple day nests in both riparian and grassland communities (Shenk and Sivert 1999a), and may abandon a nest after approximately a week of use (Ryon 2001)" (USFWS 2003b).

Meadow jumping mice are capable of leaps in excess of one meter, yet if pursued will utilize progressive hops of 30 centimeters (Whitaker 1972). General means of movement is not normally jumping, as *Zapus* will move slowly through vegetation, walking or crawling on all fours, and take very little hops (± 10 cm). Swimming as a means of locomotion by Preble's has been reported regularly (Meaney et al. 2003, Clippinger 2002).

Broad-scale Movement Patterns

Multi-year trapping studies have detected low trap site fidelity, or transiency in Preble's (Meaney et al. 2003, Whitaker 1972), a likely reflection of high species mobility. Meaney et al. (2003) observed regular travel distances of 200 meters, and occasional travel distances of approximately 600 meters. This propensity for long distance travel was detected in a seperate study in Colorado, in which Preble's moved an average of 526 meters and a maximum of 1,610 meters in a 24-hour period (Ryon 1999).

Reproduction and Survivorship

Breeding Behavior

Only the most general assumptions can be made about the breeding behavior of Preble's at this time. Very little is known about the behavior of jumping mice in general, and therefore the authors we will not make any assertions about Preble's breeding behavior in this document.

Breeding Phenology

Meadow jumping mice in the eastern United States have exhibited two seasonal peaks in reproduction, one in July followed by a second peak in August. Adults emerge from hibernation exhibiting the lowest annual measured weights (14-14.5 g, n=5; Meaney et al. 1999). The earliest capture of a pregnant female during research along South Boulder Creek, Colorado (1997-2000), was in the second week of June, though earliest reproduction occured more commonly in the third week of June (Meaney et al. 2003). Characteristics of pregnant females include weight in excess of 22 g, lactation (enlarged nipples), and visibly enlarged abdomens. Mean annual survival rate of females was estimated at 17.5 percent (± 10.8), hence females will commonly have a single reproductive season (Meaney et al. 2003). Meadow jumping mice commonly bare two litters in a season, although third litters have been reported (Quimby 1951)

Fecundity and Survivorship

Meadow jumping mice commonly produce two litters per year, but there are records of three litters per year (Quimby 1951). They average five young born per litter, but litter size can range from two to eight young (Quimby 1951, Whitaker 1972). Preble's is capable of reproduction in the season of birth, yet it is presumed that this occurs infrequently (Meaney et al. 1999)

A four-year population study of Preble's along the Colorado Front Range was able to clearly detect depressed survival rates during summer (Meaney et al. 2003). A trapping effort in excess of

21,000 trap nights monitored populations before and after a birth pulse in July. Except for two instances, population estimates along trap grids in August were unchanged. The lack of an expected population expansion following reproduction was related to lower summer survivorship in addition to dispersal and other factors, although methods could not distinguish between dispersal and mortality (Meaney et al. 2003). This study reported over-winter survival of 54.1% ± 18.8%, which was in excess of reported rates from research conducted in New York and Massachusetts. Through late August and into mid-September the weight range of Preble's prepared for hibernation was 25-34 g.

Difference in summertime survivability between sexes has been observed (Meaney et al. 2003). Females had twice the survival rate when compared to males during the Meaney study. This may be a reflection of increased vagility in males while searching for mates. Dispersal may be a confounding factor, yet evidence suggests that males are more exposed to predation during the breeding season.

Population Demographics

Metapopulation Dynamics

The authors are not aware of any current literature suggesting metapopulation dynamics are observed in meadow jumping mouse populations.

Genetic Concerns

Genetics: Genus *Zapus*

At this time there is no significant debate among mammalogists over the validity of the genus *Zapus*. It is generally accepted as a distinct and biologically-meaningful taxon and thus its genetic distinction from similar genera will not be fully explored here. It is assumed that *Napeozapus* is

the genus most closely allied with *Zapus*, and thus would show the most similar genetic patterns. As discussed above, *Napeozapus* does not occur within ca. 500 mi of Wyoming (Figure 1).

Species *Zapus hudsonius*

Genetic analyses have shown *Z. hudsonius* to be a unique and identifiable species that is relatively easily distinguished from similar species, especially when specimens from distant sites are compared. Hafner et al. (1981) used genetic analyses to identify and distinguish *Z. hudsonius* from nearby *Z. princeps* in Arizona and New Mexico. Wunder and Harrington (1996; *in* Schorr 2001) were similarly successful in using genetic patterns to resolve *Z. hudsonius* from *Z. princeps* in the South Platte River Basin in Colorado.

Riggs et al. (1997) used mitochondrial DNA to analyze the genetics of *Zapus* along the Southern Rocky Mountain front in Colorado and southeast Wyoming. Their main conclusion was that *Zapus* specimens from low elevations, suspected to be *Z. h. preblei*, formed a relatively homogenous genetic group. However, the northernmost samples in the study, including several from southeast Wyoming, were more closely allied with *Z. princeps*; these samples could not be reliably assigned to species. The general consensus among regional mammalogists is that *Z. hudsonius* X *Z. princeps* hybridization in extreme northern Colorado and southeast Wyoming is the most parsimonious explanation for such results (Hafner 1997, Riggs et al. 1997, Pague and Grunau 2000, Schorr 2001). Hybridization between related species in areas of co-occurrence is well known for other vertebrates (see examples in Pague and Grunau 2000, Hafner 1997). Krutzsch (1954) stated that *Z. hudsonius* X *Z. princeps* hybridization did not seem to occur in other areas of sympatry, such as British Columbia, but his conclusion was informed by morphological comparisons only without any genetic information.

Subspecies *Zapus hudsonius preblei*

Hafner et al. (1981) and Riggs et al. (1997; see also Hafner 1997) used genetic analyses to support subspecific status of *Z. h. preblei* as distinct from other *Z. hudsonius* subspecies, based on specimens from the South Platte and Arkansas river basins. However, as outlined above, genetic tests were unable to conclusively assign subspecies, or even species, identity to specimens from southeast Wyoming.

New genetic studies, with the intent of resolving both the species- and subspecies-level distinctions of *Zapus* in this region, have been submitted to the Office of the Governor in Wyoming and the US Fish and Wildlife Service, yet remain unpublished (Ramey et al. 2004). The thesis set forth in Ramey et al. (2004) refutes the currently accepted taxonomic distinction of *Z. h. preblei*. Instead, mitochondrial DNA sequence data suggests that *Z. h. preblei* is a less genetically variable population of *Z. h. campestris*. The Ramey (2004) study had not undergone scientific review from specialists in the fields of genetics and mammalian systematics at the time of this assessments preparation.

Food Habits

Food Items

Much of the following dietary information is found in unpublished reports of the Colorado Division of Wildlife, and reported in the federal register documents (USFWS 1998, 2003b). At present, the authors are unaware of dietary analysis from Preble's in Wyoming. It is evident, however, that Preble's utilizes a wide variety of insects and plant parts from throughout available habitat. Fecal analyses from Colorado based studies have provided the best data on the Preble's diet to date, yet components of the diet that are more digestible may be underreported. Based on fecal analyses Preble's eats insects; fungus; moss; pollen; willow; *Chenopodium sp.* (lamb's quarters); *Salsola* sp. (Russian thistle); *Helianthus* spp. (sunflowers); *Carex* spp. (sedge);

Verbascum sp. (mullein); *Bromus, Festuca, Poa, Sporobolus* and *Agropyron* spp. (grasses); *Lesquerella* sp. (bladderpod); *Equisetum* spp. (horsetail); and assorted seeds (Shenk and Eussen 1998, Shenk and Sivert 1999a *in* USFWS 2003b). The seasonal diet of Preble's consists primarily of insects (up to 100% in June) and fungus after emerging from hibernation, shifts to fungus, moss, seeds and fleshy fruits during midsummer (July-August), with insects again added in September. Shift in diet along with changes in mouse movement patterns suggests that the Preble's may require specific seasonal diets, perhaps related to the physiological constraints imposed by hibernation (Shenk and Sivert 1999a *in* USFWS 2003b).

Foraging Stategy

Given the length of the hibernation period, Preble's accomplish reproduction, recruitment, and physiological preparation for the lengthy winter in a very short period of time (in Colorado ± 85 days; Clippinger 2002). Hence, the description of foraging strategy would be opportunism. The diversity of food items (above) reflects the great variety of forage, and the only observed pattern is that the forage most available in any given season is commonly taken.

Foraging Variation

Preble's is a deep hibernator, remaining in hibernation as long or longer than most mammals (Whitaker 1972). The length of the hibernation period necessitates several weeks of pre-hibernation fattening, a critical period to Preble's survival. Given the relatively short period of summertime activity, the Preble's is not selective at any given time, rather forages opportunistically on available food items. Vegetative diversity may be a key to over-winter survival, as failure of a particular seed crop, if dominant on the landscape, may lead to insufficient fat stores, and high over-winter mortality. Spring foraging success may impact annual fitness, as

young born in early litters are more likely to survive hibernation that those from late litters (Muchlinksi 1988 *in* Meaney et al. 2003).

Community Ecology

Predators and Competitors

Preble's are primarily either nocturnal or crepuscular, which may prevent them from being highly visible to daytime predators. However, a wide suite of species are capable of depredating Preble's including garter snakes (*Thamnophis* spp.), prairie rattlesnakes (*Crotalus viridus*), bullfrogs (*Rana catesbiana*), foxes (*Vulpes vulpes* and *Urocyon cinereoargenteus*), house cats (*Felis catus*), long-tailed weasels (*Mustela frenata*), and red-tailed hawks (*Buteo jamaicensis*) (Shenk and Sivert 1999a, Schorr 2001 *in* USFWS 2000b). Other potential predators include coyotes (*Canis latrans*), Barn Owls (*Tyto alba*), Great Horned Owls (*Bubo virginianus*), Screech Owls (*Otus* spp.), Long-eared Owls (*Asio otus*), Northern Harriers (*Circus cyaneus*), and large predatory fish (USFWS 2000b). Preble's appear to have very little means of protection against predators, and will use concealment or remain perfectly still to avoid detection (Whitaker 1972).

Parasites and Disease

Preble's are known to carry parasites and diseases, yet there is no known factor of this kind which has extensive negative impacts on Preble's at the population level (USFWS 2002b). Parasites and diseases common to small mammals are known to reduce vigor, reproductive success, and mortality among individuals. Ticks, fleas, bot-flys, and mites are all common external parasites of jumping mice. Endoparasites including nematodes, trematodes, a fluke, and a protozoa of the *Eimeriidae* have also been reported, yet it is uncertain if any of these is common for Preble's. Bacteria common to *Zapus hudsonius* include *Escherichia coli, Bacillus mycoides, Klebsiella* sp., and *Bacteriodes* sp. (Whitaker 1972). Currently known parasites and diseases

described above are not known to be a serious threat to populations of Preble's at this time (USFWS 2002b).

Conservation

Conservation Status

Federal Endangered Species Act

Concern over the viability and persistence of *Z. h. preblei* began as early as September, 1985 when the USFWS gave the taxon Category 2 status, which indicated that at the time a proposal to list under the Act may have been appropriate but conclusive biological information to support such a proposal did not yet exist. This was followed by 20 other official USFWS decisions over the next 18 years, as documented in the Federal Register (see: http://ecos.fws.gov/species_profile/SpeciesProfile?spcode=A0C2). These decisions include the Final Rule to list as Threatened in May 1998 (USFWS 1998), Proposed Special Regulations in August 2001, and Designation of Critical Habitat for the Preble's Meadow Jumping Mouse (USFWS 2003a). For further information regarding protections afforded Preble's through administration of the Act see Existing Regulatory Mechanisms below.

Bureau of Land Management

The current status of *Z. h. preblei* as Threatened under the Act precludes it from receiving other special designations from federal land management agencies in Wyoming, such as the USDA Forest Service (Region 2) and the USDI Bureau of Land Management (Wyoming State Office). Although each of these agencies maintains a Sensitive Species list to help guide management actions (e.g., USDA Forest Service 1994, USDI Bureau of Land Management 2001), each list specifically excludes taxa already listed under ESA because those taxa receive automatic and pre-determined management priorities. Wyoming Natural Diversity Database biologists have

surveyed land under the jurisdiction of the Casper Field Office (Ehle and Keinath 2001, Beauvais 2003). Two years of WYNDD studies for the Casper Field Office resulted in the capture of four jumping mice at one survey location: Corduroy Creek, Parcel 17, in dense aspen overstory with occasional subalpine fir (Ehle and Keinath 2001). It appears that Preble's is very thinly distributed in this region (Figure 4), and that environments in extreme eastern Wyoming, including those administered by the BLM , are possibly unsuitable for Preble's (Beauvais 2003).

Forest Service

As pertains to the USDI Bureau of Land Management (*see above*), the current status of *Z. h. preblei* as Threatened under the Act precludes it from receiving other special designations from the USDA Forest Service (Region 2). Although each of these agencies maintains a Sensitive Species list to help guide management actions (e.g., USDA Forest Service 1994, USDI Bureau of Land Management 2001), each list specifically excludes taxa already listed under ESA because those taxa receive automatic and pre-determined management priorities. As described in Biogeography (see above) *Z. hudsonius* conspecifics are extant in Wyoming on both the Medicine Bow-Routt National Forest and the Black Hills National Forest. Much of the capture data and specimens from Wyoming come from work conducted on the Medicine Bow-Routt National Forest in southeastern Wyoming (USDA Forest Service, unpublished reports 1998, 1999, 2001). An ongoing WYNDD study, funded by the Medicine Bow–Routt National Forest will address distribution and tolerance of Preble's to management practices on the Laramie and Douglas ranger districts.

State Wildlife Agencies

This meadow jumping mouse subspecies is considered "threatened" by the Colorado Division of Wildlife (1998) and of "unknown status" by the Wyoming Game and Fish Department. The species (*Zapus hudsonius*) is protected under the Wyoming Nongame Wildlife Regulations.

Heritage Ranks and WYNDDs Wyoming Significance Rank

Zoologists at WYNDD have ranked *Z. h. preblei* as G5 T2 S1, with a Wyoming Contribution Score of Very High. Importantly, these designations are predicated on the assumption that the subspecies is valid, identifiable, and distributed throughout lowland riparian systems in north-central Colorado and southeast Wyoming as currently understood by the USFWS:

- G5 = The full species *Z. hudsonius* is demonstrably widespread, abundant, and secure with a very low probability of extinction from its entire range.
- T2 = The subspecies *Z. h. preblei* is rare and imperiled with a high probability of extinction from its entire range.
- S1 = The subspecies *Z. h. preblei* is rare and imperiled with a very high probability of extinction from the state of Wyoming.
- Wyoming Contribution Very High = The subspecies *Z. h. preblei* is a native, resident taxon with a small continental range and a high percentage of that range within the state of Wyoming; thus Wyoming populations of *Z. h. preblei* contribute very highly to the rangewide persistence of the taxon.

Hafner et al. (1998) classified *Z. h. preblei* as "Endangered" under the system used by the International Union for Conservation of Nature and Natural Resources.

Biological Conservation Issues

The final rule to designate critical habitat for the Preble's, the Service (2003b) summarizes the circumstances of the subspecies decline, "The Preble's meadow jumping mouse is closely associated with relatively narrow ecosystems that are adjacent to rivers and streams and that

represent a small part of the landscape. The decline in the extent and quality of this habitat is considered the main factor threatening the Preble's meadow jumping mouse. Habitat alteration, degradation, loss, and fragmentation resulting from urban development, flood control, water development, agriculture, and other human land uses have adversely impacted mouse populations. Habitat destruction may harm individual mice directly. It may also harm them indirectly by eliminating nest sites, food resources, and hibernation sites; by disrupting behavior; or by forming a barrier to movement."

Abundance and Trends

In the early 1990's perceived rarity and extirpation from historically occupied habitat triggered the concern over long-term viability of the Preble's. According to the draft recovery plan (USFWS 2003c) no rangewide population estimates exist for the species. Without a comprehensive understanding of current subspecies abundance, the only basis for trend assessments is presence or absence surveys in historical habitat. In lieu of a broad population estimate, recovery team analysis of limited site specific data indicates that adequate numbers, sizes, and distribution of populations may currently exist to meet recovery criteria. However, the extant ecological threats to these populations have not been successfully abated at this time to prevent further decline and endangerment of the species.

Range Context

The decline in extent of suitable habitat is one of the two major factors currently impacting the Preble's. Urban and suburban development has fragmented and/or destroyed suitable habitat, as well as facilitated the introduction of domesticated predators and habitat generalists. Rapid urban development along the Colorado Front Range has led to the extirpation of Preble's from the greater Denver and Colorado Springs metropolitan areas. Generally, the meadow jumping mouse

(*Z. hudsonius*) is not found in mixed grasslands, reclaimed grasslands, shortgrass prairie, row crop fields, or areas directly associated with human structures (Clippinger 2002). Given the broad overlap of Preble's habitat and the expanding urban and suburban development along the Colorado Front Range continued loss of Preble's habitat is expected (USFWS 2003b). Present distributional boundaries in Wyoming include dry shortgrass prairie to the east, and an elevational ecotone to the west along the Laramie Range, possibly extending locally further north and west in Albany and Converse counties. General upward limit of distribution in Wyoming is 2470m (8,100'); in Colorado 2,300m (7,600'; USFWS 2003b).

Extrinsic Threats

There is an extensive list of direct and indirect effects of anthropogenic influences on the landscape inhabited by Preble's. It is important to qualify this list in that further research is needed to discern qualitatively what thresholds exist, and when usage becomes prohibitive to Preble's occupation. For instance, many recent Preble's capture sites on the Medicine Bow National Forest occur on grazed rangeland, whereas the Service indicates (2003b) intensive grazing is detrimental to Preble's. Many of the following extrinsic threats have cascading effects, wherein the biology is altered at multiple scales which comprise the ecosystem; from plant and animal community assemblages, physical structure of live and dead biomass, hydrology, ultimately to soil structure and geochemistry.

Development

Expanding human populations near Preble's habitats may result in increased level of predation, through "subsidized" predators, or those species which benefit directly or indirectly from human habitation. The striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), and the domestic and feral cat (*Felis silvestris*) are found in greater densities in and around areas of human activity; all four of these species feed opportunistically on small

mammals. Analyses of land use patterns around occupied and unoccupied sites along the Colorado Front Range suggest that high and low intensity residential developments are detrimental to Preble's occupancy up to 210 meters from trapping locations (Clippinger 2002).

Construction of new trails, roads, and bridges, in addition to maintenance of the existing infrastructure, fragments habitat, impedes dispersal movement, and may lead to localized contamination of watercourses. As noted below (*see* Intrinsic Vulnerability), vehicle collision is a known cause of mortality to Preble's.

Agriculture

"Conversion of native riparian ecosystems to commercial croplands and grazed rangelands was identified as the major threat to Preble's persistence in Wyoming" (Clark and Stromberg 1987, Compton and Hugie 1993 *in* USFWS 2003b). Intensive haying and grazing operations may significantly effect Preble's populations through habitat reduction or direct mortality. There is evidence that certain agricultural and grazing practices can be compatible with Preble's conservation, yet this requires protection of riparian vegetative diversity and structure. The Service (2003b) acknowledges the potential for coexistence of Preble's and livestock, yet reports that overgrazing can decimate riparian communities on which the Preble's depends.

Invasive Species

There are no conclusive data regarding Preble's tolerance of exotic plant species. Habitat degradation is a concern in cases where non-native plants such as Russian olive (*Elaeagnus angustifolia*) or leafy spurge (*Euphorbia esula*) displace native vegetation and reduce available habitat (USFWS 2003b). Landscape usage which may facilitate colonization by invasives include fragmentation, alteration of hydrography (xerification), introduction of foreign seed stock, and heavy utilization of Preble's habitat by livestock.

There is strong evidence that non-native predators and "subsidized predators" (cats and dogs; Clippinger 2002) are capable of decimating the local fauna. In conjunction with habitat fragmentation, decrease in native plant cover, and increase in asphalt and concrete, these predators are able to hunt out areas to the exclusion of even the most common native species (Soule' et al. 1988 *in* Clippinger 2002).

Alteration of Hydrography

The hydrology of upland systems may be the limiting factor to Preble's distribution and survival. Dewatering through diversion, removal of mesic plant associates, or measures to address flooding and stormwater runoff (riprap, lining of ditches) will result in more xeric habitats, which may not be habitable by Preble's. Similarly, channelization and increased stream flow will degrade Preble's habitat (USFWS 2003b). Periodic flooding is a common and natural event throughout the Preble's range Disruption of periodic flood events reduces the introduction of newly deposited soil, and may stunt regeneration of dense, riparian vegetative communities.

Fire Suppression

Kaufman et al. (1990 *in* USFWS 2003b) reviewed the impacts of wildland fire on small mammals in grassland communities. In one study, impacts of fire on meadow jumping mice were positive, and in a second study fire had no measured effect. Wildland fire is a natural component of Front Range and Wyoming foothills ecosystems, and hence influences processes which meadow jumping mice have co-evolved with. Preservation of the natural periodicity and intensity of fire in these landscapes may maintain riparian, transitional, and upland vegetation throughout the Preble's range (USFWS 2002b). Fire suppression disrupts the natural fire regime, and may result in an unnatural accumulation of fire fuels and catastrophic fire events. Effects of catastrophic fire include direct mortality, habitat destruction, soil erosion, and the breakdown of connectivity between populations (USFWS 2002b).

Intrinsic Vulnerability

Habitat specialization is a significant life history trait of the Preble's which jeopardizes its survival. This subspecies relies upon riparian ecosystems which are physically narrow, and represent a very small percentage of the landscape. Specialization on the specific characteristics and processes of this ecosystem has caused declines in the species where integrity of this ecosystem is compromised. The Service (2003b) lists mortality factors other than predation as drowning, vehicle collision, and likely factors know for conspecifics such as starvation, exposure, disease, and insufficient fat stores for hibernation. Given the duration of hibernation (± 210 days; Clippinger 2002) Preble's reproductive potential is relatively low, which may impact survivability of populations in small, isolated patches of habitat. Small populations are more susceptible to extirpation from stochastic events (USFWS 2003b). The relatively short period of time in which most life history requirements are met suggests that Preble's may be more exposed to predation, or other external threats, as less effort is afforded to vigilance.

Protected Areas

The only formally protected areas for Preble's are the stream reaches included in the designated critical habitat (*see below* Existing Regulatory Mechanisms; USFWS 2003b). However, outside of the current activities addressed in the amended Special Rule and areas addressed in approved Habitat Conservation Plans, Preble's is protected as a listed Threatened species by authority of the Act at all times (*see above* Federal Endangered Species Act).

Conservation Action

Existing or Future Conservation Plans

Existing Regulatory Mechanisms

The final rule to list the Preble's Meadow Jumping Mouse as a threatened species pursuant to the Endangered Species Act (Act) of 1973, as amended, was published May 13, 1998 (USFWS

1998). All principle regulatory mechanisms which deal specifically with Preble's, stem from administration of this ruling. Subsequent to the listing, a Special Rule pursuant to section 4(d) of the Act was issued. Under section 4, exemptions from illegal take as defined in section 9 of the act are established. Special regulations governing allowable take of Preble's were published in May 22, 2001, amended October 1, 2002, and proposed for extension on February 24, 2004. Protections of the Preble's, as defined by the Act, are described in the final rule to list (USFWS 1998). These include consultation requirements, recovery planning, and protective prohibitions of unauthorized take. The special rule and amendment have lifted prohibition of incidental take during activities such as rodent control near human dwellings, ongoing agricultural activities, landscape maintenance, existing uses of water, and certain activities related to noxious weed control, and ongoing ditch maintenance (USFWS 2004).

The following language which describes Critical Habitat designation and the implementation of Habitat Conservation Plans was taken from the US Fish and Wildlife Service Mountain- Prairie Region, Endangered Species Program website http://mountain-prairie.fws.gov/preble/ .

Critical Habitat

The U. S. Fish and Wildlife Service final rule designating Critical Habitat in Wyoming and Colorado was published in the Federal Register (Vol. 68, No. 120) on June 23, 2003. The three Critical Habitat Units in Wyoming, Cottonwood Creek, Chugwater Creek, and Lodgepole Creek with Upper Middle Lodgepole Creek are found at the back of this assessment (Figures 5-8).

> "Critical habitat identifies specific areas, both occupied and unoccupied, that are essential to the conservation of a listed species and that may require special management considerations or protection. Section 7 of the Act will prohibit destruction or adverse modification of critical habitat by any activity funded, authorized, or carried out by any Federal agency, and Federal agencies proposing

actions affecting areas designated as critical habitat must consult with the Service on the effects of their proposed actions, pursuant to section 7(a)(2) of the Act.

In determining which areas to designate as critical habitat the Service is required to use the best scientific and commercial data available and to consider physical and biological features (primary, constituent elements) that are essential to conservation of the species, and that may require special management considerations and protection. The primary constituent elements for the PMJM include those habitat components essential for the biological needs of reproducing, rearing of young, foraging, sheltering, hibernation, dispersal, and genetic exchange. The Preble's is able to live and reproduce in and near riparian areas located within grassland, shrubland, forest, and mixed vegetation types where dense herbaceous or woody vegetation occurs near the ground level, where available open water exists during their active season, and where there are ample upland habitats of sufficient width and quality for foraging, hibernation, and refugia from catastrophic flooding events.

The critical habitat designation for PMJM defines the width of designated critical habitat as a distance outward from the river or stream edge (as defined by the ordinary high water mark) varying with the size (order) of a river or stream. The designation includes river and stream reaches and adjacent floodplains and uplands that are within the known geographic and elevational range of the PMJM, in the North Platte River and South Platte River drainages in Colorado and Wyoming."

Habitat Conservation Plans

"Private landowners, corporations, state or local governments, or other non-Federal landowners who wish to conduct activities on their land that might incidentally harm (or "take") PMJM must first obtain an incidental take permit from the Service. To obtain a permit, the applicant must develop a Habitat Conservation Plan (HCP), designed to ensure there is adequate minimizing and mitigating of the effects the proposed activity might have to PMJM or PMJM habitat. This process allows development to proceed legally that would otherwise result in the illegal take of PMJM, while promoting PMJM conservation on private (non-federal) lands. In general, HCPs are required by the Service when permanent

> or temporary disturbance to habitat occurs within 300 feet of the 100 year floodplain of any drainages or subdrainages in the PMJM range. HCPs for PMJM have been approved by the Service for private residences, large-scale commercial and residential developments, natural resource management, and multiple-use trails. Currently the Service is working with Front Range county planning and open space departments to develop regional HCPs which would address multiple planning objectives."

Eleven Habitat Conservation Plans with incidental take permits have been approved to date (04/12/04) by the Service. All HCPs are in the state of Colorado; primarily in Douglas, El Paso, Boulder, and Denver Counties.

In the 1998 rule to list the subspecies the Service acknowledges the need for federal oversight of Preble's management, as local ordinances were insufficient in providing direct protection for Preble's or its habitat. Inadequacy of existing regulatory mechanisms is cited as a significant factor in the decline of Preble's. "Various existing federal laws, such as the Clean Water Act, Endangered Species Act, Federal Power Act, Fish and Wildlife Coordination Act, Food Security Act, and National Environmental Policy Act have not in the past been effective in protecting occupied riparian habitat" (USFWS 2002b).

Existing Management Plans

In an unpublished report to the U.S. Air Force Academy, Grunau et al. (1999) prepared the Conservation and Management Plan for the Preble's Meadow Jumping Mouse on the U.S. Air Force Academy (47 pp.). To date, this is the most extensive conservation management plan, designed with the following conservation goals 1. Maintain and enhance AFA populations of Preble's, and associated native plant and animal species. 2. Protect the integrity of the USAFA portion of the main stem of Monument Creek (approximately 6.5 miles). 3. Protect seven miles of

USAFA tributaries to Monument Creek that are currently occupied by Preble's, and contain Preble's habitat that is connected to the habitat along Monument Creek.

Existing Conservation Strategies

The principle guiding influence on Preble's conservation strategy is the U. S. Fish and Wildlife Service. Pursuant to section 4(f) of the Act, the Service organized a recovery team to develop and implement a plan to stay the decline of Preble's, and address existing threats to ultimately ensure the long term survival of this subspecies. A recovery plan, "delineates, justifies, and schedules the research and management actions necessary to support recovery of a subspecies. The current Preble's Meadow Jumping Mouse Recovery Plan is in a draft form. The completed plan will be published in the Federal Register, and represents the official position of the Service only after they have signed it as approved.

The lack of suitable habitat in Colorado and Wyoming limits current Preble's distribution and abundance. Maintenance of existing, quality habitat if the current conservation goal strived for by the Service (1998), the following conservation strategy language is taken from the Preble's Meadow Jumping Mouse Recovery Team – Draft Recovery Plan (USFWS 2003c):

Recovery Objective:

The purpose of (the Recovery) 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.

Conservation Elements

Inventory and Monitoring

Guidelines for surveys to determine the presence or absence of Preble's have been developed be the Service, in consultation with experts in the field. These guidelines establish the minimum standard for a valid survey, and are designed with an emphasis on gathering ecological and distributional data, and to ensure individuals of the subspecies are protected from undue harassment or harm. All trapping and handling of Preble's is administered through a federal permit process, and cannot be undertaken under any circumstances without first meeting established permitting qualifications through the Service.

In southeast Wyoming annual inventory and monitoring of Preble's has not been a common practice. Intermittent surveys on the Douglas and Laramie Ranger Districts of the National Forest have been performed. F.E. Warren Air Force Base, near Cheyenne, WY, has funded the only multi-year inventory of Preble's, an eight year study of Crow Creek and adjoining tributaries. This is the only long-term small mammal study designed to monitor Preble's populations in Wyoming.

Otherwise, inventory for Preble's, to the knowledge of the authors, has only been conducted on a site specific, ESA/National Environmental Policy Act- (NEPA) clearance basis.

Habitat Preservation and Restoration

According to the draft recovery plan of the Preble's recovery team (2003c) riparian habitat and Preble's population conservation has been approached in the form of land easements and acquisitions, which preceded the designation of critical habitat. Examples of such protections in Colorado include acquisition of Circle Ranch in Larimer County and Greenland Ranch easement in Douglas County.

Captive Propagation and Reintroduction

The authors are not aware of any current literature reporting on attempted or successful captive propagation of meadow jumping mice.

Information Needs

The status of Preble's as a subspecies of meadow jumping mouse is under review in the scientific literature. Unpublished research on meadow jumping mouse systematics has been forwarded to the U.S. Fish and Wildlife Service. It is premature to evaluate or use information stemming from this research without the understanding that current standards of peer-review and publication in acceptable scientific literature are, at this time, not met. This underscores the need for scientific studies which will contribute to the shaping of effective management guidelines to ensure the long-term viability of what, at this time, is still regarded as Preble's Meadow Jumping Mouse.

Additional complexity is added to the question of the taxonomic validity of this subspecies, due to suspected hybridization zones with a species from another *Zapus* genus, the Western jumping mouse (*Zapus princeps princeps*; Western). Type specimens of Western and Preble's

have been utilized to develop a reliable laboratory technique to discern the two species, yet identification to species of any jumping mouse in the field is not reliable (Conner and Shenk (2003). It is essential to the future validity of meadow jumping mouse conservation, to reach consensus, if possible, on the systematics of evolutionarily significant units within the taxa *Zapus*.

The 1998 listing of *Z. h. preblei* has stimulated *Zapus* surveys and specimen collections in southeast Wyoming. Collected specimens have been sent to various analytical labs, most commonly the Denver Museum of Nature and Science (Denver, Colorado), where they undergo a series of analyses and tests. The results of these tests are not always made widely available, nor are they organized in a discrete summary showing the results of all tests on all collected specimens. Such a summary for all specimens collected throughout the entire suspected range of *Z. h. prebeli* would substantially improve our understanding of *Zapus* taxonomy and distribution in the region.

There is very little known about meadow jumping mouse behavior, from virtually any of the 12 conspecifics in the genus *hudsonius* (USFWS 2002b). Development of an accurate conservation program for the meadow jumping mice will hinge upon a greater understanding of environmental thresholds by which viable populations will persist. Until our understanding of acceptable modifications of Preble's habitat improves, conservative management schemes, and the potential prolonged status of the Preble's as a federally listed species will persist.

Tables and Figures

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

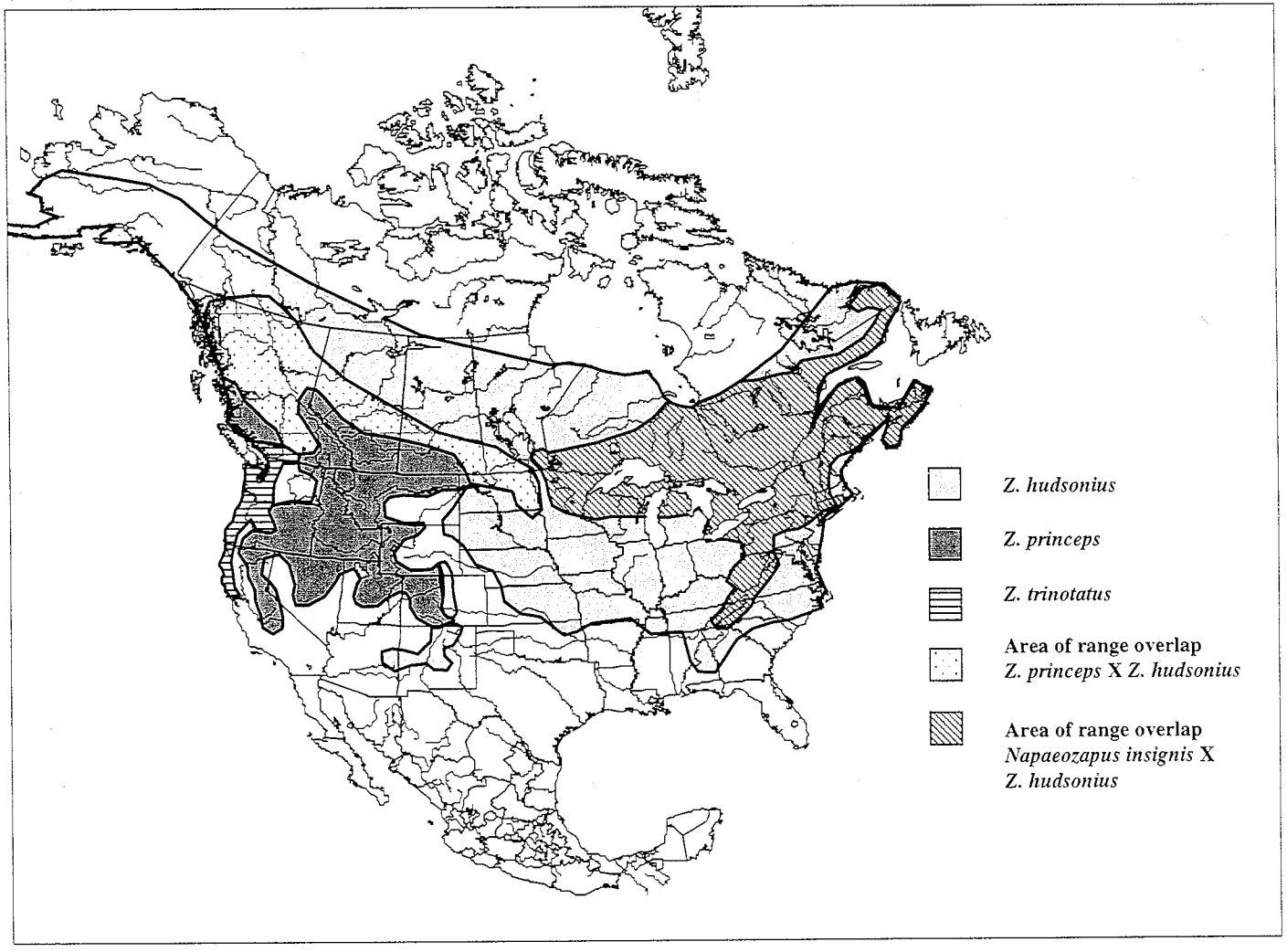


Figure 2. Distribution of jumping mice along the Rocky Mountain front. Modified from Hall (1981) and Hafner et al. (1981). Subspecies of *Z. princeps* are not shown for the sake of clarity.

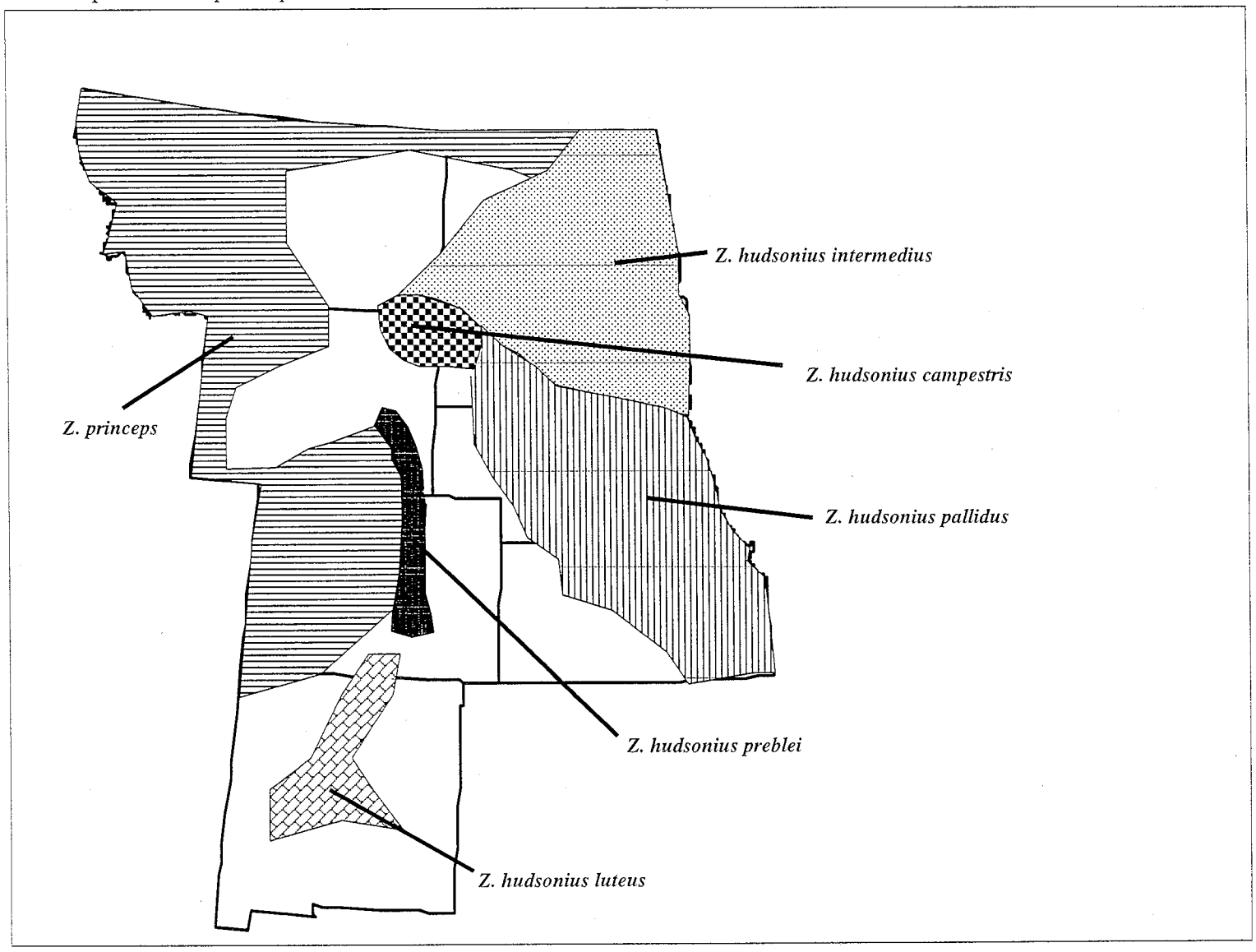


Figure 3. Distribution of Zapus species in southeast Wyoming. All data is on file at the Wyoming Natural Diversity Database, University of Wyoming. Bold lines indicate county boundaries; fine lines indicate major roads.

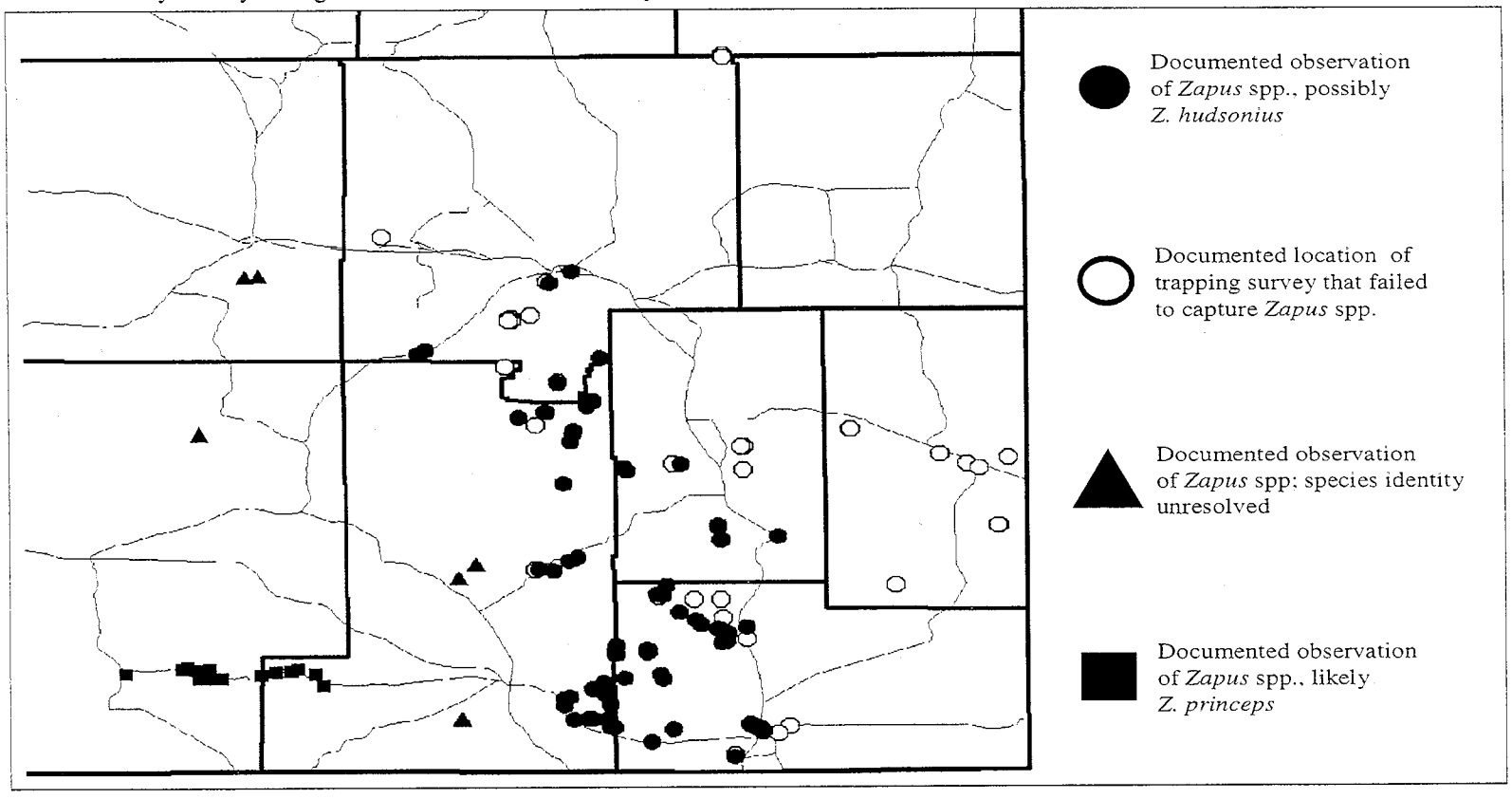


Figure 4. Observations of suspected Preble's meadow jumping mice within the boundary (bold red line) of the Casper Field Office (Wyoming) of the USDI Bureau of Land Management. Black lines show county boundaries; green lines show major roads. Blue dots show all known Preble's mouse capture sites to date (no captures were documented during this study). Gray dots show Preble's mouse trapping efforts that failed to record the taxon, excluding efforts from this study. All data on file at the Wyoming Natural Diversity Database at the University of Wyoming, Laramie, Wyoming.

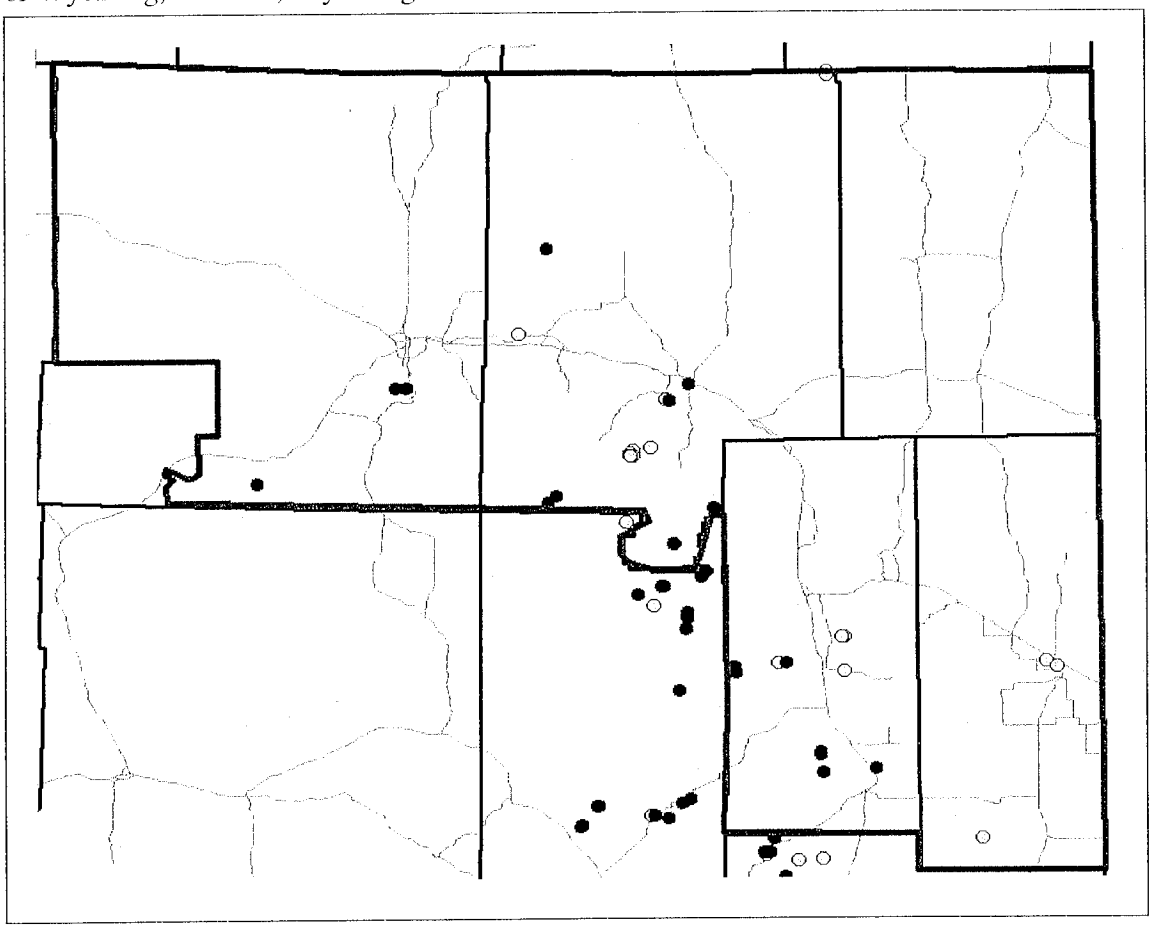


Figure 5. Preble's Meadow Jumping Mouse Critical Habitat, Wyoming Index Map

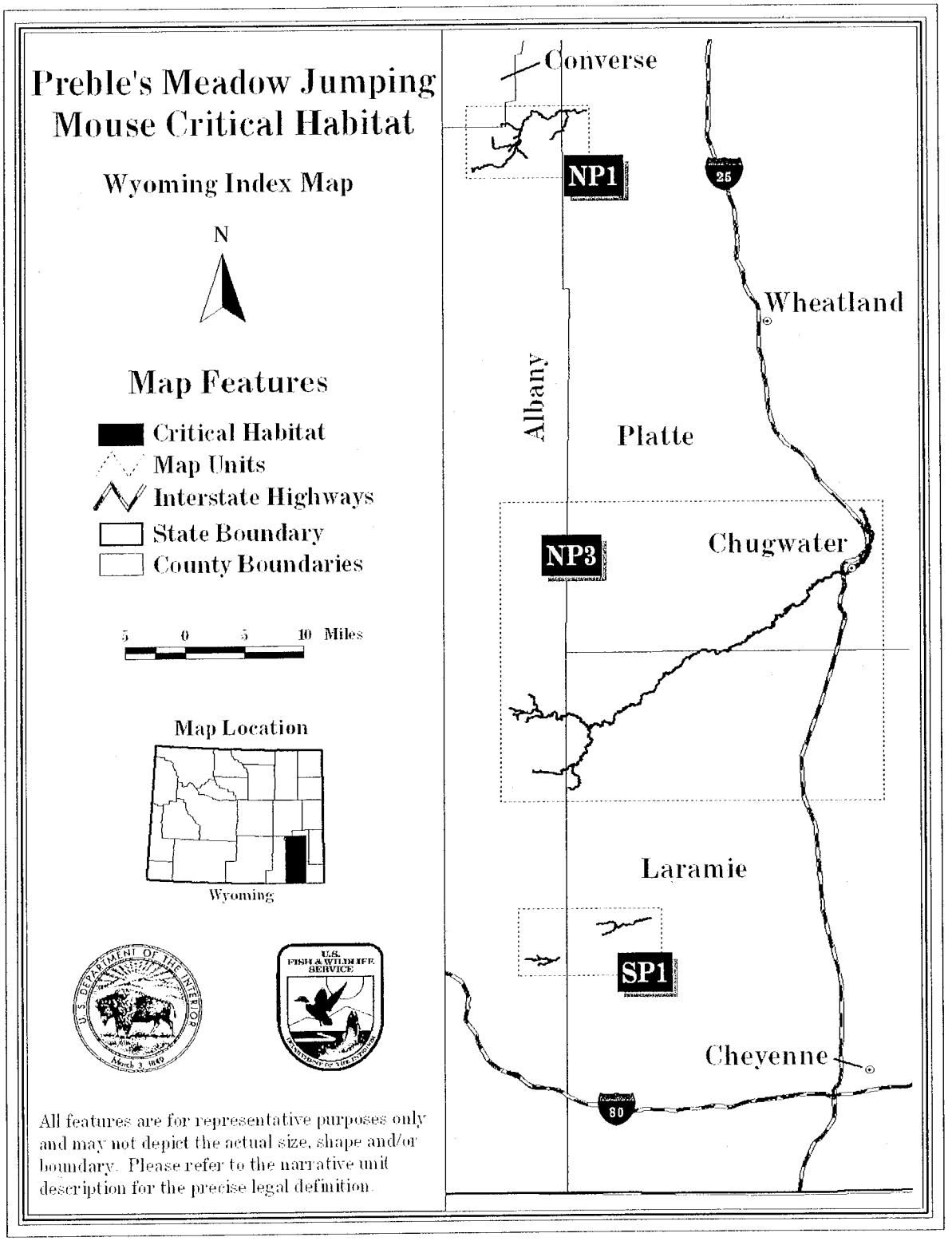


Figure 6. Preble's Meadow Jumping Mouse Critical Habitat, Unit NP1 (Cottonwood Creek)

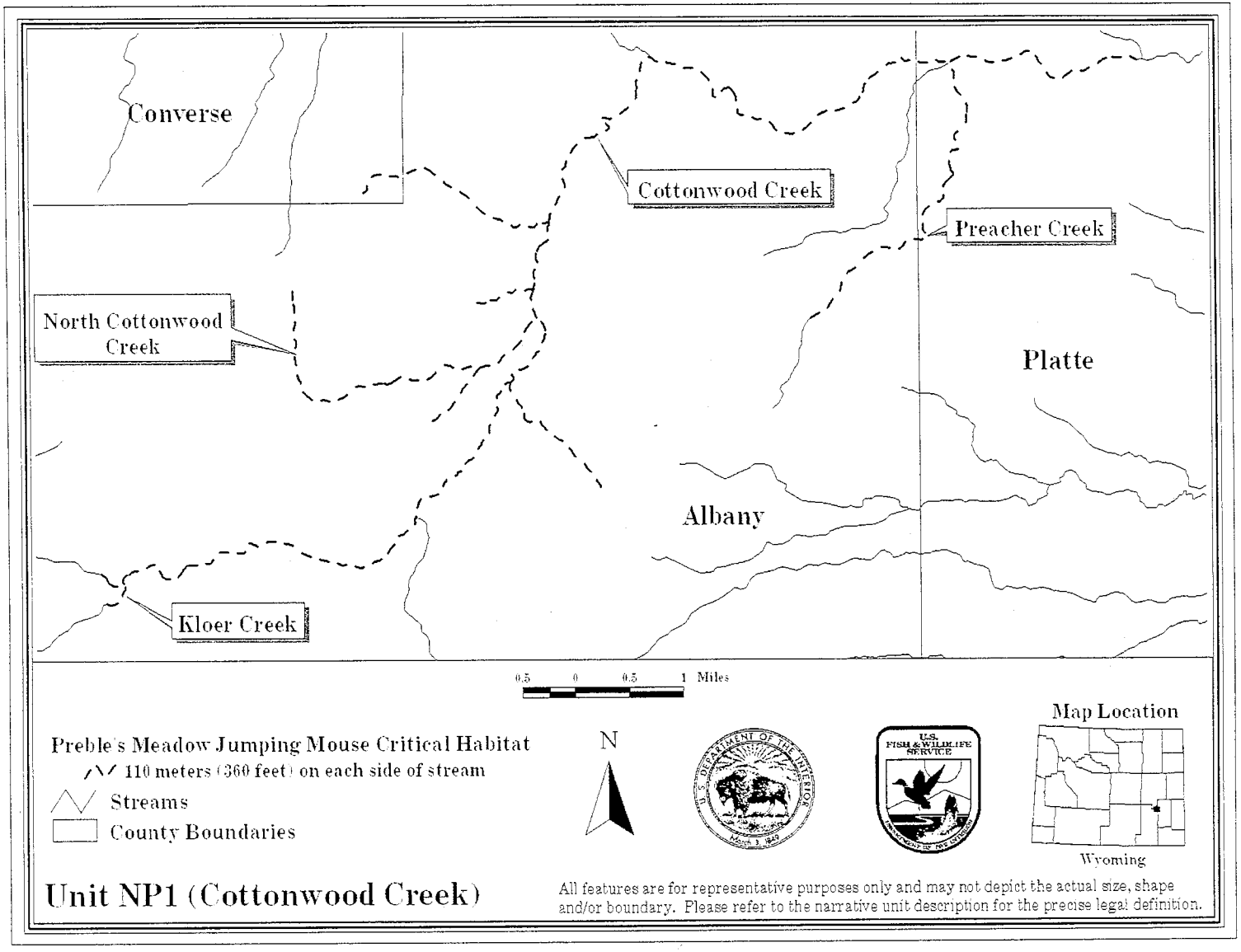


Figure 7. Preble's Meadow Jumping Mouse Critical Habitat, Unit NP3 (Chugwater Creek)

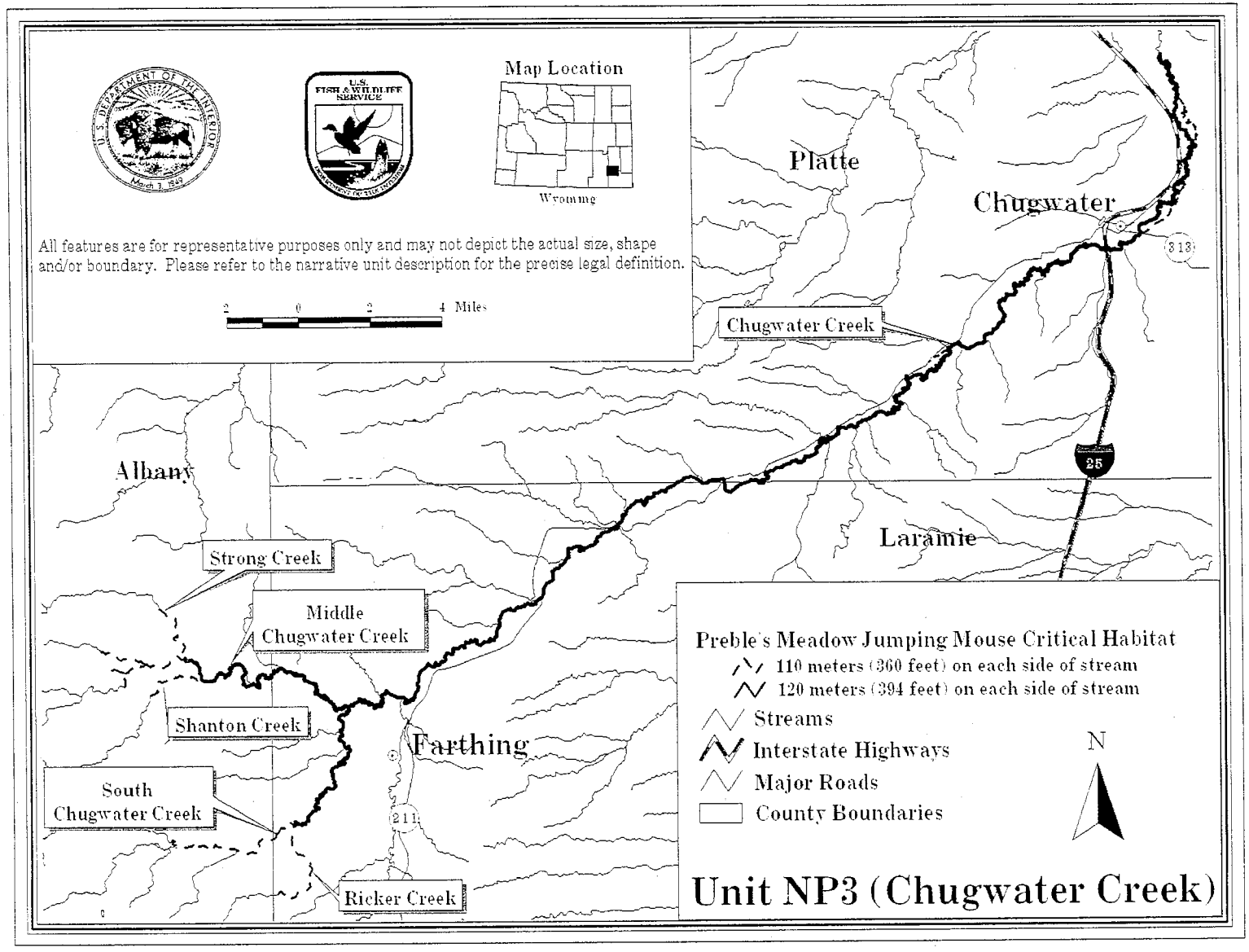
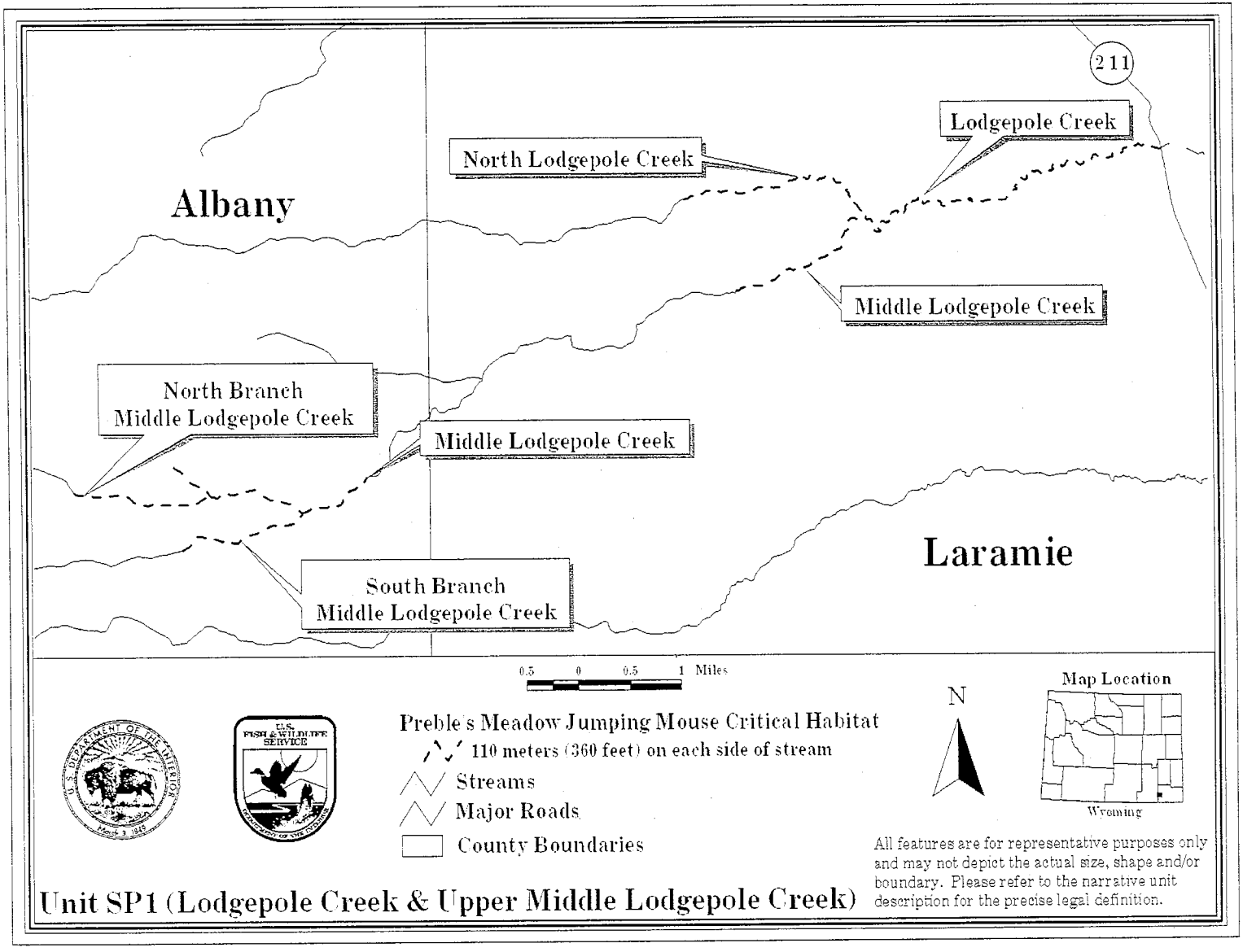


Figure 8. Preble's Meadow Jumping Mouse Critical Habitat, Unit SP1 (Lodgepole Creek and Upper M. Lodgepole Creek.



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United States Department of Agriculture | Forest Service | Medicine Bow - Routt National Forests and Thunder Basin National Grassland | 2468 Jackson Street Laramie, WY 82070-6535 http://www.fs.fed.us/r2/mbr

File Code: 1570-1/1950-1
Date: May 11, 2004

MR. JEREMY NICHOLS
BIODIVERSITY CONSERVATION ALLIANCE
P.O. BOX 1512
LARAMIE, WY 82073

Certified - Return Receipt Requested

Dear Mr. Nichols:

We have received your Notice of Intent to Sue ("NOI") dated March 17, 2004. This response constitutes the **current** position of the United States Department of Agriculture-Forest Service, Rocky Mountain Region ("Forest Service"). However, **this position may change at any time, and nothing in this response should be construed to waive any rights, defenses, or privileges.**

The Forest Service is deeply concerned about the issues alleged in your NOI. Please find attached a Supplemental Information Report ("SIR") the Forest Service had commissioned to address the issues identified in the NOI. This SIR became final on May 11th, 2004. Furthermore, the Forest Service is actively participating with Wyoming DEQ, Laramie County Conservation District, and the Laramie Rivers Conservation District on a Crow Creek Watershed Plan in the event the two reaches in that drainage are listed as impaired under the State's 303(d) list. If listed, the Forest Service will work with all stakeholders, including the public, to determine the best course of actions to mitigate fecal coliform and E. coli counts in those stream reaches. Hopefully after your review of this SIR, and our plans to develop a Crow Creek Watershed Plan, you will agree that the Forest Service is taking all practical actions within its authority to address the issues identified in your NOI.

As to the legal allegations in your NOI, we must advise you that under **the facts asserted** in your NOI, you have not stated a **claim** under the citizen suit provisions of 33 U.S.C § 1365. *Oregon Natural Desert Assc. v. Dombeck,* 172 F.3d 1092, 1098, *cert. denied* November 1999.

Additionally, we note that your NOI does not provide required notice to the State of Wyoming or the owners of the referenced stock **and associated Forest Service grazing permits.** As the State of Wyoming is charged with regulating non-point sources, and as the stockowners own the allegedly offending stock, these are indispensable parties to this matter and require appropriate notice. Finally, your NOI does not reference the contributions of the City of Cheyenne to the issues identified in your NOI.

Of course, the Forest Service will vigorously defend itself if you decide to pursue litigation. In that regard, nothing in this letter should be read to suggest that you would have a meritorious claim, nor should anything in this letter be taken as an admission of any issue of fact or law. In light of the above, we would respectfully request you to withdraw the NOI, and also to actively participate in the group of stakeholders who are attempting to resolve these issues.

Sincerely,

CLINTON D. KYHL
District Ranger

Encl (1)

SUPPLEMENTAL INFORMATION REPORT

To The
1998 Allotment Management Plan Revisions
For The
Pole Mountain Grazing Allotments Environmental Assessment (EA)
And
Decision Notice (DN)

DISCLOSING

Documentation of Changed Circumstances since the 1998 EA and DN

Albany County, Wyoming
May 2004

SUPPLEMENTAL INFORMATION REPORT

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SUPPLEMENTAL INFORMATION REPORT

I. Introduction

On October 22, 1998, the ***Allotment Management Plan Revisions for the Pole Mountain Grazing Allotments and Limiting Firearm Use Within the Pole Mountain Area Environmental Assessment (Pole Mountain EA)*** was released to the public. The Pole Mountain EA was tiered to the 1985 Medicine Bow Land and Resource Management Plan (1985 Forest Plan) and described the potential environmental effects of implementing proposed Allotment Management Plan (AMP) revisions and firearm limitations within the Pole Mountain Area of the Medicine Bow National Forest. A Decision Notice and Finding of No Significant Impact (DN/FONSI), identifying the Proposed Action, as it related to livestock grazing, was also issued at that time[1]. No appeals connected to the livestock grazing portion of the EA were received during the administrative appeal period (36 Code of Federal Regulations, Part 215 – Notice, Comment, and Appeal Procedures for National Forest System Projects and Activities) for the DN/FONSI.

In 2000, the Upper North Platte River Basin, which includes watersheds within the Pole Mountain Area, began experiencing varying levels of drought. Drought conditions have resulted in reduced forage production and water availability on National Forest System (NFS) lands within the Pole Mountain Area. To mitigate the impacts that livestock could have on rangeland and water resources during this drought period, the Forest Service and grazing permittees made efforts to alter livestock management. Efforts included issuing drought letters for the 2002 to 2004 grazing seasons (see Appendix A), reducing stocking numbers by 48 and 47 percent in 2002 and 2003, respectively, changing pasture rotations, and reducing the overall season of use. Despite these efforts, however, localized areas experienced forage over-utilization, and State of Wyoming water quality standards for E. coli and fecal coliform were exceeded in two stream segments.

On June 23, 2003, critical habitat for the Preble's Meadow Jumping Mouse (PMJM) was designated in the Federal Register by the U.S. Fish & Wildlife Service (USFWS). Designation of critical habitat formally identifies specific areas important to the recovery of the PMJM and notifies federal agencies of specific areas to be given special consideration when planning. Roughly 4.2 miles of PMJM critical habitat were designated on Middle Lodgepole Creek within the Pole Mountain Area.

On December 29, 2003 the Record of Decision (ROD) for the Revised Medicine Bow National Forest Plan (Revised Forest Plan) was signed by Rick D. Cables, Regional Forester for Region 2 of the USDA Forest Service. The Revised Forest Plan includes new and/or revised standards and guidelines for livestock grazing and PMJM habitat management than those analyzed in the Pole Mountain EA (1998). Standards and guidelines analyzed in the Pole Mountain EA were derived from the 1985 Forest Plan. Although page 51 of the ROD for the Revised Forest Plan indicates that "it is not necessary to apply the Revised Plan's standards and guidelines retroactively," discretion is allowed, on a case-by-case basis, to modify pre-existing authorizations if they are

[1] A DN/ FONSI addressing the recreational firearm limitations was issued on January 28, 2000.

not consistent with newly established standards, including the standards and guidelines in the Revised Forest Plan.

A. Purpose of the Supplemental Information Report (SIR)

The purpose of this SIR is to determine whether a number of events that have occurred since the Pole Mountain EA and DN/FONSI were issued singularly or cumulatively create a "significant new circumstance(s)" or result in "new information" that may have a bearing on how domestic livestock grazing is administered within the Pole Mountain Area of the Medicine Bow National Forest. It is also intended to assist the Responsible Official in determining whether or not a correction to the Pole Mountain EA is necessary or if the Forest Service must prepare a revised environmental assessment prior to continued authorization of domestic livestock grazing. Direction for preparing a SIR is found in Forest Service Handbook (FSH) 1909.15(18)(1), *"Review and Documentation of New Information Received After a Decision Has Been Made"* and is cited below:

> "If new information or changed circumstances relating to the environmental impacts of a proposed action come to the attention of the responsible official after a decision has been made and prior to completion of the approved program or project, the responsible official must review the information carefully to determine its importance. If, after an interdisciplinary review and consideration of new information within the context of the overall program or project, the responsible official determines that a correction, supplement, or revision to an environmental document is not necessary, implementation should continue. Document the results of the interdisciplinary review in the appropriate program or project file. If the responsible official determines that a correction, supplement, or revision to an environmental document is necessary, follow the relevant direction in section 18.2-4."

Direction contained in FSH 1909.15(18)(4) states the following:

> "Revise an EA if the interdisciplinary review of new information or changed circumstances indicates that changes in the EA are needed to address environmental concerns that have a bearing on the action or its impacts. Upon completion of the revised EA, prepare a new finding of no significant impact (FONSI) which addresses the effects of the action. Reconsider the original decision; and, based upon the EA and FONSI, issue a new decision or document that the original decision is to remain in effect and unchanged. A new decision notice may address all or a portion of the original decision."

This SIR is part of the project file for the ***1998 Allotment Management Plan Revisions for the Pole Mountain Grazing Allotments and Limiting Firearm Use Within the Pole Mountain Area Environmental Assessment*** and is available for public review.

II. Changed Circumstances and Conclusions

This SIR is presented to the Responsible Official for his consideration, and contains the findings of the Pole Mountain Interdisciplinary Team, in consultation with the Rocky Mountain Regional Office and the USFWS, relative to four changed circumstances since the 1998 publication of the Pole Mountain EA and DN/FONSI.

The four changed circumstances, questions to determine the significance of each changed circumstances, and analysis conclusions are outlined below. A more in depth discussion of the changed circumstances and the analysis conclusions are outlined in section III. Findings.

1. Forage utilization standards and guidelines, including those related to the maintenance of stubble height in riparian areas and utilization of herbaceous species, have been exceeded (1985 Forest Plan page III-38).

a. Does the information concerning exceeding forage utilization standards and guidelines in one pasture in each of two allotments require a change in allotment management direction overall or a change in allotment management for drought years only?

> ***Conclusion:*** *Analysis completed by a Forest Rangeland Management Specialist indicates that allotment management direction at Pole Mountain does not need to be changed at this time. However, the Forest Service must respond more quickly to the effects of drought. Such actions should include reducing seasons of use, reducing the timing of use in individual pastures, reducing stocking numbers, requiring increased riding and herding, implementing the Livestock Management portion of the 2004 Water Quality Action Plan (Appendix G), and more intensively monitoring use levels while livestock are actively grazing pastures. All of these actions fall within the parameters of the Allotment Management Plans and the Annual Operating Instructions. Therefore,* ***this "changed circumstance" does not warrant a correction to or a revision of the 1998 Pole Mountain EA.***
>
> *ACTIONS: 1) Implement all actions in the Livestock Management section of the 2004 Water Quality Action Plan (Appendix G); 2) By June 1, 2004, develop a Vegetation Monitoring Plan outlining when and where forage utilization sampling will occur; and 3) Implement the Vegetation Monitoring Plan during the 2004 livestock grazing season.*

2. State of Wyoming water quality standards for E. coli and fecal coliform bacteria have been exceeded in two stream reaches.

a. Does the information concerning exceeding water quality standards in one pasture in each of two allotments require a change in allotment management direction overall or a change in allotment management for drought years only?

Conclusion: *The Forest has a Nonpoint Source Management Strategy (March 22, 1999, Appendix E) in place to control and address nonpoint source pollution to meet water quality standards. The Forest has utilized the feedback mechanisms inherent in this strategy to monitor and adjust practices to meet established water quality criteria where it has been exceeded. Actions within the scope of the Pole Mountain EA (1998), including the continued application and implementation of the Nonpoint Source Management Strategy to monitor and implement existing allotment management direction, have been identified to address exceeding State of Wyoming water quality standards. Therefore,* ***this "changed circumstance" does not warrant a correction to or a revision of the Pole Mountain EA (1998).***

ACTION: *The Forest Service will implement the 2004 Water Quality Action Plan (Appendix G) to respond to exceeding State of Wyoming water quality standards for E. coli and fecal coliform. All of the actions contained in the 2004 Water Quality Action Plan fall within the parameters of the existing Allotment Management Plans and Annual Operating Instructions.* ***Therefore, a correction to or a revision of the Pole Mountain EA (1998) is not warranted.***

b. Do changes in allotment management need to occur if the two streams that are currently exceeding State of Wyoming water quality standards are listed on Wyoming's final 2004 305(b) State Water Quality Assessment Report and 303(d) List of Waters Requiring Total Mean Daily Load (TMDL) as impaired water bodies for not meeting contact recreation water uses?

Conclusion: *If the two streams are listed on the State's 303(d) list as impaired, the Forest Service will be required to develop a Watershed Plan to address ways to mitigate exceedance of State standards for E. coli and fecal coliform. The Watershed Plan will be developed with stakeholders, including the public.* ***Action items identified within this plan could be outside the scope of the existing 1998 Pole Mountain EA. Therefore, implementation of the plan could warrant a correction to or a revision of the 1998 Pole Mountain EA.*** *The release of the final 303(d) list is scheduled for July of 2004.*

ACTIONS: *1) Work with stakeholders in preparation of the possible listing of the two stream reaches within the Crow Creek drainage. Appendix B provides a list of actions and meetings that have occurred to date; 2) Implement the 2004 Water Quality Action Plan (Appendix G); and 3) Develop and implement a Water Quality Monitoring Plan prior to the 2004 livestock grazing season (June 1, 2004).*

3. Critical habitat for the Preble's Meadow Jumping Mouse (PMJM) has been designated within Pole Mountain grazing allotments.

a. Does the presence of PMJM critical habitat in the Pole Mountain grazing allotments require a new project level Biological Assessment (BA)/Biological Evaluation (BE) and further consultation with the USFWS?

Conclusion: *The 1998 project-level BA (June 16, 1998) identified "Mouse Protection Areas" that were specifically considered when developing conservation measures to protect the PMJM and its habitat. The USFWS concurred with the determinations outlined in the BA on September 9, 1998 (Appendix C). Following USFWS concurrence, the conservation measures were incorporated into the Pole Mountain DN/FONSI (1998) as mitigation measures.*

During the formal process of designating critical habitat, the USFWS used the Mouse Protection Areas identified in the 1998 BA to designate critical habitat on National Forest System (NFS) lands on Pole Mountain. Specifically, all areas designated as critical habitat on NFS lands on Pole Mountain lie within the previously identified Mouse Protection Areas in the 1998 BA.

A BA was also prepared, and formal consultation with the USFWS occurred, for the Revised Medicine Bow National Forest Plan (December 2003). The BA and consultation considered the effects of livestock grazing activities, as well as rangeland management standards and guidelines contained in the Forest Plan, to PMJM and designated critical habitat. In response to the BA, the USFWS issued a Biological Opinion (including the implementation of "reasonable and prudent measures" and specified "terms and conditions") indicating that planned activities are not likely to jeopardize the continued existence of PMJM and that they are not likely to adversely modify critical habitat for the PMJM. The Biological Opinion included areas designated as PMJM critical habitat in the Pole Mountain Area.

As stated above, Mouse Protection Areas identified in the project-level BA were used by the USFWS when designating critical habitat at Pole Mountain. In addition, the USFWS concurred that planned activities are not likely to jeopardize the continued existence of PMJM and that they are not likely to adversely modify critical habitat for the PMJM on Pole Mountain during the Forest Plan Revision process. ***Therefore, this "changed circumstance," in and of itself, does not warrant a new or supplemental BA nor does it warrant a correction to or revision of the Pole Mountain EA (1998). However, a supplemental BA will be prepared to address utilization monitoring, as discussed below. The supplemental BA will consider both the PMJM mouse and its critical habitat.***

ACTION: *A supplement to the 1998 BA is not warranted for the presence of PMJM critical habitat. Therefore, no action is needed.*

b. Does the information about exceeding livestock forage utilization in PMJM critical habitat in the Pole Mountain grazing allotments require a different grazing management strategy and/or a supplement to the 1998 BA[2]?

[2] The 1998 BA (June 16, 1998) included a forage utilization standard in riparian areas of 40 to 45 percent. An addendum to the BA (October 19, 1998) changed the forage utilization standard to 45 to 55 percent to be consistent with the 1985 Forest Plan standards and guidelines. The USFWS concurred with the addendum on October 22, 1998 (see Appendix *).

Conclusion: *Although the 1998 BA contains a "not likely to adversely affect" determination for the PMJM, it does not clarify if utilization standards and guidelines are to be met at a pasture level, on average across the allotments, or within each key area*[3] *measured. In addition, USFS range managers indicate that, regardless of administration methods, it is likely that there will continue to be small areas, including PMJM suitable and/or critical habitat, where livestock concentrate (1 to 10 acres in size) and forage is utilized at higher levels. As a result of this information,* ***a supplement to the 1998 BA is recommended and will involve formal or informal consultation with the USFWS as necessary. Although a supplement to the BA is recommended, a correction to or a revision of the Pole Mountain EA (1998) is not warranted at this time.***

While consultation is pending, the USFWS agrees, under Section 7(d) of the Endangered Species Act, that grazing may continue during the 2004 season. However, the Forest Service must demonstrate that an irreversible or irretrievable commitment of resources will not occur as a result of the authorized grazing. Steps which will allow such a demonstration include the issuance of a drought letter to the permittees (Appendix A), increased monitoring of utilization before thresholds are approached, responsive rotation of livestock between pastures, increased riding efforts to minimize livestock concentrating in riparian areas, reducing livestock numbers, and retaining the authority to completely remove livestock from suitable habitat should consultation or habitat conditions dictate that this action is warranted. These activities or conditions will eliminate the risk of jeopardy or adverse modification of critical habitat while consultation is pending.

ACTIONS: *1) Meet all Livestock Management action items contained in the 2004 Water Quality Action Plan (Appendix G);*

2) Supplement the 1998 BA by June 30, 2004. The supplement will identify:

- *Monitoring protocol used to evaluate the effects to PMJM and their habitat;*
- *Specific monitoring results indicating when utilization standards and guidelines are being approached; and*
- *A specific strategy for managing livestock if thresholds are approached.*

3) Continue consultation with the USFWS; and

4) Revise the 1998 Pole Mountain EA if the USFWS requires additional reasonable and prudent measures and/or items and conditions to protect PMJM and their habitat.

[3] Key areas are defined as, "a portion of the range, which, because of its location, grazing or browsing value, and/or use, serves as an indicative sample of range conditions, trend, or degree of use seasonally. A key area guides the general management of the entire area of which it is part (USDA Forest Service, 1996).

4. New livestock grazing and PMJM standards and guidelines have been included in the Revised Medicine Bow National Forest Plan and Record of Decision (December 2003).

a. Are Allotment Management Plans on Pole Mountain consistent with direction (water quality and Preble's habitat protection) in the Revised Medicine Bow National Forest Plan and Record of Decision (ROD)?

Conclusion: *Page 51 of the Record of Decision for the Revised Forest Plan indicates that "it is not necessary to apply the Revised Plan's standards and guidelines retroactively." However, discretion is allowed, on a case-by-case basis, to modify pre-existing authorizations if they are not consistent with newly established standards, including the standards and guidelines in the Revised Forest Plan. For this reason, the North Zone Forest Hydrologist and Laramie Ranger District Wildlife Biologist reviewed the Pole Mountain AMPs to determine their consistency with direction contained in the Revised Forest Plan and ROD. The following was determined:* ***Pole Mountain AMPs are consistent with water quality (Appendix H) and PMJM habitat protection (Appendix I) direction found in the Revised Medicine Bow National Forest Plan and ROD, with a few exceptions.*** *The exceptions include:*

- *The two sites exceeding State of Wyoming water quality standards have not satisfied the intent of the water quality direction in the Revised Forest Plan; however, implementation of the 2004 Water Quality Action Plan (Appendix G) should allow for future compliance; and*
- *Revised Forest Plan standards and guidelines, direction contained in 1998 BA, and the mitigation measures described in the DN/FONSI for the Pole Mountain EA (1998) provide generally consistent direction with respect to managing livestock use and riparian areas in PMJM habitat.*
- *Forage utilization standards and guidelines vary slightly; however, they are consistent with the Revised Forest Plan. The 1998 Pole Mountain EA, associated AMPs, and Annual Operating Instructions identify a 45 to 55 percent forage utilization standard and guideline in riparian areas (EA page 21), consistent with the 1985 Medicine Bow National Forest Plan (Forest Plan page III-38). The DN/FONSI and June 16, 1998 BA indicate that utilization of herbaceous species is to be limited to 40 to 45 percent (Mitigation Measure). An addendum to the BA (October 19, 1998) was prepared to reflect the 45 to 55 percent guideline, and the USFWS issued a letter concurring with this standard and guideline change on October 22, 1998 (Appendix B). The Revised Forest Plan (December 2003) contains a guideline of 40 - 50 percent forage utilization (Revised Forest Plan Table 1-7, page 1-33)* ***or*** *as set by an Allotment Management Plan (Standard, page 1-32). Since the Pole Mountain Allotments have approved AMPs containing the 45 – 55 percent utilization standard and guideline, they are consistent with direction contained in the Revised Forest Plan.*

Based on the above information, ***this "changed circumstance" does not warrant a correction to or a revision of the 1998 Pole Mountain EA.***

ACTIONS: 1) Implement the 2004 Water Quality Action Plan (Appendix G); and 2) Write a letter to the file (errata) indicating that mitigation measure #9 in the DN/FONSI (page5) is incorrect and will be changed to be consistent with the 45 - 55 percent utilization standard and guideline from the 1985 Forest Plan and the USFWS concurrence letter (October 22, 1998, Appendix B).

III. Findings

Detailed analyses of the changed circumstances and the findings are contained on pages 11 through 28 of this SIR.

Based on my review of information contained in this SIR, which addresses all four of the "changed circumstances," I conclude that there is no need to correct or revise the 1998 Pole Mountain EA at this time. The resulting effects of all of the changed circumstances are being addressed through the actions identified above, all of which are within the scope of the 1998 Pole Mountain EA. Therefore, a correction or revision of the EA is unnecessary.

Dated this 11th day of May 2004.

Clinton D. Kyhl
Laramie District Ranger
Medicine Bow-Routt National Forests

II. Changed Circumstances

Since the 1998 Pole Mountain EA and DN/FONSI were issued, four "changed circumstances" have come to light. The four circumstances and the questions developed to address each circumstance are as follows:

1. Forage utilization standards and guidelines, including those related to the maintenance of stubble height in riparian areas and utilization of herbaceous species, have been exceeded (1985 Forest Plan page III-38).

a. Does the information concerning exceeding forage utilization standards and guidelines in one pasture in each of two allotments require a change in allotment management direction overall or a change in allotment management for drought years only?

2. State of Wyoming water quality standards for E. coli and fecal coliform bacteria have been exceeded in two stream reaches.

a. Does the information concerning exceeding water quality standards in one pasture in each of two allotments require a change in allotment management direction overall or a change in allotment management for drought years only?

b. Do changes in allotment management need to occur if the two streams that are currently exceeding State of Wyoming water quality standards are listed on Wyoming's final 2004 305(b) State Water Quality Assessment Report and 303(d) List of Waters Requiring Total Mean Daily Load (TMDL) as impaired water bodies for not meeting contact recreation water uses?

3. Critical Habitat for the Preble's Meadow Jumping Mouse (PMJM) has been designated within Pole Mountain grazing allotments.

a. Does the presence of PMJM suitable or critical habitat in the Pole Mountain grazing allotments require a new project level Biological Assessment (BA)/Biological Evaluation (BE) and further consultation with the USFWS?

b. Does the information about exceeding livestock forage utilization in PMJM critical habitat in the Pole Mountain grazing allotments require a different grazing management strategy and/or a supplement to the amended1998 BA?

4. New livestock grazing and PMJM standards and guidelines have been included in the Revised Medicine Bow National Forest Plan and Record of Decision (December 2003).

a. Are allotment management plans on Pole Mountain consistent with direction (water quality and PMJM habitat protection) in the Revised Medicine Bow National Forest Plan and Record of Decision?

III. Findings

This section presents the findings that were used to determine if the four "events" that have occurred since the Pole Mountain EA and DN/FONSI were issued create a "significant new circumstance(s)" or result in "new information" that may have a bearing on how domestic livestock grazing is administered within the Pole Mountain Area of the Medicine Bow National Forest. The findings are intended to assist the Responsible Official in determining whether or not a change to the Pole Mountain EA is necessary or if the Forest Service must prepare a revised environmental assessment prior to continued authorization of domestic livestock grazing.

1. Forage utilization standards and guidelines, including those related to the maintenance of stubble height in riparian areas and utilization of herbaceous species, have been exceeded (1985 Forest Plan page III-38) (Changed Circumstance).

> *a. Does the information concerning exceeding forage utilization standards and guidelines in one pasture in each of two allotments require a change in allotment management direction overall or a change in allotment management for drought years only?*

Background: In 1990 the Laramie District began to intensively monitor vegetation utilization and to move livestock through the grazing systems based on this utilization. The monitoring methodology included clipping and weighing using utilization cages and, in low budget years, ocular estimates. When utilization was reached, livestock were moved to the next pasture or off the allotments. The Forest Plan (1985) standard being used at the time was as follows, "allowable use in riparian areas is 45 to 55 percent utilization in each pasture for deferred rotation grazing systems" (Forest Plan page III-38). This management direction has been maintained on the Pole Mountain Unit from 1990 to present.

In 2000, the Upper North Platte River Basin, which includes watersheds within the Pole Mountain Area, began experiencing varying levels of drought. Drought conditions have resulted in reduced forage production and water availability on National Forest System lands within the Pole Mountain Area. To mitigate the impacts that livestock could have on rangeland and water resources during this drought period, the Forest Service and grazing permittees made efforts to alter livestock management. Efforts included issuing drought letters for the 2002 to 2004 grazing seasons (see Appendix A), reducing stocking numbers by 48 and 47 percent in 2002 and 2003, respectively, changing pasture rotations, and reducing the overall season of use see Appendix F). Despite these efforts, however, localized areas experienced forage over-utilization, and State of Wyoming water quality standards for E. coli and fecal coliform were exceeded in two stream segments.

Vegetation Utilization Existing Condition: An average of the key areas since 1998 shows that 3 out of 6 allotments have met the standards for forage utilization listed in the AMPs and Annual Operating Instructions. Analysis of this data shows that some key areas receive a higher level of utilization than the guidelines permit. Utilization tends to vary depending on when the pasture is used and the amount of forage produced. There are, however, a few areas that consistently seem

to receive a high level of utilization. In these areas the Forest Service is striving to meet the standards and to determine the cause of the forage over-utilization.

Localized areas of forage utilization does not equate to the loss or decline of riparian area condition. This is demonstrated by no change in overall vegetation type, no downward trend in stream stability, and an improving trend in shrub density, vigor, and recruitment. The shrubby/willow component of riparian areas is healthy and showing an improving trend. Photo points, which were originally taken in 1996 and re-taken in 2001, are available which show that the current shrub component is being maintained and is frequently increasing. Photo points, again taken in 1996 and re-taken in 2001, are also available showing that stream bank conditions are improving.

Between 1999 and 2003, utilization and stubble height standards listed in the DN/FONSI for the 1998 Pole Mountain EA were exceeded in areas where vegetation was specifically sampled. Discussions with the former Laramie District Rangeland Management Specialist provided the following rationale as to why forage utilization standards and guidelines were exceeded:

- By design, utilization cages were established in the key areas, i.e., the most heavily grazed areas of a pasture. If the most heavily grazed areas were in compliance with Forest Plan utilization standards and guidelines, it was then assumed that the rest of the drainage should be in good condition.
- Appendix D contains vegetation utilization data at Pole Mountain from 1998 to 2003. Vegetation samples from utilization cages were typically collected only where thresholds were being approached. If ocular estimates indicated that a key area was not exceeding the standards, additional data were not collected. Thus, many of the blanks depicted in the utilization table contained in Appendix D indicate where utilization standards and guidelines were considered to have been within the 45 – 55 percent range.
- Drought conditions began in 2000 with 2002 and 2003 being more severe. Reduced moisture led to less forage production. As a result, existing permitted livestock had the potential to highly utilize forage in some areas. Frequently, high utilization occurred in a matter of several days, between the time the permittee was contacted to move livestock and the time it took for the permittee to take action.

The Forest Service recognizes that during a period of drought there is a need to have a higher focus on administration of grazing practices, such as more active and regular monitoring of conditions, and collecting utilization data earlier during active grazing before thresholds are being approached. We also recommend that permittees be trained to actively monitor sites and that permittees employ a full time rider in the Pole Mountain Grazing allotments to keep cattle moving between pastures in a timely manner.

Conclusion: Although monitoring data indicates that forage utilization standards and guidelines have been exceeded in localized areas, new livestock grazing management strategies are not recommended or needed at this time. The Forest Service does, however, need to demonstrate better compliance with the mitigation measures outlined in the 1998 DN/FONSI, and respond more quickly to the effects of drought. Such actions should include reducing seasons of use, reducing stocking levels, reducing the timing of use in individual pastures, requiring increased riding and herding, implementing the livestock management portion of the 2004 Water Quality

Action Plan (Appendix G), and more intensively monitoring use levels while livestock are actively grazing pastures. All of these actions fall within the parameters of the AMPs and the Annual Operating Instructions. *Therefore,* ***it is not recommended that this "changed circumstance" result in a correction to or a revision of the Pole Mountain EA (1998).***

2. State of Wyoming water quality standards for E. coli and fecal coliform bacteria have been exceeded in two stream reaches (Changed Circumstance).

a. Does the information concerning exceeding water quality standards in one pasture in each of two allotments require a change in allotment management direction overall or a change in allotment management for drought years only?

Background: The DN/FONSI for the 1998 Pole Mountain EA required livestock utilization, streambank alteration, and riparian vegetation community monitoring; it did not recommend any biological water quality monitoring. However, in response to concerns expressed by a member of the public, the Wyoming Department of Environmental Quality Water Quality Division (WYDEQ) has taken 76 bacteria water quality samples at six monitoring stations on three streams within Pole Mountain allotments since October 2002. The numeric water quality standard for fecal coliform, an indicator bacteria standard established by WYDEQ to protect contact recreational water uses, was exceeded for at least one sampling period at two of the six monitoring stations (WYDEQ, 2002; WYDEQ 2003a). Livestock have been identified as a possible major contributing source of elevated bacteria levels, but not the only source (WYDEQ, 2002; WYDEQ, 2003a; USFS, 2003).

According to the Annual Big Game Population and Harvest Reports published by the Wyoming Game & Fish Department, estimated populations of all big game species on the Pole Mountain unit (as of 2000) are above Herd Management Objective (HMO) by 10 percent or more – Iron Mountain elk, Iron Mountain and Laramie Peak mule deer, Iron Mountain antelope, and Southeast Wyoming white-tailed deer. There is no established Objective for moose populations in the area at this time.

Forest Service rangeland managers and biologists continue to coordinate and cooperate with Wyoming Game & Fish regional personnel and field biologists to manage big game populations to maintain numbers at HMO levels. Population numbers exceeding those desired levels can create impacts to habitat or desired vegetation conditions and/or create possible conflicts with other uses, including possibly contributing to exceeding water quality standards in isolated cases.

Dispersed recreation was also identified by the Wyoming Department of Environmental Quality (DEQ) as a possible contributing source of fecal coliform (Wyoming DEQ, December 2003). Forest Service managers are taking actions, as identified in the 2004 Water Quality Action Plan (Appendix G), to minimize the effects of dispersed recreation activities on water quality.

As a result of elevated levels of fecal coliform, North Branch North Fork Crow Creek and Middle Crow Creek have been listed on Wyoming's ***Draft*** 2004 305(b) State Water Quality Assessment Report and ***Draft***[4] 303(d) List of Waters Requiring TMDL's (WYDEQ, 2003b) as impaired water bodies for not meeting contact recreation water uses. Best Management Practices (BMPs) identified to protect water quality have not been fully implemented in the two stream reaches (see Nonpoint Source Management Strategy below). Therefore, continued water quality

[4] The final reports are expected in July of 2004.

and BMP monitoring are recommended to meet the intent of the Clean Water Act and the Revised Forest Plan (December 2003).

Nonpoint Source Management Strategy: The majority of potential sources of fecal pollution on the Pole Mountain allotments, such as livestock grazing, wildlife, and dispersed recreation, are considered nonpoint sources of pollution:

> Nonpoint sources of pollution are diffuse in nature, difficult to assess, and result from land use activities in which contaminated runoff flows into surface water or percolates into ground water. Many factors, such as precipitation, soil type, slope, geology, vegetative cover, depth to groundwater, and distance to surface water can affect whether a land use will cause nonpoint source pollution (WYDEQ, 2000 p ii).

The Forest Service and WYDEQ have agreed to coordinate and cooperate in achieving water quality goals and standards (USFS, 1981). WYDEQ "recognizes the value and benefits of authorities, technical capabilities, and nonpoint programs currently being implemented by state, local and federal agencies" (WYDEQ, 2000 p2). As outlined in a Memorandum of Understanding (USFS, 1981), the Forest Service has developed a "NonPoint Source Management Strategy" (Appendix E). This strategy is recognized by WYDEQ as the primary means to address nonpoint source pollution on National Forest System lands as summarized below:

> The program that the USFS implements to control nonpoint sources of pollution works on the premise that nonpoint sources can be controlled by relying on state BMP programs, as intended by Congress in CWA Section 319. As applied by the USFS on National Forest System lands, the BMP program consists of: 1) defining practices, based on the best information available, that are expected to protect water quality; 2) monitoring to ensure the practices are applied; 3) monitoring to determine the effectiveness of practices; 4) mitigation to address unforeseen problems; and, 5) adjustment of design specifications of BMPs for future activities, where appropriate (WYDEQ, 2000 p13).

Application: The following discussion describes how the Forest Service has applied the Nonpoint Source Management Strategy to the Pole Mountain allotments and taken specific action to address water quality issues in the Crow Creek and Green Mountain Allotments. Practices that have been defined on these allotments that are expected to protect water quality are shown, followed by a discussion of implementation monitoring for that practice. The effectiveness of how these practices meet water quality criteria is discussed. Actions and mitigation taken to address elevated levels of fecal coliform, an unforeseen problem, are summarized for 2002 and 2003. Adjustments to design specifications of BMPs and recommended actions for the future are also presented.

Best Management Practices and Implementation Monitoring: Several practices have been defined to protect water quality on the Pole Mountain allotments. These practices and

the monitoring to determine if these practices have been implemented as planned are discussed below.

BMP #1 - Grazing System: *All of the allotments will be managed under a deferred-rotation grazing system. The order in which pastures are used will be rotated each grazing season (USFS AMP, Management Actions). Prohibit season-long grazing in riparian pastures (USFS, 1998b. p4, #2). Control the length of grazing period in spring use riparian pastures to minimize utilization of regrowth. This is normally 20 to 30 days (USFS, 1998b. p4, #8).*

Implementation Monitoring BMP #1: All seven allotments on Pole Mountain are managed under a deferred-rotation grazing system; therefore, each pasture contains livestock for only a portion of each grazing season. Rangeland Management personnel maintain actual use records to document the season of use for each pasture. There are no riparian pastures (all pastures also contain extensive upland areas) in the Pole Mountain Allotments and all pastures are summer/fall use, so the riparian pasture and spring use mitigation measures do not directly apply.

The reach of North Branch North Fork Crow Creek with elevated fecal coliform levels is located in the Crow Creek Allotment, West pasture. Actual use for this pasture was 464[5] cattle for 22 days (7/22-8/13) in 2002 and 380 cattle for 30 days (8/21-9/20) in 2003. Fecal coliform samples taken from May 14-June 10, 2003 were well below established water quality criteria. Sample periods with elevated levels of fecal coliform were October 3-21, 2002 and September 15-29, 2003.

Two other water quality sample stations located on North Branch North Crow Creek have not shown elevated levels of fecal coliform. One station, located just upstream of Highway 210 (approximately 1 mile above the station with the elevated fecal coliform) is in the #1 East pasture of the Lodgepole Allotment. Actual use for that pasture was 464 cattle for 21 days (7/2-7/22) in 2002 and 370 yearlings for 39 days (6/20-7/28[6]) in 2003. The other station is located at the Forest boundary (approximately 3 miles downstream of the station with elevated fecal coliform) in the #3 South pasture of the Crow Creek Allotment. Actual use for that pasture was 464 cattle for 26 days (6/7-7/2) in 2002 and 340 cattle for 40 days (6/9-7/18[7]) in 2003.

The reach of Middle Crow Creek with elevated fecal coliform levels is located in the Green Mountain Allotment, West pasture. Actual use for this pasture was 466 cattle for 11 days (8/6-8/17) in 2002 and 375 cattle for 20 days (8/21-9/10) in 2003. The sample period with elevated levels of fecal coliform was September 15-29, 2003. The October 3-21, 2002 and May 14-June 10, 2003 sample periods showed fecal coliform levels were well below established water quality criteria.

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[5] Although 454 livestock are permitted, a slight increase in livestock numbers was permitted due to the shortened grazing season.

[6] Yearlings came on in shifts with full numbers (370 yearlings) using the allotment for only 19 days between 7/10-7/28.

[7] Cattle came on in shifts with full numbers (380 cattle) using the allotment for 33 days between 6/16-7/18.

Water quality samples taken at two stations in 2002 and 2003 on the South Branch North Fork Crow Creek have not shown elevated levels of fecal coliform. One station, located just downstream of Highway 210, is in the #1B Northcentral pasture of the Green Mountain Allotment. Actual use for that pasture was 466 cattle for 11 days (7/17-7/27) in 2002 and 375 cattle for 18 days (7/11-7/28) in 2003. The #2 Northwest pasture of the Green Mountain Allotment is located just upstream of this sample point and actual use for that pasture was 466 cattle for 11 days (7/27-8/6) in 2002 and 375 cattle for 24 days (7/28-8/20) in 2003. The other station is located at the Forest boundary (approximately 2.5 miles downstream of the station at Highway 210), is in the #1A North pasture of the Crow Creek Allotment. Actual use for that pasture was 466 cattle for 15 days (7/3-7/15) in 2002 and 375 cattle for 22 days (6/20-7/11[8]) in 2003. Actual use for the Crow Creek #3 South and #1B Northcentral pastures, which may also influence this water quality sample point, are presented above.

BMP #2 - Utilization standards and guidelines/Triggers for Livestock Movement: *Remove livestock from grazing units when average stubble heights on Carex spp. reach 3-4 inches in spring-use pastures and 4-6 inches in summer/fall pastures (USFS, 1998b. p4, #5). Require the maintenance of a 4 inch stubble height of sedges and rushes in all riparian areas within grazing allotments (USFS, 1998b. p4, #10). Remove livestock from grazing units when streambank disturbance (trampling, exposed soils, etc.) from current years livestock grazing reaches 20 to 25 percent of the key area stream reach (USFS, 1998b. p4, #6). Limit utilization of woody plants to 15 to 20 percent current annual growth (USFS, 1998b. p4, #7).*

Implementation Monitoring BMP #2: Based on conversations with Ed Snook (former hydrologist on the Forest), Clarke McClung and George Wiggins (former Rangeland Management Specialists on Laramie District), riparian stubble height has been used to determine when to move livestock from riparian areas on these allotments. Streambank disturbance and utilization of woody plants has not been monitored on the allotments since completion of the EA. The stubble height monitoring was not conducted from 1999-2001, but key areas were monitored for stubble height in 2002 and 2003. In 2002, stubble height was monitored on 14 key areas of the Pole Mountain allotments. Stubble heights at these sites ranged from 2.0 to 3.8 inches. In 2003, stubble height was monitored on 16 key areas of the Pole Mountain allotments. Stubble heights at these sites ranged from 1.8 to 11.5 inches. ***Overall, most stubble height monitoring stations did not meet the established guidelines on the Pole Mountain allotments in 2002 and less than half of the stations met the guidelines in 2003.***

Riparian stubble height averaged 2.62 and 2.48 inches in 2002 and 2003 respectively, on the Crow Creek allotment. Results from key area monitoring closest to the reach of stream with elevated levels of fecal coliform are not available in 2002, but were 3.65 inches in 2003. Riparian stubble height averaged 3.41 and 5.65 inches in 2002

[8] Cattle came on in shifts with full numbers (466 cattle) using the allotment for 12 days between 6/30-7/11.

and 2003 respectively, on the Green Mountain allotment. Results from key area monitoring closest to the reach of stream with elevated levels of fecal coliform were 3.8 in 2002 (fecal coliform samples met water quality criteria in 2002), and 3.0 inches in 2003. ***Most stubble height monitoring stations on the Crow Creek and Green Mountain Allotments did not meet the established standards in 2002 and 2003.***

BMP #3 - Livestock Distribution: *Riding should be done to periodically move the stock to areas of lighter utilization. Herding large groups of livestock in or along riparian areas should be avoided as much as possible (USFS AMP, Management Actions).*

Implementation Monitoring BMP #3: Based on the experiences of Clarke McClung and George Wiggins from 1990 to 2003, most permittees are present on the allotments two to three times a week to check and distribute livestock. Forest Service personnel also monitor livestock distribution and work with permittees to ensure adequate livestock distribution. Range personnel maintain actual use records that detail the amount of time permittees spend on allotments in any given season. Permitted versus actual use data from 2000 to 2003 is presented in Appendix F.

In September 2003 the Crow Creek allotment livestock were herded to the south end of the #2 West pasture in preparation for being moved off the allotment. Cattle were concentrated in a relatively small triangular shaped area immediately to the east of the holding unit and in the vicinity of the water quality sampling station. Some of the water quality samples with elevated levels of fecal coliform were taken during this period.

Inadequate distribution of livestock in 2002 and 2003 contributed to over-utilization of riparian forage on the Crow Creek and Green Mountain allotments in the vicinity of the water quality sampling points with elevated levels of fecal coliform (see BMP #2 above).

BMP #4 - Type and numbers of livestock: *Permitted numbers and type of livestock are shown in the Allotment Management Plan (USFS, AMP, Management Actions).*

Implementation Monitoring BMP #4: The Crow Creek allotment is permitted for 454 cow/calf pairs (2,074 head months) from June 1 to October 15, on 8,189 suitable acres. The Green Mountain allotment is permitted for 524 cow/calf pairs (2,284 head months) from June 1 to October 15, on 8,320 suitable acres. See discussion under BMP #1 for specific dates and numbers in pastures where elevated levels of fecal coliform were measured.

BMP #5 – Salting Practices: *Salt should be placed at least 300 – 400 yards from water. No salting, insecticide devices or feed supplements are allowed within riparian areas (USFS, AMP, Management Actions).*

Implementation Monitoring BMP #5: Based on the experiences of Clarke McClung and George Wiggins from 1990 to 2003, salting has not typically been done in riparian areas on the Pole Mountain allotments.

BMP #6 – Water developments: *Stock-water developments provide additional water sources throughout allotments allowing better distribution of livestock and reducing concentrations of livestock in riparian areas.*

Implementation Monitoring BMP #6: There are 21 stock-water developments within the Pole Mountain allotments including 6 in the Crow Creek Allotment and 4 on the Green Mountain Allotment.

BMP #7 – Rest Problem Areas: *Implement total rest in riparian pastures with deteriorated range where conditions are not likely to improve with livestock grazing (USFS, 1998b. p4, #4).*

Implementation Monitoring BMP #7: There are no riparian pastures (all pastures also contain extensive upland areas) in the Pole Mountain allotments, so the riparian pasture mitigation measure does not directly apply. No pastures have been recommended for rest, or rested as a result of deteriorated range since completion of the EA. Some permittees have taken non-use for other reasons during that period.

Effectiveness Monitoring: Water quality samples integrate all of the natural and anthropogenic conditions in a watershed, but sampling is rarely adequate to conclusively determine sources or causes of nonpoint source pollution. Monitoring the effectiveness of an individual BMP in meeting water quality criteria is problematic due to fecal contamination being a nonpoint source of pollution and the variety of potential natural and anthropogenic sources of fecal pollution. Nonetheless, evaluation of the effectiveness of BMPs can provide an indication of the sources or causes of pollution, but determinations are based largely on professional judgment of how the practices interact and contribute to overall water quality conditions. Evaluation of the effectiveness of BMPs primarily provides a mechanism to prioritize and adjust BMPs to achieve water quality standards.

Water Quality Sampling: The Wyoming Department of Environmental Quality Water Quality Division (WYDEQ) has taken 76 bacteria water quality samples at six monitoring stations on three streams within the Pole Mountain allotments since October 2002. ***The numeric water quality standard for fecal coliform, an indicator bacteria standard established by WYDEQ to protect contact recreational water uses, was exceeded for at least one sampling period at two of the six monitoring stations (WYDEQ, 2002 and WYDEQ 2003a).*** Livestock have been identified as a possible major contributing source of elevated bacteria levels, but not the only source (WYDEQ, 2002; WYDEQ, 2003; USFS, 2003).

Evaluation of all available water quality monitoring results at this time indicate that elevated fecal coliform levels are not a widespread problem on the Pole Mountain allotments and have been confined to a couple of localized areas. This conclusion is

supported by an assessment of nearly 800 water quality samples collected on the Forest between 1973 and 1979, which indicated that most streams (98.5 % of the samples) had bacterial levels less than 200 colonies/100 mL (Gloss, 2003). Six samples on Middle Crow (near Blair and Wallis picnic grounds) and Lodgepole Creeks (near Tie City) were among the sites which did exceed 200 colonies/100 ml (Gloss, 2003). More recent bacterial water quality samples taken at various locations across the Forest are showing similar results with localized areas of elevated fecal coliform, but overall low concentrations of fecal coliform (Gloss, 2004). WYDEQ sampling on the North Branch North Fork Crow Creek (WYDEQ, 2003a) also indicates that elevated levels of fecal coliform are localized, since the sample site which exceeded water quality criteria was bracketed by samples sites above and below which did not exceed water quality criteria.

Best Management Practices: The deferred grazing system established for the Pole Mountain allotment is believed to be one of the most effective BMPs implemented to protect water quality, by providing for even forage utilization and limiting season-long concentrations of livestock in riparian areas.

Riparian stubble height, used as an indicator to determine when to move livestock, has not met established guidelines in the majority of samples in 2002 and 2003, both at sites with and without elevated levels of fecal coliform. Available data are limited and do not show an obvious correlation between riparian stubble height and levels of fecal coliform (see Figure 1). Since standards for riparian stubble height have not been met in the vicinity of stream reaches with elevated levels of fecal coliform in 2002 and 2003, it is not possible at this time to determine if this BMP is effective to protect water quality.

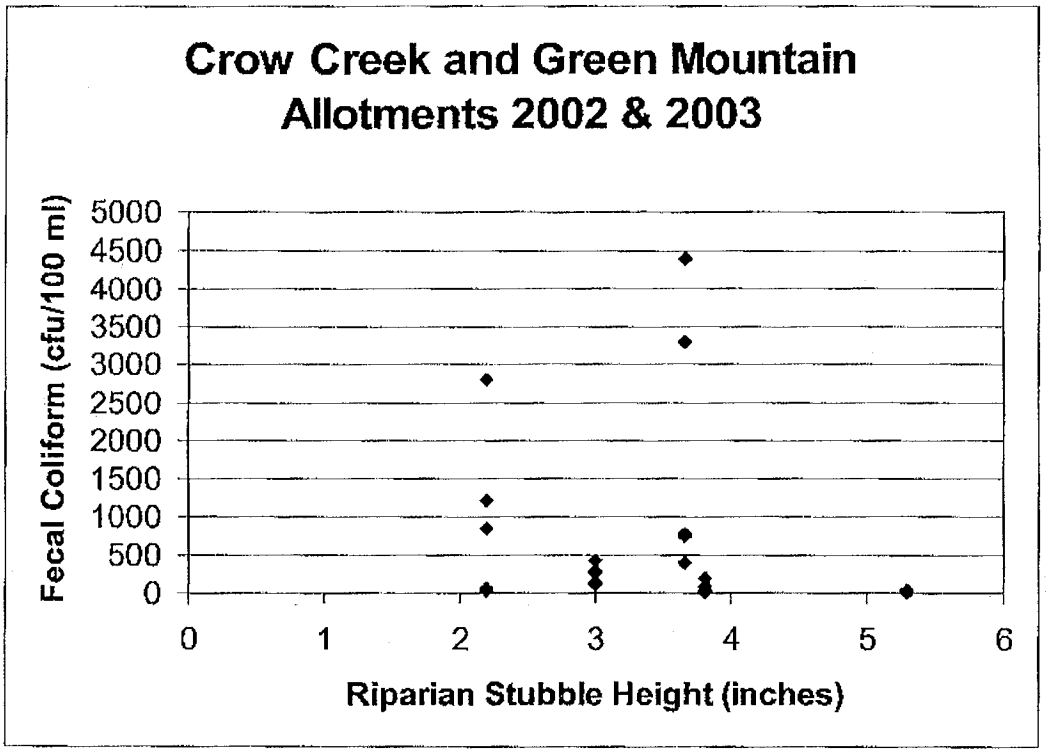

Figure 1. Relationship between riparian stubble height and fecal coliform

Research suggests bacteria contamination from livestock is related to the concentration of cattle near streams and the ability of riparian vegetation to filter out pollutants. There appears to be a positive correlation between when livestock are present and fecal coliform (see Figure 2). Anecdotal observations support this conclusion (e.g. WYDEQ, 2002; WYDEQ, 2003a). Distribution of livestock throughout the allotments to reduce concentrations in riparian areas is likely one of the primary factors influencing fecal coliform concentrations from livestock sources. Salting practices and water developments have been effectively used to distribution livestock to upland areas in these allotments. The number and type of livestock probably play a minor role in fecal coliform concentrations as compared to distribution.

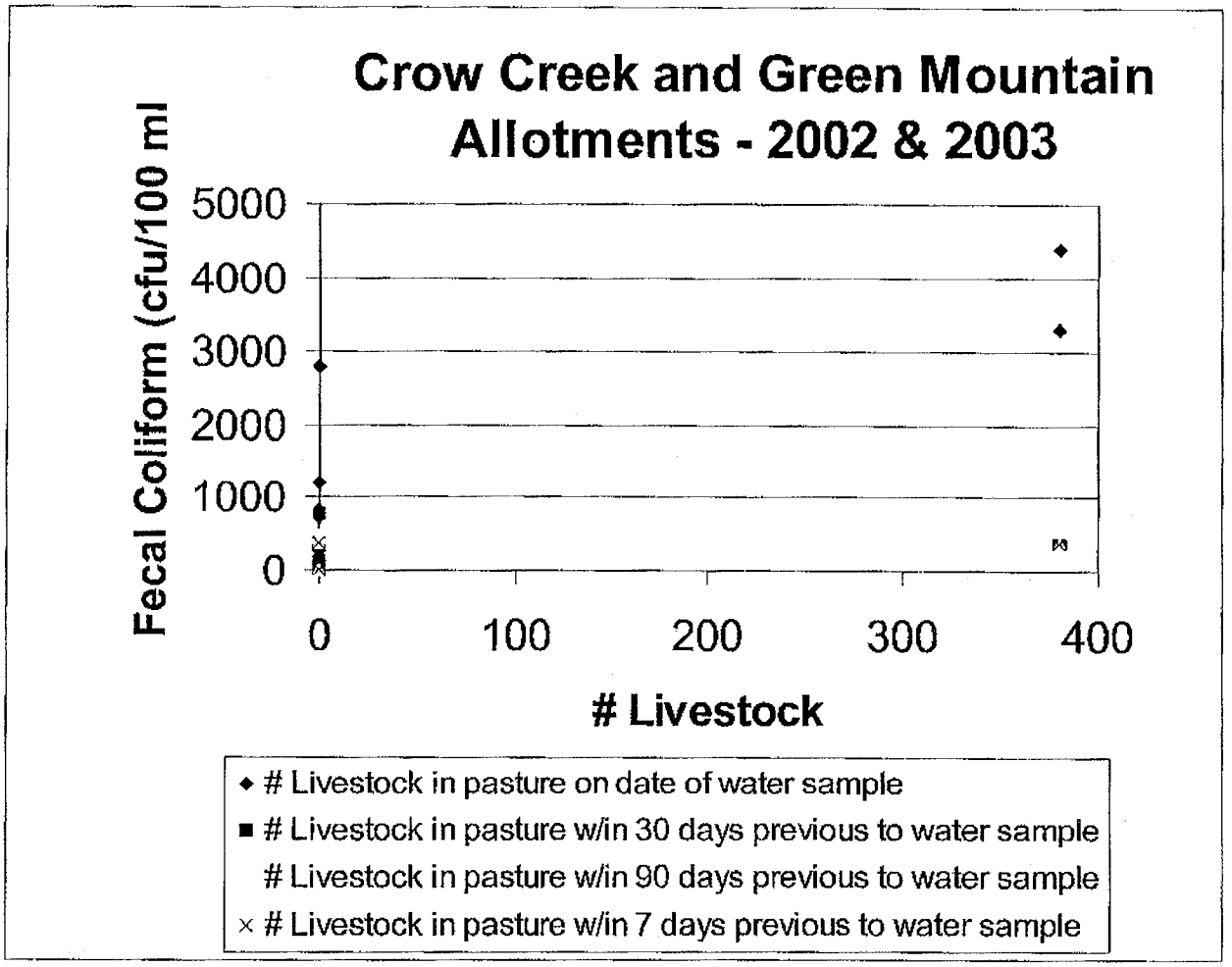

Figure 2. Relationship between livestock numbers, presence in allotment and fecal coliform

Overall management practices on Pole Mountain have been effective at protecting water quality since the majority of water quality sampling stations meet state water quality standards for fecal coliform. Photos repeated in the same locations in 1996 and 2001 indicate a general trend toward improved riparian conditions (Laramie Ranger District Range files). Photos show increased herbaceous and shrub cover and improved streambank stabilization. Improved riparian conditions suggest that overall BMPs have been an effective means to manage livestock and reduce livestock concentrations in riparian areas, which has likely improved water quality conditions. There are no obvious differences in management practices in the vicinity of the stations with elevated levels of fecal coliform, as compared to stations that met water quality criteria. ***Increased administration of riparian utilization standards and guidelines is necessary to determine the effectiveness of that practice in meeting water quality criteria and Forest Plan direction.*** Limited evidence suggests timing and distribution of livestock near the water quality stations may be the primary reason for elevated levels of fecal coliform from livestock sources. ***Other reasons for elevated levels of fecal coliform, such as human and natural sources, cannot be discounted and should continue to be considered.***

Actions and mitigation to address unforeseen elevated levels of fecal coliform: The Forest has taken a variety of actions to address elevated levels of fecal coliform on Pole Mountain. Based on the limited water quality information available in the fall of 2002, the overall strategy for 2003 was to make minor adjustments to grazing practices, focus on meeting riparian utilization standards and guidelines, and conduct additional monitoring to determine the extent and persistence of elevated levels of fecal coliform. The actions taken as of February 12, 2004 are summarized in a letter to the WYDEQ (USFS, 2004).

Adjustment of design specifications of BMPs for future activities: Water quality monitoring in 2003 provided a better understanding of the extent and duration of elevated levels of fecal coliform on North Branch North Fork Crow Creek. Elevated levels of fecal coliform appear to be limited to the area near NFSR 701 and occur during late summer low flow conditions. Water quality monitoring in 2003 also surfaced elevated levels of fecal coliform on Middle Crow Creek, but did not define the extent and duration of conditions on that stream. Riparian stubble height did not meet standards in the vicinity of the stream reaches with elevated levels of fecal coliform, indicating the need for more frequent utilization monitoring and increased administration of livestock distribution in the Pole Mountain allotments. Actions recommended to address fecal water quality issues in 2004 are detailed in Appendix G – 2004 Water Quality Action Plan.

Conclusion: The Forest has a Nonpoint Source Management Strategy in place to control and address nonpoint source pollution in order to meet water quality standards. The Forest has utilized the feedback mechanisms inherent in this strategy to monitor and adjust practices in an effort to meet established water quality criteria where it has been exceeded. Water quality criteria for fecal coliform have been exceeded on North Branch North Fork Crow Creek (2002 and 2003) and Middle Crow Creek (2003). Implementation and/or effectiveness of Forest Plan direction in the AMPs have been insufficient to ensure water quality protection. Additional actions within the scope of the existing environmental analysis have been identified to address these situations. ***Continued application and implementation of the Nonpoint Source Management Strategy to monitor and implement allotment management direction is necessary to meet water quality standards.***

b. Do changes in allotment management need to occur if the two streams that are currently exceeding State of Wyoming water quality standards are listed on Wyoming's final 2004 305(b) State Water Quality Assessment Report and 303(d) List of Waters Requiring Total Mean Daily Load (TMDL) as impaired water bodies for not meeting contact recreation water resources?

If streams are listed on the State's 303(d) list as impaired, the Forest Service will be required to develop a Watershed Plan to address ways to mitigate exceedance of State standards for E. coli and fecal coliform. The Watershed Plan will be developed with stakeholders, including the public. Action items identified within this plan could be outside the scope of the existing 1998 Pole Mountain EA. Therefore, implementation of the plan could warrant a correction to or a

revision of the 1998 Pole Mountain EA. The release of the final 303(d) list is scheduled for July of 2004.

3. Critical habitat for the Preble's Meadow Jumping Mouse (PMJM) has been designated within Pole Mountain grazing allotments (Changed Circumstance).

a. Does the presence of PMJM suitable or critical habitat in the Pole Mountain grazing allotments require a new project level Biological Assessment (BA)/Biological Evaluation (BE) and further consultation with the USFWS?

On June 23, 2003, critical habitat for the PMJM was designated in the Federal Register by the USFWS. Designation of critical habitat formally identifies specific areas important to the recovery of the PMJM and notifies federal agencies of specific areas to be given special consideration when planning. Roughly 4.2 miles of critical habitat were designated on Middle Lodgepole Creek within the Pole Mountain Area.

Official designation of critical habitat for the PMJM occurred several years after the project level Biological Assessment (1998 BA) was prepared for the Pole Mountain EA (1998). However, as part of the original BA, "Mouse Protection Areas" were identified and specifically considered when developing conservation measures to protect the PMJM and its habitat. The conservation measures were incorporated into the final decision document for the project as mitigation measures. During the formal process of designating critical habitat, the USFWS used the Mouse Protection Areas to designate critical habitat on Pole Mountain. Specifically, all areas designated as critical habitat on Pole Mountain lie within the previously identified Mouse Protection Areas used during the 1998 BA.

A BA was prepared, and formal consultation with the USFWS occurred, for the Revised Medicine Bow National Forest Plan (December 2003). The BA and consultation included the effects of livestock grazing activities, as well as rangeland management standards and guidelines contained in the Forest Plan to PMJM and designated critical habitat. In response to the BA, the USFWS issued a Biological Opinion (including the implementation of "reasonable and prudent measures" and specified "terms and conditions") indicating that planned activities are not likely to jeopardize the continued existence of PMJM and that they are not likely to adversely modify critical habitat for the PMJM. The Biological Opinion included areas designated as PMJM critical habitat in the Pole Mountain Area. Therefore, ***neither a correction nor a supplement to the amended 1998 BA is warranted based on the presence of PMJM critical habitat.***

b. Does the information about exceeding livestock forage utilization in PMJM critical habitat in the Pole Mountain grazing allotments require a different grazing management strategy and/or a supplement to the amended 1998 BA?

Table 1 shows the results of forage utilization monitoring in designated key range areas within estimated PMJM suitable habitat. Blank figures indicate areas where forage clippings were not sampled. **Key areas N5 through N8 (shaded rows)** are within or adjacent to designated critical habitat. Table 2 depicts stubble heights of Carex spp. after livestock grazing had occurred in PMJM suitable and/or critical habitat. These Tables were extracted from the "Wildlife Review of the 1998 Pole Mountain Allotment Management Plan Revisions" report (Appendix J).

Table 1 – Percent utilization of key areas in PMJM suitable and/or critical habitat

Allotment Name	Key Area Number	1998	1999	2000	2001	2002	2003
Crow Creek							
	C4	--	--	--	--	--	75%
	C5E	--	--	--	--	--	--
	C5W	--	--	--	--	91%	--
	C9	--	--	--	--	71%	65%
Green Mtn.							
	G3	20%	--	--	--	--	--
	G4E	40%	--	--	--	--	67%
	G4W	40%	--	--	--	--	61%
	G6	--	--	--	--	82%	66%
	G7	--	--	--	--	--	--
	G9	--	--	65%	--	--	--
	G15	--	--	--	53%	58%	--
Horse Creek							
	N3	--	--	--	67%	83%	--
	N5	45%	--	--	80%	--	--
	N6	50%	--	--	63%	--	--
	N7	55%	--	--	71%	70%	--
	N8	45%	86%	60%	87%	--	82%
	N10	--	--	--	57%	--	62%

Table 2 – Stubble height of Carex spp. after grazing in PMJM suitable habitat

Allotment	Year	2002	2003
Crow Creek			
	C4	2.0	2.0
	C5	3.0	1.8
Green Mountain			
	G3	3.4	--
	G4	3.7	--
	G6	3.1	--
	G7	3.8	--
Horse Creek			
	H8	--	6.5
Lodgepole			
	L6	--	11.5
North Pasture			
	N3	--	5.2
	N5	--	3.2
	N7	3.2	4.4 4.6
	N8	--	5.8
	N10	3.0	--

Although the above data indicates that forage utilization standards and guidelines have been exceeded in localized areas within suitable and/or critical PMJM habitat, new livestock grazing management strategies are not recommended at this time[9]. As previously mentioned, however, the Forest Service must demonstrate better compliance with the mitigation measures outlined in the 1998 DN/FONSI, and to respond more quickly to the effects of drought. Such actions could include reducing seasons of use, reducing the timing of use in individual pastures, reducing livestock numbers, requiring increased riding and herding, and more intensively monitoring use levels while livestock are actively grazing pastures. All of these actions fall within the parameters of the Allotment Management Plans and the Annual Operating Instructions. *Therefore, **it is not recommended that this "changed circumstance" result in a correction to or a revision of the Pole Mountain EA (1998).***

Summary of Recent Information Consultation with the USFWS Concerning Over-utilization of Forage Conditions

On April 16, 2004 the Laramie Ranger District Wildlife Biologist met with USFWS personnel. Several key points related to the management of the PMJM at Pole Mountain were discussed and are as follows:

- The "not likely to adversely affect" determination for the PMJM, as outlined in the amended 1998 BA, is most likely still a valid assertion. However, if the Forest Service is unable to meet forage utilization standards and guidelines in all suitable and critical

[9] This recommendation is based on the forage over-utilization rationale presented on page 12 of this SIR.

habitat during continued drought conditions, a supplement to the BA should be completed. If further analysis results in a "likely to adversely affect" determination, formal consultation with the USFWS should be initiated.

- The amended 1998 BA and consultation do not clarify if utilization standards and guidelines are to be met at a pasture level, on average across the allotments, or within each key area measured. In addition, USFS range managers indicate that regardless of administration methods, it is likely that there will be small areas where livestock concentrate (1 to 10 acres in size) and forage is utilized at higher levels. As a result of this new information, a supplement to the amended 1998 is recommended and will involve formal or informal consultation with the USFWS as necessary. In addition to considering the new information discussed above, a supplement to the BA should:
    - Identify the monitoring protocol used to evaluate affects to Preble's mouse and their habitat,
    - Identify what specific monitoring results indicate we are approaching utilization thresholds,
    - Identify a specific strategy for managing livestock if thresholds are approached.

If the amended 1998 BA is supplemented, the USFWS agrees, under Section 7(d) of the Endangered Species Act, that grazing may continue during the 2004 season while consultation is pending. However, the Forest Service must demonstrate that an irreversible or irretrievable commitment of resources will not occur as a result of the authorized grazing. Steps which will allow such a demonstration include the issuance of a drought letter to the permittees (Appendix A), increased monitoring of utilization before thresholds are approached, responsive rotation of livestock between pastures, increased riding efforts to minimize livestock concentrating in riparian areas, reducing livestock numbers, and retaining the authority to completely remove livestock from suitable habitat should consultation or habitat conditions dictate that this action is warranted. These activities or conditions will eliminate the risk of jeopardy or adverse modification of critical habitat while formal consultation is pending.

4. New livestock grazing and PMJM standards and guidelines have been included in the Revised Medicine Bow National Forest Plan and Record of Decision (December 2003) (Changed Circumstance).

a. Are allotment management plans on Pole Mountain consistent with direction (water quality and PMJM habitat protection) in the Revised Medicine Bow National Forest Plan and Record of Decision (December 2003)?

Water Quality: Water quality direction has not changed significantly as a result of the Revised Forest Plan. The Clean Water Act, as implemented through state water quality regulations, must be followed. Forest Plan Standards and Guidelines and BMPs provide the specific means to meet state water quality regulations. An evaluation of how direction in the Pole Mountain allotments compares to Revised Forest Plan standards and guidelines and BMPs is presented in Appendix H. ***Overall, water resource direction in the AMPs is consistent with direction in the Revised Forest Plan.*** Most differences are minor and do not significantly change the effects or intent of the existing Pole Mountain Grazing AMPs. The Revised Forest Plan does provide additional direction on the placement of stock water developments and a change in the distance salt must be placed from riparian areas. These two minor changes are recommended for inclusion in any future management of Pole Mountain allotments (Appendix H). ***The effects of making these updated changes to the Pole Mountain Grazing Allotments have been considered here and no additional analysis is recommended.***

Implementation and/or effectiveness of direction in the Pole Mountain allotment AMPs has not fully satisfied the intent of the water quality direction in the Revised Forest Plan at the two sites where water quality standards have been exceeded. Implementation of the proposed 2004 Water Quality Action Plan should alleviate exceeding State of Wyoming water quality standards in the future.

PMJM Habitat Protection: Standards and Guidelines for range and livestock management were updated in the Revised Forest Plan and Record of Decision (December 2003). The new standards and guidelines were compared to those evaluated in the 1998 BA and the mitigation measures described in the DN/FONSI for the Pole Mountain EA (1998). Direction contained in those documents gives generally consistent direction in managing livestock use and riparian areas in PMJM habitat (see Appendix I). All documents allow forage utilization to occur up to 50 percent (if the DN/FONSI is corrected to reflect the 45 to 55 percent utilization standards and guidelines) and the maintenance of Carex spp. stubble heights between 3 to 6 inches in riparian areas.

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