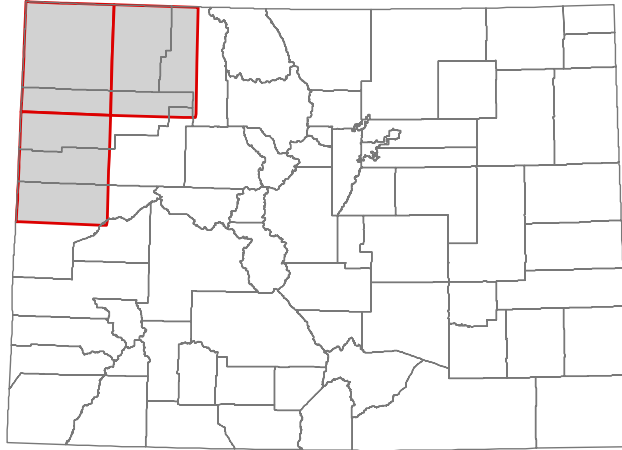


Distributional Survey of Rare Small Mammals (Orders Insectivora, Chiroptera, and Rodentia) in Colorado: Year Two



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Introduction

As a group, the distributions of small mammals have been well studied in Colorado (Warren 1910, 1942; Lechleitner 1969; Armstrong 1972; Fitzgerald *et al.* 1994), yet the geographic ranges of some species are not well understood. Gaps in information exist because many mammalian groups are understudied. Because the ecology and distribution of some species are poorly understood, it is difficult to determine the best strategies for conservation. A better understanding of small mammal distributions throughout Colorado will allow for the development of more comprehensive and successful conservation strategies.

The goals of this project are twofold. Of primary interest is the understanding of distributions of rare small mammals in Colorado. This includes evaluating what species occur in the State as well better defining their ranges. Additionally, we would like to address the lack of surveys for small mammals in general. Aside from those focused on federally listed species (*e.g.*, *Zapus hudsonius preblei*), distributional surveys for small mammals are rare.

The mammalian taxonomic orders addressed in this study are Insectivora (shrews and moles), Chiroptera (bats), and Rodentia (mice, rats, voles, gophers, squirrels, prairie dogs, *etc.*). These orders are often underrepresented in survey efforts. The less-common species and subspecies have been prioritized to better focus survey effort as well as inform conservation strategies. Although this project focused on rare species, survey effort helped to clarify the ranges of many small mammals.

In order to meet the primary objective of clarifying the distribution of lesser-known small mammals in Colorado, Schorr and Siemers (2001) developed a protocol that focuses on a prioritized list of species, but also allows for the sampling of mammals in major habitats throughout the State. This protocol focuses on rare or understudied species and surveys are focused on habitat types within latitude/longitude blocks. See Methods below for further discussion.



Figure 1. *Sorex monticolus* from El Paso County. Photo by R.A. Schorr

Methods

The methods outlined below follow those described by Schorr and Siemers (2001) with a few exceptions. The most notable exception is the use of Ecological Systems developed by NatureServe (Comer *et al.* 2003a; Comer *et al.* 2003b) as opposed to the habitat categories developed within the survey protocol (Schorr and Siemers 2001). While both classifications are based upon the Colorado Gap Analysis Project (GAP), the Ecological Systems, referred to as “habitats” throughout this report, have been developed for the entire state of Colorado and provide a consistent framework within which the mammal project can be based. Fieldwork for this project occurred during Spring 2004, and Spring and Summer 2005. This timeframe is referred to as a “year” of effort throughout the report to reflect the protocol established previously (Schorr and Siemers 2001; Siemers *et al.* 2003).

Study Area

Using latitude/longitude (latilong) blocks (1° latitude by 1° longitude), Colorado was sectioned into ten approximately-equal parts (Schorr and Siemers 2001). The study area for the current effort includes three latilong blocks in the northwest corner of Colorado (Northwest Group) (Figure 2).

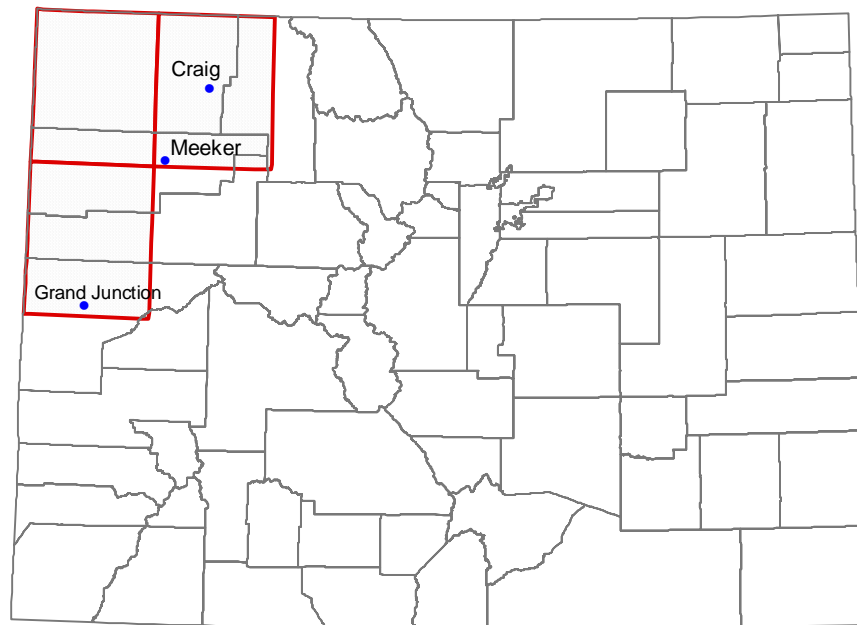


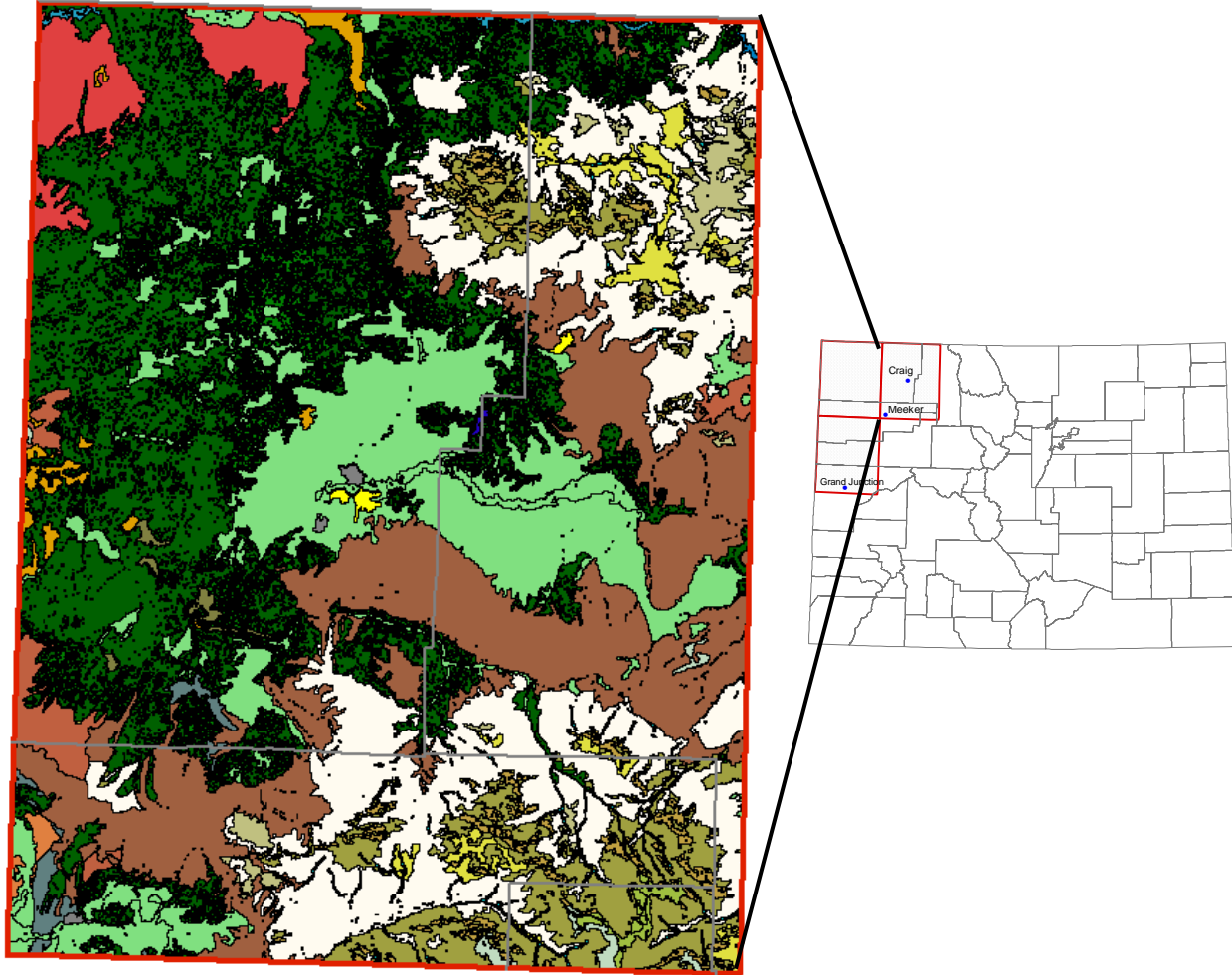
Figure 2. Three latilong blocks of Year 2 (Northwest) study area.

The study area was further broken down into 35 habitat types based on Ecological Systems (Table 1). Four of these 35 habitats (Colorado Plateau Pinyon-Juniper Woodland, Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Mixed Salt Desert Scrub, and Rocky Mountain Gambel Oak - Mixed Montane Shrubland) represented over 65% of the total study area (Table 1; Figures 3-5).

Table 1. Area and percent of total area of each Ecological System (habitat) in the study area.

Ecological System	Acres	Percent of total
Colorado Plateau Mixed Bedrock and Tableland	1198	< 1
Colorado Plateau Pinyon-Juniper Woodland	1581613	22
Herbaceous Planted/Cultivated	468630	6
High Intensity Residential	15859	< 1
Inter-Mountain Basins Big Sagebrush Shrubland	1409753	19
Inter-Mountain Basins Big Sagebrush Steppe	260459	4
Inter-Mountain Basins Greasewood Flat	28689	< 1
Inter-Mountain Basins Mixed Salt Desert Scrub	917868	13
Inter-Mountain Basins Montane Sagebrush Steppe	62597	< 1
Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland	29008	< 1
Inter-Mountain Basins Shale Badland	43203	< 1
North American Arid West Emergent Marsh	1731	< 1
Open Water	991	< 1
Quarries/Strip Mines/Gravel Pits	3506	< 1
Rocky Mountain Alpine Bedrock and Scree	802	< 1
Rocky Mountain Alpine Dwarf - Shrubland	5036	< 1
Rocky Mountain Aspen Forest and Woodland	452004	6
Rocky Mountain Cliff and Canyon	52619	< 1
Rocky Mountain Dry Tundra	6675	< 1
Rocky Mountain Foothill Grassland	39289	< 1
Rocky Mountain Foothill Limber Pine - Juniper Woodland	149835	2
Rocky Mountain Gambel Oak - Mixed Montane Shrubland	687890	10
Rocky Mountain Juniper Woodland and Savanna	220210	3
Rocky Mountain Lodgepole Pine Forest	35164	< 1
Rocky Mountain Lower Montane - Foothill Shrubland	270230	4
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	28883	< 1
Rocky Mountain Montane Dry - Mesic Mixed Conifer Forest and Woodland	3715	< 1
Rocky Mountain Ponderosa Pine Savanna	638	< 1
Rocky Mountain Ponderosa Pine Woodland	26359	< 1
Rocky Mountain Subalpine - Montane Riparian Woodland and Shrubland	18523	< 1
Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland	157644	2
Rocky Mountain Subalpine Mesic - Spruce-Fir Forest and Woodland	49840	< 1
Rocky Mountain Subalpine Mesic Meadow	56824	< 1
Southern Rocky Mountain Montane Grassland	447	< 1
Southern Rocky Mountain Pinyon - Juniper Woodland	146471	2

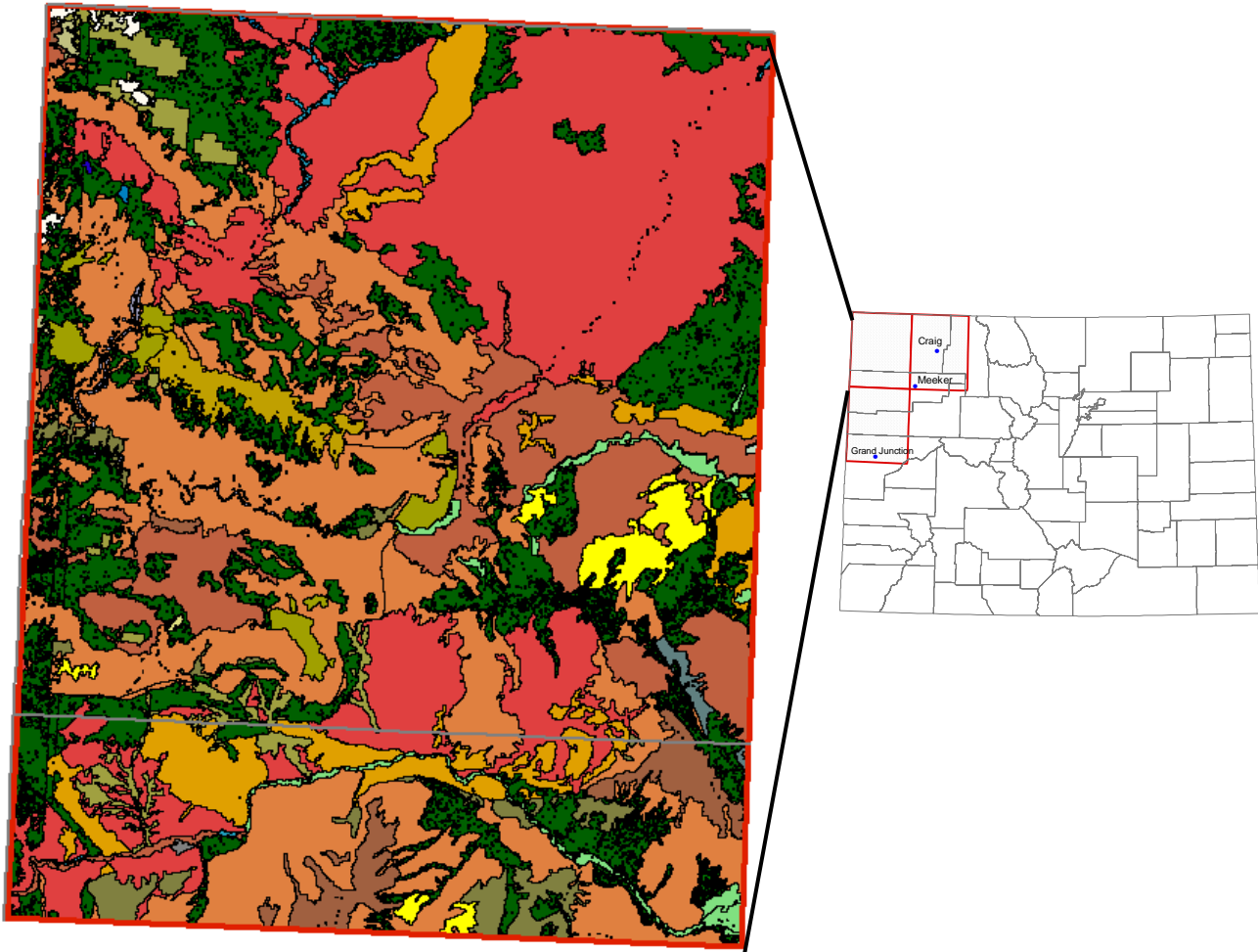
Figure 3. Ecological Systems of the study area's Northeastern latilong block. The 4 primary Ecological Systems in this block are Inter-mountain Basins Big Sagebrush Steppe, Rocky Mountain Gambel Oak – Mixed Montane Shrubland, Rocky Mountain Aspen Forest and Woodland, and Herbaceous Planted/Cultivated.



Ecological Systems

- | | |
|---|---|
| <ul style="list-style-type: none"> Central Mixedgrass Prairie Colorado Plateau Mixed Bedrock and Tableland Colorado Plateau Pinyon-Juniper Woodland Herbaceous Planted/Cultivated High Intensity Residential Inter-Mountain Basins Big Sagebrush Shrubland Inter-Mountain Basins Big Sagebrush Steppe Inter-Mountain Basins Greasewood Flat Inter-Mountain Basins Mixed Salt Desert Scrub Inter-Mountain Basins Montane Sagebrush Steppe Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland Inter-Mountain Basins Shale Badland North American Arid West Emergent Marsh Open Water Quarries/Strip Mines/Gravel Pits Rocky Mountain Alpine Bedrock and Scree Rocky Mountain Alpine Dwarf - Shrubland Rocky Mountain Aspen Forest and Woodland Rocky Mountain Cliff and Canyon | <ul style="list-style-type: none"> Rocky Mountain Dry Tundra Rocky Mountain Foothill Grassland Rocky Mountain Foothill Limber Pine - Juniper Woodland Rocky Mountain Gambel Oak - Mixed Montane Shrubland Rocky Mountain Juniper Woodland and Savanna Rocky Mountain Lodgepole Pine Forest Rocky Mountain Lower Montane - Foothill Shrubland Rocky Mountain Lower Montane Riparian Woodland and Shrubland Rocky Mountain Montane Dry - Mesic Mixed Conifer Forest and Woodland Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland Rocky Mountain Ponderosa Pine Savanna Rocky Mountain Ponderosa Pine Woodland Rocky Mountain Subalpine - Montane Riparian Woodland and Shrubland Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland Rocky Mountain Subalpine Mesic - Spruce-Fir Forest and Woodland Rocky Mountain Subalpine Mesic Meadow Southern Rocky Mountain Montane Grassland Southern Rocky Mountain Pinyon - Juniper Woodland Western Great Plains Closed Depression |
|---|---|

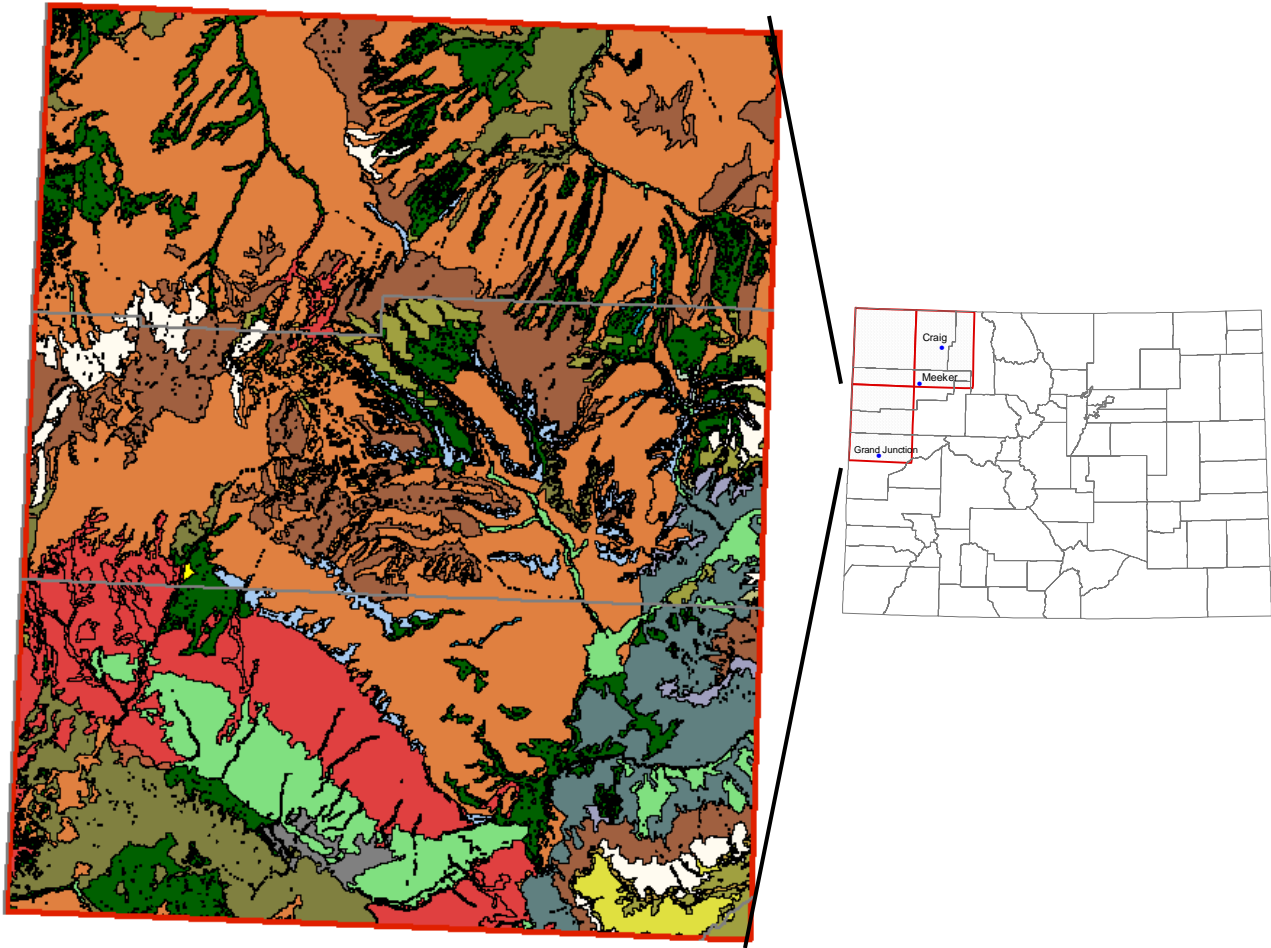
Figure 4. Ecological Systems of the study area's Northwestern latilong block. The 3 primary Ecological Systems in this block are Inter-mountain Basins Mixed Salt Desert Scrub, Colorado Plateau Pinyon-Juniper Woodland, and Inter-mountain Basins Big Sagebrush Steppe.









































Ecological Systems

- Central Mixedgrass Prairie
- Colorado Plateau Mixed Bedrock and Tableland
- Colorado Plateau Pinyon-Juniper Woodland
- Herbaceous Planted/Cultivated
- High Intensity Residential
- Inter-Mountain Basins Big Sagebrush Shrubland
- Inter-Mountain Basins Big Sagebrush Steppe
- Inter-Mountain Basins Greasewood Flat
- Inter-Mountain Basins Mixed Salt Desert Scrub
- Inter-Mountain Basins Montane Sagebrush Steppe
- Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland
- Inter-Mountain Basins Shale Badland
- North American Arid West Emergent Marsh
- Open Water
- Quarries/Strip Mines/Gravel Pits
- Rocky Mountain Alpine Bedrock and Scree
- Rocky Mountain Alpine Dwarf - Shrubland
- Rocky Mountain Aspen Forest and Woodland
- Rocky Mountain Cliff and Canyon
- Rocky Mountain Dry Tundra
- Rocky Mountain Foothill Grassland
- Rocky Mountain Foothill Limber Pine - Juniper Woodland
- Rocky Mountain Gambel Oak - Mixed Montane Shrubland
- Rocky Mountain Juniper Woodland and Savanna
- Rocky Mountain Lodgepole Pine Forest
- Rocky Mountain Lower Montane - Foothill Shrubland
- Rocky Mountain Lower Montane Riparian Woodland and Shrubland
- Rocky Mountain Montane Dry - Mesic Mixed Conifer Forest and Woodland
- Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland
- Rocky Mountain Ponderosa Pine Savanna
- Rocky Mountain Ponderosa Pine Woodland
- Rocky Mountain Subalpine - Montane Riparian Woodland and Shrubland
- Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland
- Rocky Mountain Subalpine Mesic - Spruce-Fir Forest and Woodland
- Rocky Mountain Subalpine Mesic Meadow
- Southern Rocky Mountain Montane Grassland
- Southern Rocky Mountain Pinyon - Juniper Woodland
- Western Great Plains Closed Depression

Figure 5. Ecological Systems of the study area's Southwestern latilong block. The 2 primary Ecological Systems in this block are Colorado Plateau Pinyon-Juniper Woodland, and Rocky Mountain Gambel Oak – Mixed Montane Shrubland.



Ecological Systems

- | | | | |
|---|--|---|--|
|  | Central Mixedgrass Prairie |  | Rocky Mountain Dry Tundra |
|  | Colorado Plateau Mixed Bedrock and Tableland |  | Rocky Mountain Foothill Grassland |
|  | Colorado Plateau Pinyon-Juniper Woodland |  | Rocky Mountain Foothill Limber Pine - Juniper Woodland |
|  | Herbaceous Planted/Cultivated |  | Rocky Mountain Gambel Oak - Mixed Montane Shrubland |
|  | High Intensity Residential |  | Rocky Mountain Juniper Woodland and Savanna |
|  | Inter-Mountain Basins Big Sagebrush Shrubland |  | Rocky Mountain Lodgepole Pine Forest |
|  | Inter-Mountain Basins Big Sagebrush Steppe |  | Rocky Mountain Lower Montane - Foothill Shrubland |
|  | Inter-Mountain Basins Greasewood Flat |  | Rocky Mountain Lower Montane Riparian Woodland and Shrubland |
|  | Inter-Mountain Basins Mixed Salt Desert Scrub |  | Rocky Mountain Montane Dry - Mesic Mixed Conifer Forest and Woodland |
|  | Inter-Mountain Basins Montane Sagebrush Steppe |  | Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland |
|  | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland |  | Rocky Mountain Ponderosa Pine Savanna |
|  | Inter-Mountain Basins Shale Badland |  | Rocky Mountain Ponderosa Pine Woodland |
|  | North American Arid West Emergent Marsh |  | Rocky Mountain Subalpine - Montane Riparian Woodland and Shrubland |
|  | Open Water |  | Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland |
|  | Quarries/Strip Mines/Gravel Pits |  | Rocky Mountain Subalpine Mesic - Spruce-Fir Forest and Woodland |
|  | Rocky Mountain Alpine Bedrock and Scree |  | Rocky Mountain Subalpine Mesic Meadow |
|  | Rocky Mountain Alpine Dwarf - Shrubland |  | Southern Rocky Mountain Montane Grassland |
|  | Rocky Mountain Aspen Forest and Woodland |  | Southern Rocky Mountain Pinyon - Juniper Woodland |
|  | Rocky Mountain Cliff and Canyon |  | Western Great Plains Closed Depression |

Selection and Prioritization of Small Mammal Taxa

To assess which small mammals are valid taxonomic entities, we used the *Suggested Interpretation of Mammalian Taxonomy in Colorado for Use in Ranking and Tracking* (Wunder *et al.* 1998). From this assessment, species and subspecies were selected based on their relative rarity and the amount of information known about them. The two rarity scales used in assessing a species' or subspecies' rarity were the Colorado Division of Wildlife's (CDOW) Colorado Vertebrate Ranking System (COVERS) and the Colorado Natural Heritage Program's (CNHP) Biodiversity Tracking and Conservation System.

All taxa that are currently tracked by CNHP from Insectivora, Chiroptera, and Rodentia were included in the study. CNHP zoologists have determined species or subspecies tracking status based on several factors. Those factors include: 1. the animal's rarity based on its geographic range, habitat specificity, and local population size [based on Rabinowitz (1981)]; 2. whether the animal is evolutionarily distinct or isolated; 3. whether the animal is endemic to Colorado; and 4. whether there is sufficient information to document declining population trends (CNHP 1999). For this year's survey effort, twenty-one species and subspecies were determined to be of greatest conservation concern and information need (Table 2).

Table 2. Small mammal taxa addressed in Year 2.

Scientific name	Common name	CNHP Rank*	Fine-filter (F), Coarse-filter (C), or Opportunistic (O)	Years to be surveyed
Order Insectivora				
<i>Sorex hoyi</i>	pygmy shrew	G5 T2T3 S2	C	2, 4, 7, 8
<i>Sorex nanus</i>	dwarf shrew	G4 S2	C	1 – 5, 7, 8
Order Chiroptera				
<i>Antrozous pallidus</i>	pallid bat	G5 S4	C	1 – 7, 10
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	G4 S2	C	1 – 8
<i>Euderma maculatum</i>	spotted bat	G4 S2	C	2
<i>Myotis californicus</i>	California myotis	G5 S3	C	2, 3, 7
<i>Myotis thysanodes</i>	fringed myotis	G5 S3	C	1 – 9
<i>Myotis yumanensis</i>	Yuma myotis	G5 S3	C	1 – 7, 10
<i>Nyctinomops macrotis</i>	big free-tailed bat	G5 S1?	C	1 – 8, 10
<i>Tadarida brasiliensis</i>	Mexican free-tailed bat	G5 S1	C	2 – 7
Order Rodentia				
<i>Cynomys leucurus</i>	white-tailed prairie dog	G4 S4	O	2 – 4, 7, 8
<i>Dipodomys ordii priscus</i>	Ord's kangaroo rat	G5 T4T5 S3	F	2
<i>D. ordii sanrafaeli</i>	Ord's kangaroo rat	G5 T3T5 S3	F	2
<i>Lemmyscus curtatus</i>	sagebrush vole	G5 S?	F	2
<i>Perognathus fasciatus callistus</i>	olive-backed pocket mouse	G5 T3 S2?	C	2

Table 2 (continued)

Scientific name	Common name	CNHP Rank*	Fine-filter (F), Coarse-filter (C), or Opportunistic (O)	Years to be surveyed
Order Rodentia (continued)				
<i>Perognathus flavescens caryi</i>	plains pocket mouse	G5 T4 SH	F	2, 3, 7
<i>Perognathus parvus</i>	Great Basin pocket mouse	G5 S1?	F	2
<i>Tamias dorsalis</i>	cliff chipmunk	G5 S2	F	2
<i>Tamias rufus</i>	Hopi chipmunk	G5 S5	F	2 – 4, 7
<i>Thomomys bottae howelli</i>	valley pocket gopher	G5 T4 S3	O	2, 3
<i>Thomomys clusius</i>	Wyoming pocket gopher	unconfirmed in CO	F	2

*Colorado Natural Heritage Program Biodiversity Tracking and Conservation System.

Inventory methods

1. Field survey techniques:

- a. Rodent live-trapping: Small mammal fauna were sampled using Sherman live traps (approximately 8cm x 8cm x 24 cm). Traps were baited with rolled oats and a ball of polyfil (polyester fiberfill) was placed in each trap to provide warmth. Traps were set in the evening (after 5 pm) and checked the following morning before 11 am. Traps were set out of direct sunlight to prevent overheating. All animals were identified immediately during the checking of traps. Sometimes measurements of external physical features, such as weights and lengths, were taken. Individuals that were not new or notable location records or needed for positive identification were released.
- b. Pitfall trapping: Pitfall traps were used to capture insectivores and other small mammals, which are frequently under-sampled in live trapping. Pitfall traps are 4-liter, number-10 coffee cans or similar-sized plastic paint buckets buried flush in the ground along natural features in the area. These traps were inspected to retrieve and identify any animals that were captured. Individuals that were not new or notable location records or needed for positive identification were released.
- c. Mist netting: Mist nets were used to capture bats. Mist nets are the most effective means of capturing flying bats in open areas. Mist nets are constructed of fine synthetic fibers supported by a lattice-work of braided nylon. The frame and trammels of the net are supported to form a capture area perpendicular to the ground with 4 or 5 long horizontal pockets of fine mesh (Wilson *et al.* 1996). The nets were monitored constantly to prevent bats from becoming completely ensnared and to prevent damage to the nets. Bats were removed, identified, and measurements of key features are taken. Individuals that were not new or notable location records or needed for positive identification were released. Before being released, bats were allowed to recover from stress imposed during handling.
- d. Fossorial mammal trapping: Pocket gophers (*Thomomys*, *Geomys*, and *Cratogeomys*) were captured using Victor gopher traps. These traps are commonly used for gopher

control throughout the state of Colorado. Gopher sign (active mounds, tunnels) dictated how many and where traps were set.

- e. Visual identification: Not all species or subspecies required the collection of voucher specimens to document their presence in an area. Visual observations of mammals or their sign can assist in delineating a species or subspecies range. For instance, prairie dogs can be identified to species without taking specimens and documentation of the extent of the mounds seen in an area can be used to delineate prairie dog colonies.

2. Survey protocol:

Each mammal on the prioritized list for year two of the survey (Table 2) was evaluated to determine how its distribution could be delineated most appropriately. We used a method based on scale-dependent (fine or coarse) surveying. We used the following characteristics to determine which mammals would be surveyed using coarse-filter methods and which would be surveyed using fine-filter methods: 1. the size of the animal's distribution in Colorado [based on Fitzgerald *et al.* (1994)]; 2. how well-defended this distribution is (how many locations have been documented to determine the current distribution). A third category for surveying (opportunistic) was included for taxa that are not of the highest priority for this project, but additional information would be beneficial for assessing conservation action.

- i. Fine-filter surveying: For mammals that have a fairly restricted distribution in Colorado (*e.g.*, pocket gopher subspecies), we used a targeted effort to better determine their distribution and their presence within that distribution. This involved surveying within and at select limits of their current known distribution. As the mammals were detected at the outer limits of the distribution, additional survey took place further and further from the edge of the distribution until the species or subspecies of interest could no longer be detected.
- ii. Coarse-filter surveying: The distributions of some of the small mammals on the prioritized list are difficult to assess. For some taxa there are few data on their current distribution (*e.g.*, *Perognathus fasciatus*), while others are more widely distributed, but there are relatively few records within their distributions (*e.g.*, most shrews and bats). Logistically, it would be difficult to adequately delineate the distribution of these species or subspecies. For these taxa (and others that may not be apparent), surveys were conducted in major habitat types within the study area in an attempt to obtain new location records. For the coarse-filter animals that have better-described habitat associations (*e.g.*, *Perognathus fasciatus*), we conducted coarse-filter surveys in similar habitat types throughout the study area.
- iii. Opportunistic surveying: Several rare taxa have well-delineated distributions (*e.g.*, *Cynomys leucurus*) and this project did not focus its efforts on these mammals. However, data regarding distribution were collected as these species were encountered.

Results

Fossorial Mammal Trapping

Trapping for pocket gophers took place in 8 locations and in 5 different Ecological Systems (Table 3; Figure 6) and was primarily focused on capturing Wyoming pocket gophers (*Thomomys clusius*). Locations represent 2-10 gopher traps set for one day.

Table 3. Fossorial mammal trapping results. UTM's fall within or have been converted to Zone 13.

Date	Species	Location	Ecological System
5/28/2004	<i>Thomomys talpoides</i>	Rio Blanco County Easting: 227229 Northing: 4433507	Colorado Plateau Pinyon-Juniper Woodland
6/6/2004	<i>Thomomys talpoides</i>	Moffat County Easting: 168735 Northing: 4537201	Rocky Mountain Aspen Forest and Woodland
6/17/2004	none	Moffat County Easting: 173983 Northing: 4500144	Inter-Mountain Basins Montane Sagebrush Steppe
6/17/2004	none	Moffat County Easting: 173604 Northing: 4498343	Inter-Mountain Basins Big Sagebrush Shrubland
6/20/2004	<i>Thomomys talpoides</i>	Moffat County Easting: 277084 Northing: 4538277	Inter-Mountain Basins Mixed Salt Desert Scrub
6/20/2004	none	Moffat County Easting: 280715 Northing: 4532946	Inter-Mountain Basins Big Sagebrush Shrubland
6/20/2004	none	Moffat County Easting: 277061 Northing: 4538087	Inter-Mountain Basins Mixed Salt Desert Scrub
6/21/2004	<i>Thomomys talpoides</i>	Moffat County Easting: 276945 Northing: 4537986	Inter-Mountain Basins Mixed Salt Desert Scrub

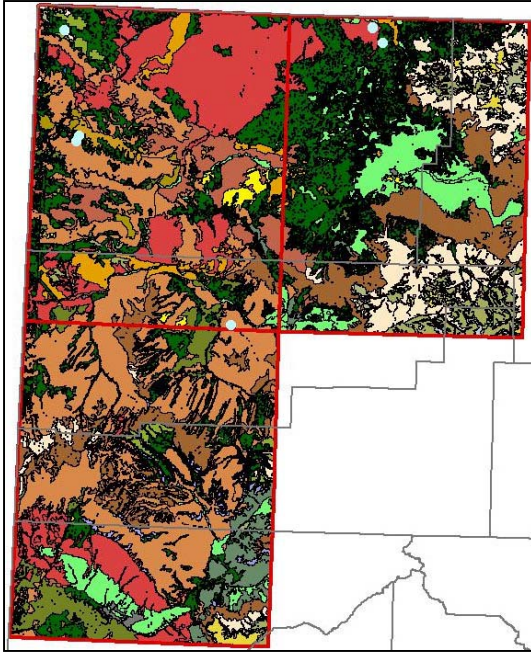


Figure 6. Gopher trapping localities.

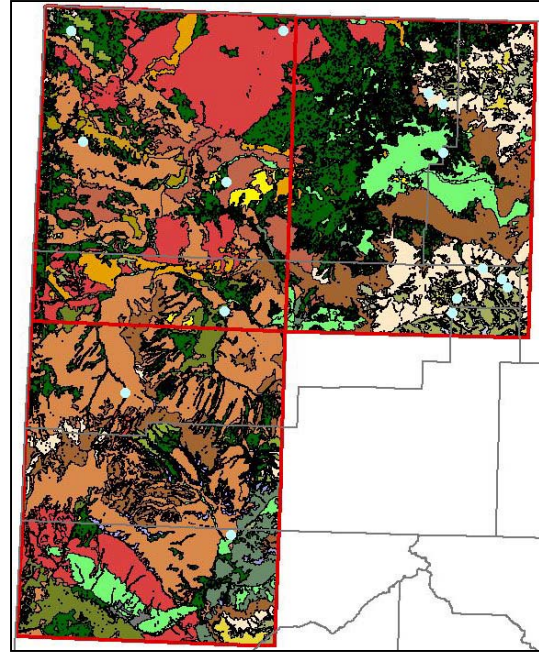


Figure 7. Pitfall trapping localities.

Pitfall Trapping

Pitfall traps were set in 15 locations and in 7 different Ecological Systems (Table 4; Figure 7). Locations represent 5 to 10 pitfall traps set for one night.

Table 4. Pitfall trapping results. UTM's fall within or have been converted to Zone 13.

Date	Species	Location	Ecological System
5/26/2004	<i>Microtus</i> spp.	Rio Blanco County Easting: 188065 Northing: 4409885	Inter-Mountain Basins Big Sagebrush Shrubland
6/4/2004	none	Moffat County Easting: 243542 Northing: 4537338	Inter-Mountain Basins Mixed Salt Desert Scrub
6/6/2004	none	Moffat County Easting: 168735 Northing: 4537201	Rocky Mountain Aspen Forest and Woodland
6/21/2004	<i>Sorex merriami</i> & <i>S. monticolus</i>	Moffat County Easting: 294549 Northing: 4515497	Rocky Mountain Aspen Forest and Woodland
6/22/2004	<i>Microtus</i> spp.	Moffat County Easting: 173045 Northing: 4498286	Inter-Mountain Basins Big Sagebrush Shrubland
6/22/2004	none	Moffat County Easting: 299811 Northing: 4511377	Rocky Mountain Aspen Forest and Woodland
6/23/2004	none	Moffat County Easting: 299767 Northing: 4494293	Inter-Mountain Basins Big Sagebrush Shrubland

Table 4 (continued). Pitfall trapping results.

Date	Species	Location	Ecological System
6/22/2005	<i>Microtus longicaudus</i>	Rio Blanco County Easting: 222810 Northing: 4438367	Rocky Mountain Juniper Woodland and Savanna
7/15/2005	none	Rio Blanco County Easting: 322344 Northing: 4446883	Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland
7/16/2005 & 7/18/2005	<i>Sorex</i> spp.	Rio Blanco County Easting: 304506 Northing: 4443026	Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland
7/17/2005	none	Moffat County Easting: 223601 Northing: 4483936	Inter-Mountain Basins Big Sagebrush Shrubland
7/18/2005	none	Rio Blanco County Easting: 302766 Northing: 4437952	Rocky Mountain Aspen Forest and Woodland
7/18/2005	none	Rio Blanco County Easting: 313691 Northing: 4453670	Rocky Mountain Aspen Forest and Woodland
7/18/2005	<i>Sorex</i> spp.	Rio Blanco County Easting: 320324 Northing: 4449919	Rocky Mountain Subalpine - Montane Riparian Woodland and Shrubland
8/17/2005	none	Mesa County Easting: 224923 Northing: 4359628	Colorado Plateau Pinyon-Juniper Woodland

Mistnetting

Mistnetting for bats was performed at 28 different locations and in 11 different habitats (Table 5; Figure 8). Most locations represent a single mistnetting effort (night) using multiple (2 or 3) nets.

Table 5. Mistnetting results. UTM's fall within or have been converted to Zone 13.

Date(s)	Species	Location	Ecological System
5/17/2004	none	Rio Blanco County Easting: 182002 Northing: 4445070	Rocky Mountain Lower Montane - Foothill Shrubland
5/19/2004	<i>Lasionycteris noctivagans</i>	Garfield County Easting: 171433 Northing: 4388663	Rocky Mountain Gambel Oak - Mixed Montane Shrubland
6/3/2004	<i>Myotis ciliolabrum</i>	Moffat County Easting: 243542 Northing: 4537338	Inter-Mountain Basins Mixed Salt Desert Scrub
6/4/2004	<i>Lasiurus cinereus</i> , <i>Myotis ciliolabrum</i>	Moffat County Easting: 191212 Northing: 4533441	Rocky Mountain Lower Montane Riparian Woodland and Shrubland

Table 5 (continued). Mistnetting results.

Date(s)	Species	Location	Ecological System
6/5/2004	none	Moffat County Easting: 168735 Northing: 4537201	Rocky Mountain Aspen Forest and Woodland
6/6/2004	<i>Lasionycteris noctivagans</i> , <i>Lasiurus cinereus</i> , <i>Myotis</i> <i>ciliolabrum</i> , <i>M. evotis</i>	Moffat County Easting: 176595 Northing: 4518551	Inter-Mountain Basins Mixed Salt Desert Scrub
6/7/2004	<i>Corynorhinus townsendii</i> , <i>Myotis volans</i>	Rio Blanco County Easting: 261596 Northing: 4447675	Rocky Mountain Gambel Oak – Mixed Montane Shrubland
6/12/2004	<i>Myotis lucifugus</i>	Moffat County Easting: 232195 Northing: 4516436	Inter-Mountain Basins Mixed Salt Desert Scrub
6/13/2004	<i>Myotis californicus</i> , <i>M.</i> <i>lucifugus</i> , <i>M. evotis</i> , <i>M. volans</i>	Moffat County Easting: 216154 Northing: 4535663	Inter-Mountain Basins Mixed Salt Desert Scrub
6/14/2004	<i>Antrozous pallidus</i> , <i>Eptesicus</i> <i>fuscus</i> , <i>Euderma maculatum</i> , <i>Lasionycteris noctivagans</i> , <i>Myotis ciliolabrum</i> , <i>M. evotis</i> , <i>M. volans</i> , <i>M. yumanensis</i>	Moffat County Easting: 176340 Northing: 4500360	Rocky Mountain Ponderosa Pine Woodland
6/15/2004	<i>Eptesicus fuscus</i> , <i>Euderma</i> <i>maculatum</i> , <i>Lasionycteris</i> <i>noctivagans</i> , <i>Myotis</i> <i>californicus</i> , <i>M. ciliolabrum</i> , <i>M.</i> <i>evotis</i> , <i>M. lucifugus</i> , <i>M.</i> <i>yumanensis</i>	Moffat County Easting: 172978 Northing: 4497816	Inter-Mountain Basins Big Sagebrush Shrubland
6/27/2004	none	Rio Blanco County Easting: 178603 Northing: 4442084	Inter-Mountain Basins Big Sagebrush Shrubland
6/29/2004	<i>Myotis evotis</i> , <i>M. ciliolabrum</i> , <i>M. volans</i>	Rio Blanco County Easting: 215327 Northing: 4437914	Inter-Mountain Basins Big Sagebrush Shrubland
5/8/2005	none	Moffat County Easting: 206180 Northing: 4481675	Rocky Mountain Lower Montane - Foothill Shrubland
5/9/2005	<i>Myotis ciliolabrum</i>	Moffat County Easting: 169833 Northing: 4460774	Inter-Mountain Basins Big Sagebrush Shrubland
5/17/2005	<i>Myotis evotis</i> , <i>M. volans</i>	Rio Blanco County Easting: 206868 Northing: 4438101	Inter-Mountain Basins Big Sagebrush Shrubland
5/18/2005	<i>Eptesicus fuscus</i> , <i>Lasionycteris</i> <i>noctivagans</i> , <i>Myotis</i> <i>ciliolabrum</i>	Rio Blanco County Easting: 213524 Northing: 4446272	Inter-Mountain Basins Big Sagebrush Shrubland
5/19/2005	none	Moffat County Easting: 282130 Northing: 4485897	Rocky Mountain Foothill Grassland

Table 5 (continued). Mistnetting results.

Date(s)	Species	Location	Ecological System
6/16/2005	<i>Myotis evotis</i>	Moffat County Easting: 183440 Northing: 4531779	Inter-Mountain Basins Big Sagebrush Shrubland
6/17/2005 & 6/18/2005	<i>Lasionycteris noctivagans</i> , <i>Lasiurus cinereus</i> , <i>Myotis californicus</i> , <i>M. ciliolabrum</i> , <i>M. evotis</i>	Moffat County Easting: 176942 Northing: 4503245	Rocky Mountain Ponderosa Pine Woodland
6/24/2005	<i>Antrozous pallidus</i> , <i>Lasionycteris noctivagans</i> , <i>Myotis ciliolabrum</i> , <i>M. californicus</i> , <i>M. evotis</i> ,	Rio Blanco County Easting: 185460 Northing: 4422135	Colorado Plateau Pinyon-Juniper Woodland
6/25/2005	<i>Eptesicus fuscus</i> , <i>Myotis evotis</i>	Garfield County Easting: 208869 Northing: 4360385	Colorado Plateau Pinyon-Juniper Woodland
7/14/2005	<i>Myotis californicus</i> , <i>M. lucifugus</i>	Rio Blanco County Easting: 322344 Northing: 4446883	Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland
7/16/2005	<i>Myotis evotis</i> , <i>M. volans</i>	Rio Blanco County Easting: 232326 Northing: 4446209	Inter-Mountain Basins Big Sagebrush Shrubland
7/17/2005	none	Moffat County Easting: 257572 Northing: 4476829	Inter-Mountain Basins Big Sagebrush Shrubland
7/18/2005	<i>Lasiurus cinereus</i> , <i>Myotis californicus</i> , <i>M. ciliolabrum</i> , <i>M. evotis</i> , <i>M. lucifugus</i> , <i>M. volans</i>	Rio Blanco County Easting: 213614 Northing: 4420754	Rocky Mountain Juniper Woodland and Savanna
7/19/2005	<i>Myotis ciliolabrum</i> , <i>M. lucifugus</i> , <i>M. volans</i> , <i>Pipistrellus hesperus</i>	Garfield County Easting: 157160 Northing: 4366175	Inter-Mountain Basins Mixed Salt Desert Scrub
8/18/2005	none	Mesa County Easting: 175535 Northing: 4338916	Inter-Mountain Basins Big Sagebrush Shrubland

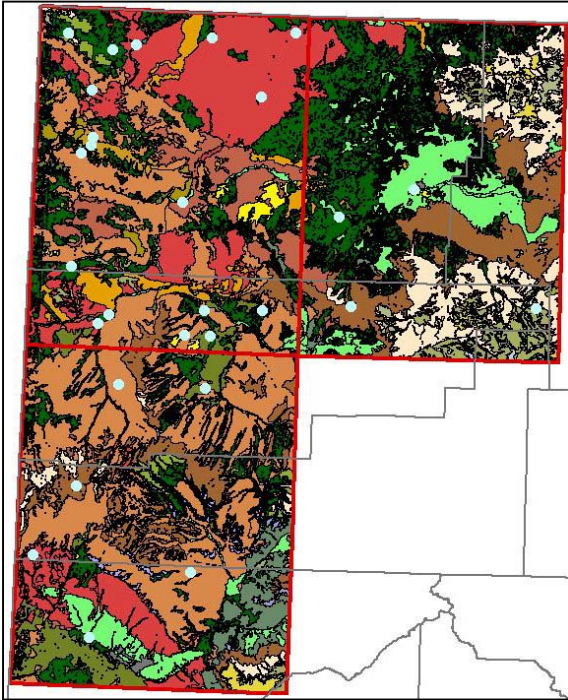


Figure 8. Bat mistnetting localities.

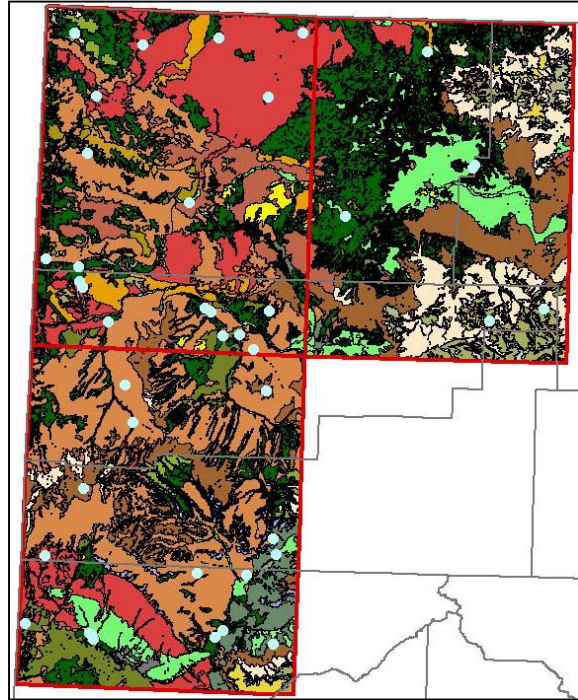


Figure 9. Sherman trapping localities.

Sherman Live-trapping

Sherman traps for rodents were set in 43 locations and in 13 different habitats (Table 6; Figure 9). Effort at each location varied from approximately 50 to 200 trapnights. The majority of locations represent an effort of 75-125 traps set for one night.

Table 6. Sherman live-trapping results. UTM's fall within or have been converted to Zone 13.

Date	Species	Location	Ecological System
5/18/2004	<i>Peromyscus maniculatus</i>	Rio Blanco County Easting: 170627 Northing: 4455878	Inter-Mountain Basins Greasewood Flat
5/18/2004	<i>Peromyscus truei</i>	Rio Blanco County Easting: 171524 Northing: 4453904	Inter-Mountain Basins Mixed Salt Desert Scrub
5/19/2004	<i>Peromyscus maniculatus</i>	Rio Blanco County Easting: 188065 Northing: 4409884	Inter-Mountain Basins Big Sagebrush Shrubland
5/20/2004	<i>Peromyscus boylii</i>	Garfield County Easting: 171620 Northing: 4388219	Rocky Mountain Gambel Oak - Mixed Montane Shrubland
5/20/2004	<i>Peromyscus maniculatus</i> , <i>Tamias minimus</i>	Garfield County Easting: 171783 Northing: 4388228	Rocky Mountain Gambel Oak - Mixed Montane Shrubland

Table 6 (continued). Sherman live-trapping results.

Date	Species	Location	Ecological System
5/26/2004	<i>Peromyscus maniculatus</i>	Rio Blanco County Easting: 227229 Northing: 4433507	Colorado Plateau Pinyon-Juniper Woodland
6/4/2004	none	Moffat County Easting: 243542 Northing: 4537338	Inter-Mountain Basins Mixed Salt Desert Scrub
6/5/2004	<i>Peromyscus maniculatus</i>	Moffat County Easting: 191212 Northing: 4533441	Rocky Mountain Lower Montane Riparian Woodland and Shrubland
6/6/2004	<i>Peromyscus maniculatus</i> , <i>Phenacomys intermedius</i>	Moffat County Easting: 168735 Northing: 4537201	Rocky Mountain Aspen Forest and Woodland
6/7/2004	<i>Dipodomys ordii</i> , <i>Peromyscus maniculatus</i>	Moffat County Easting: 176057 Northing: 4516538	Colorado Plateau Pinyon-Juniper Woodland
6/12/2004	<i>Peromyscus maniculatus</i>	Moffat County Easting: 232195 Northing: 4516436	Inter-Mountain Basins Mixed Salt Desert Scrub
6/14/2004	<i>Peromyscus maniculatus</i>	Moffat County Easting: 216154 Northing: 4535663	Inter-Mountain Basins Mixed Salt Desert Scrub
6/16/2004	<i>Peromyscus maniculatus</i>	Moffat County Easting: 172986 Northing: 4498052	Inter-Mountain Basins Big Sagebrush Shrubland
6/20/2004	<i>Peromyscus maniculatus</i> , <i>Reithrodontomys megalotis</i>	Moffat County Easting: 284282 Northing: 4531103	Inter-Mountain Basins Big Sagebrush Shrubland
6/23/2004	<i>Lemmings curtatus</i> , <i>Peromyscus maniculatus</i>	Moffat County Easting: 299003 Northing: 4493067	Open Water (adjacent to Inter-Mountain Basins Big Sagebrush Shrubland)
6/23/2004	<i>Lemmings curtatus</i> , <i>Peromyscus maniculatus</i>	Routt County Easting: 299675 Northing: 4494127	Inter-Mountain Basins Big Sagebrush Steppe
6/27/2004	<i>Peromyscus maniculatus</i> , <i>Neotoms</i> sp.	Mesa County Easting: 152605 Northing: 4343852	Inter-Mountain Basins Mixed Salt Desert Scrub
6/28/2004	<i>Peromyscus maniculatus</i>	Rio Blanco County Easting: 179799 Northing: 4442687	Colorado Plateau Pinyon-Juniper Woodland
5/9/2005	none	Moffat County Easting: 206260 Northing: 4481658	Rocky Mountain Lower Montane - Foothill Shrubland
5/9/2005	<i>Dipodomys ordii</i> , <i>Peromyscus maniculatus</i>	Moffat County Easting: 170280 Northing: 4460845	Inter-Mountain Basins Big Sagebrush Shrubland
5/10/2005	<i>Peromyscus maniculatus</i>	Moffat County Easting: 159536 Northing: 4463409	Colorado Plateau Pinyon-Juniper Woodland

Table 6 (continued). Sherman live-trapping results.

Date	Species	Location	Ecological System
5/16/2005	<i>Peromyscus maniculatus</i> , <i>P. truei</i>	Rio Blanco County Easting: 217371 Northing: 4438100	Inter-Mountain Basins Big Sagebrush Shrubland
5/17/2005	<i>Neotoma lepida</i> , <i>Peromyscus crinitus</i> , <i>P. maniculatus</i> , <i>Tamias minimus</i>	Rio Blanco County Easting: 211613 Northing: 4447082	Inter-Mountain Basins Big Sagebrush Shrubland
5/18/2005	<i>Neotoma lepida</i> , <i>Peromyscus maniculatus</i>	Rio Blanco County Easting: 213528 Northing: 4445996	Inter-Mountain Basins Big Sagebrush Steppe
5/18/2005	<i>Microtus longicaudus</i>	Rio Blanco County Easting: 222886 Northing: 4438473	Rocky Mountain Juniper Woodland and Savanna
5/18/2005	<i>Microtus longicaudus</i>	Rio Blanco County Easting: 222810 Northing: 4438367	Rocky Mountain Juniper Woodland and Savanna
6/24/2005	<i>Peromyscus maniculatus</i>	Rio Blanco County Easting: 231669 Northing: 4420097	Rocky Mountain Gambel Oak - Mixed Montane Shrubland
6/25/2005	<i>Microtus longicaudus</i> , <i>Peromyscus maniculatus</i>	Garfield County Easting: 208869 Northing: 4360385	Colorado Plateau Pinyon-Juniper Woodland
6/26/2005	<i>Neotoma truei</i> , <i>Peromyscus maniculatus</i> , <i>P. truei</i>	Rio Blanco County Easting: 185460 Northing: 4422135	Colorado Plateau Pinyon-Juniper Woodland
7/14/2005	<i>Clethrionomys gapperi</i> , <i>Peromyscus maniculatus</i>	Rio Blanco County Easting: 322344 Northing: 4446883	Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland
7/16/2005	<i>Sorex</i> sp.	Rio Blanco County Easting: 304506 Northing: 4443026	Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland
7/17/2005	<i>Peromyscus maniculatus</i>	Rio Blanco County Easting: 232324 Northing: 4446182	Inter-Mountain Basins Big Sagebrush Shrubland
7/18/2005	<i>Microtus montanus</i> , <i>Peromyscus maniculatus</i> , <i>Reithrodontomys megalotis</i>	Moffat County Easting: 257466 Northing: 4477236	Inter-Mountain Basins Big Sagebrush Shrubland
7/19/2005	<i>Peromyscus maniculatus</i>	Garfield County Easting: 159290 Northing: 4366048	Inter-Mountain Basins Mixed Salt Desert Scrub
8/15/2005	<i>Peromyscus maniculatus</i>	Garfield County Easting: 233622 Northing: 4371684	Southern Rocky Mountain Pinyon - Juniper Woodland
8/16/2005	none	Garfield County Easting: 224923 Northing: 4359628	Colorado Plateau Pinyon-Juniper Woodland

Table 6 (continued). Sherman live-trapping results.

Date	Species	Location	Ecological System
8/16/2005	<i>Peromyscus maniculatus</i> , <i>P. truei</i>	Garfield County Easting: 233709 Northing: 4337130	Southern Rocky Mountain Pinyon - Juniper Woodland
8/16/2005	<i>Peromyscus maniculatus</i>	Garfield County Easting: 234750 Northing: 4366586	Inter-Mountain Basins Greasewood Flat
8/17/2005	<i>Neotoma cinerea</i> , <i>Peromyscus maniculatus</i>	Mesa County Easting: 217273 Northing: 4341740	Rocky Mountain Lower Montane - Foothill Shrubland
8/17/2005	<i>Peromyscus maniculatus</i>	Mesa County Easting: 214774 Northing: 4339491	Inter-Mountain Basins Big Sagebrush Shrubland
8/18/2005	<i>Dipodomys ordii</i> , <i>Peromyscus maniculatus</i>	Mesa County Easting: 175037 Northing: 4338782	Inter-Mountain Basins Big Sagebrush Shrubland
8/18/2005	<i>Peromyscus maniculatus</i>	Mesa County Easting: 174344 Northing: 4340492	Inter-Mountain Basins Big Sagebrush Shrubland
8/18/2005	<i>Peromyscus maniculatus</i>	Mesa County Easting: 173606 Northing: 4340656	Inter-Mountain Basins Big Sagebrush Shrubland

Fine-filter Species

Ord's kangaroo rat (*Dipodomys ordii priscus* & *D. o. sanrafaeli*)

Within the study area, two subspecies of Ord's kangaroo rat (*D. o. priscus* and *D. o. sanrafaeli*) occur (Armstrong 1972). Both of these subspecies were considered fine-filter targets for this year's study.

Dipodomys ordii priscus was found in two locations and in two different habitats. These include Inter-mountain Basins Big Sagebrush Shrubland and Colorado Plateau Pinyon-Juniper Woodland. *Dipodomys ordii sanrafaeli* was found in one location in Inter-mountain Basins Big Sagebrush Shrubland near the Colorado River.

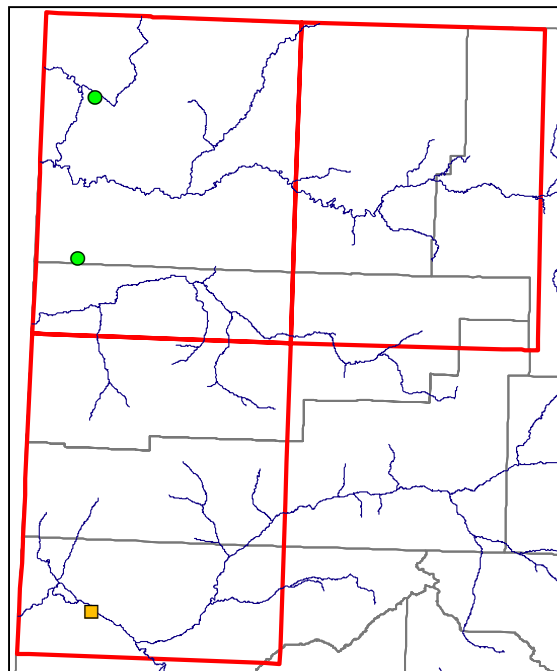


Figure 10. *Dipodomys ordii* capture locations. ○ = *D. o. priscus*; □ = *D. o. sanrafaeli*

Sagebrush vole (*Lemmiscus curtatus*)

The sagebrush vole, as its name suggests, is closely associated with sagebrush habitats. Populations of this species fluctuate with temperature and rainfall (Carroll and Genoways 1980 and references therein), and may be an indicator of range quality (Fitzgerald *et al.* 1982).

While trapping for this species in apparently suitable habitat, we often captured other vole species (*e.g.*, *Microtus montanus*). *Lemmiscus curtatus* was found in two locations near Elkhead Reservoir within the drainage of Elkhead Creek (a tributary to the Yampa River) near the Moffat/Routt county boundary in Inter-mountain Basins Big Sagebrush Shrubland.

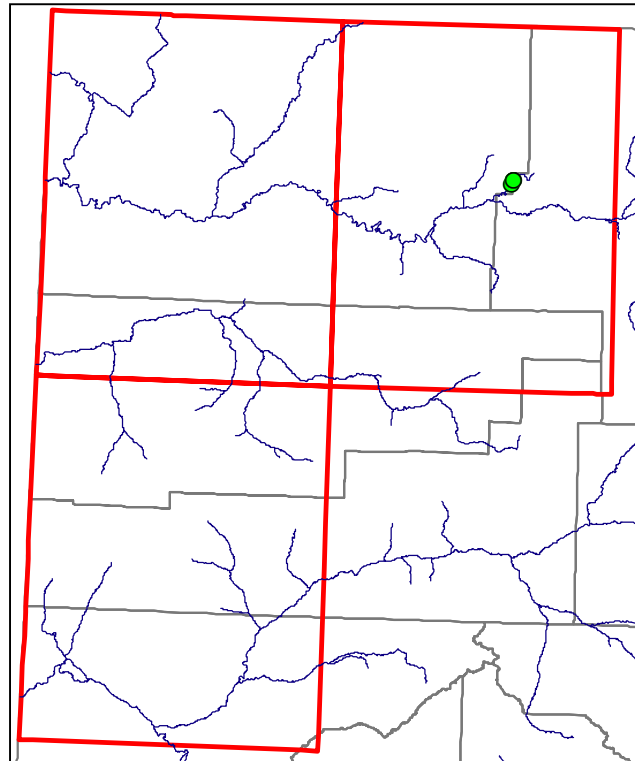


Figure 11. *Lemmiscus curtatus* capture locations.

Other Fine-filter Rodents

During this survey, there were a number of fine-filter species that we expected to capture but did not. These include the plains pocket mouse (*Perognathus flavescens caryi*), Great Basin pocket mouse (*Perognathus parvus*), and Wyoming pocket gopher (*Thomomys clusius*).

Pocket mice can be difficult to capture in some areas, especially when they are in low densities. The first year of work for this project along the Front Range (Siemers *et al.* 2003) produced a number of pocket mice collected with pitfall traps. We did not capture any pocket mice in pitfall traps or Sherman live traps this year.

The expectation of capturing the Wyoming pocket gopher was based upon what are now known to be misidentified specimens from a collection in California. We captured gophers from the same location near the Wyoming border in Moffat County as the other specimens, but they have been identified as northern pocket gophers (*Thomomys talpoides*). The specimens in California have been reexamined and also identified as northern pocket gophers. The Wyoming pocket gopher likely does not occur in Moffat County.

Coarse-filter Species

Spotted bat (*Euderma maculatum*)

The first specimen of the spotted bat from Colorado was collected from the Brown's Park National Wildlife Refuge in 1981 (Finley and Creasy 1982). Since then, a number of specimens have been collected (*e.g.*, Bogan *et al.* 1988) and acoustical surveys (Navo *et al.* 1992; Storz 1995) have further documented its presence in western Colorado. This species has been noted as being difficult to capture, and may be locally common, but not abundant (Navo *et al.* 1992; Storz 1995).

We documented the spotted bat at two locations within the study area. Two spotted bats were captured, including a pregnant female, in Inter-mountain Basins Big Sagebrush Shrubland habitat. Another individual was captured at an additional location approximately 4.2 km away in Rocky Mountain Ponderosa Pine Woodland habitat. Specimens were not taken, but were documented with photographs.

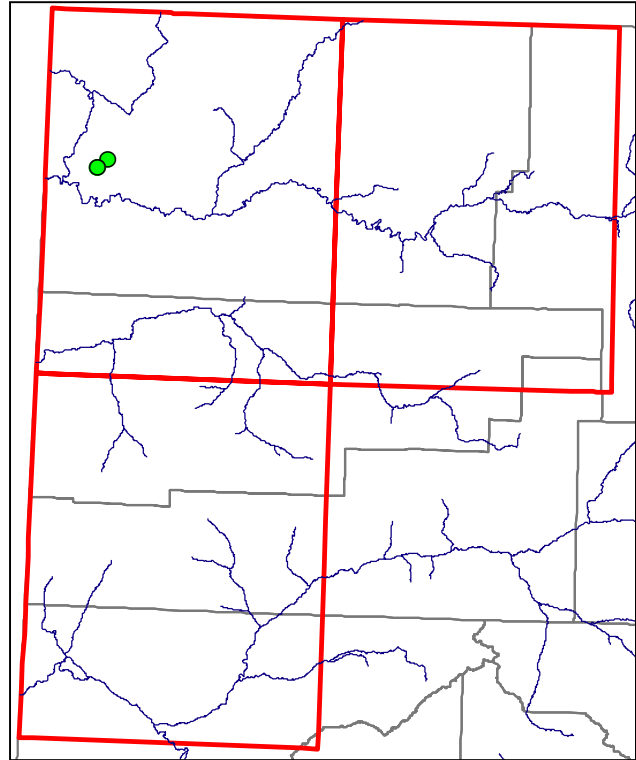


Figure 12. *Euderma maculatum* capture locations.



Figure 13. Spotted bat from Moffat County. Photo by J. L. Siemers & Y. R. Chen

Townsend's big-eared bat (*Corynorhinus townsendii*)

Townsend's big-eared bat is a species closely associated with caves and mines. Although we are not aware of any documented roosting locations in the immediate area, we captured this species at one location in Rio Blanco County within Rocky Mountain Gambel Oak – Mixed Montane Shrubland habitat. Mines are present in the vicinity of this capture location, which warrant further survey for possible roost locations.

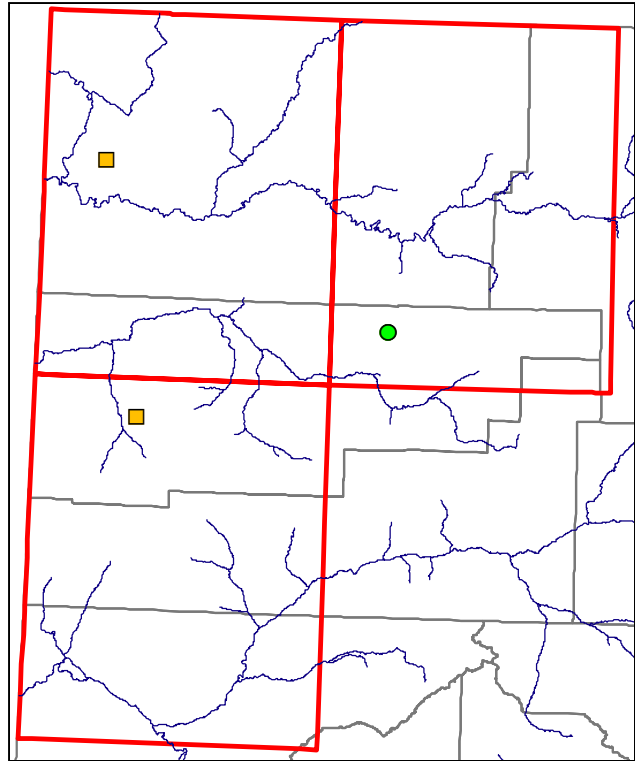


Figure 14. *Corynorhinus townsendii* and *Antrozous pallidus* capture locations. ○ = *C..townsendii*; □ = *A. pallidus*

Pallid bat (*Antrozous pallidus*)

The pallid bat was captured at two locations in Moffat and Rio Blanco counties in Rocky Mountain Ponderosa Pine Woodland and Colorado Plateau Pinyon-Juniper Woodland habitat types.



Figure 15. Pallid bat from Moffat County. Photo by J. L. Siemers & Y. R. Chen

California myotis (*Myotis californicus*)

The California myotis was captured at six different locations in Moffat and Rio Blanco counties in six different habitats. These habitats include: Inter-Mountain Basin Mixed Salt Desert Scrub, Rocky Mountain Pine Woodland, Inter-Mountain Basins Big Sagebrush Shrubland, Colorado Plateau Pinyon-Juniper Woodland, Rocky Mountain Juniper Woodland and Savanna, and Rocky-Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland.

Yuma myotis (*Myotis yumanensis*)

The Yuma myotis was captured at two different locations in Moffat County in Rocky Mountain Ponderosa Pine Savanna and Inter-Mountain Basins Big Sagebrush Shrubland habitats.

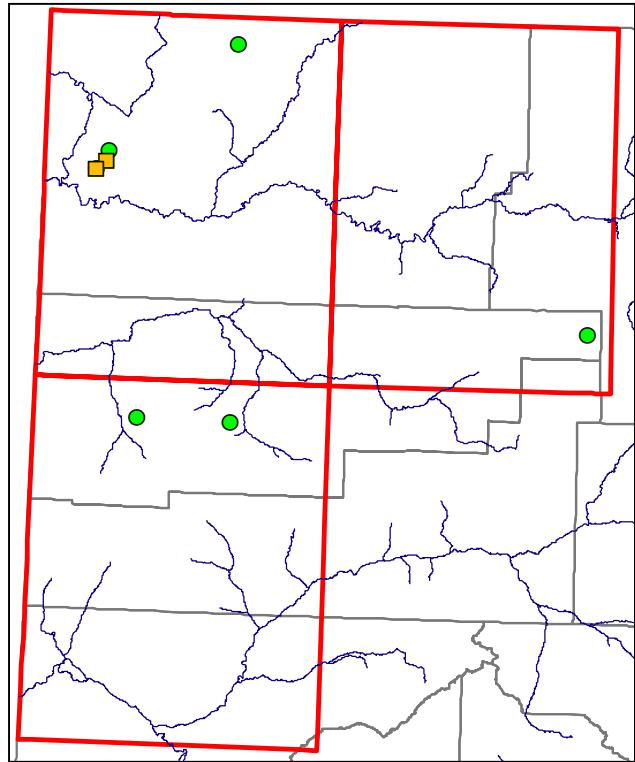


Figure 16. *Myotis californicus* and *M. yumanensis* capture locations. ○ = *M. californicus*; □ = *M. yumanensis*

Shrews

Two shrew species, the dwarf shrew (*Sorex nanus*) and the pygmy shrew (*S. hoyi*) were considered coarse-filter targets for this year's effort (Table 2). In Colorado the dwarf shrew occurs primarily in the mountainous regions of the state at elevations above 5,500 feet (Fitzgerald *et al.* 1994), and its range overlaps the eastern margin of this year's study area. Specimens of the pygmy shrew have been taken from the central mountains of Colorado above 9,600 feet (Fitzgerald *et al.* 1994). This species was included as a target due to the proximity of its range to the northeastern latilong block of the study area. No captures of the dwarf or pygmy shrew were made during this effort.

Opportunistic Species

White-tailed prairie dog (*Cynomys leucurus*)

Locations of white-tailed prairie dog towns were recorded opportunistically as they were encountered during the survey. We recorded towns in the northwest block of the study area in Moffat and Rio Blanco counties. A total of 13 towns were observed in 4 different habitat types. The majority of towns occurred in two habitat types: Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush Shrubland. The two other habitat types were Inter-Mountain Basins Greasewood Flat and Rocky Mountain Lower Montane – Foothill Shrubland.

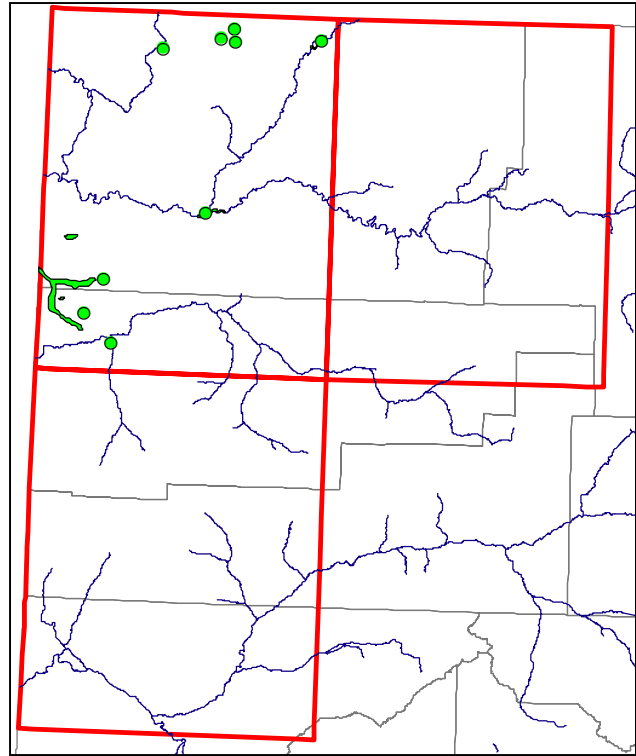


Figure 17. *Cynomys leucurus* observation locations. Towns are depicted with polygons; those too small to be observed at this scale are depicted with a point (○).

Discussion

An understanding of the distribution of an animal is essential to the development of an effective management strategy. Gaps in information exist regarding the distribution of many small mammals in Colorado and studies such as this one are useful in better clarifying where such small mammals occur.

Finley and Bogan (1995) documented numerous range extensions for terrestrial mammals in northwestern Colorado that were not previously reflected in recent sources on Colorado mammals (*e.g.*, Fitzgerald *et al.* 1994). As they have emphasized before in an account focused on Dinosaur National Monument (Bogan *et al.* 1988), basic information on the distribution of mammals in northwestern Colorado (and elsewhere) is lacking. The current effort was directed toward areas in northwestern Colorado outside of Dinosaur National Monument and Brown's Park National Wildlife Refuge, and toward less common species.

The spotted bat, considered widespread but rare (Fenton *et al.* 1987), was captured at two different locations during this study. While captures and audible detections of this species are becoming more numerous in Colorado (Navo *et al.* 1992; Storz 1995), the documentation of additional use areas is significant. Additional records of the pallid bat were also documented and while this bat is fairly common in the southwestern United States and Mexico, captures in Colorado are less frequent.

Findings from this study also suggest areas for future survey and monitoring. Townsend's big-eared bat, a bat species of high conservation priority in Colorado (Ellison *et al.* 2003), was captured in a location where there is not known to be a nearby roost. There are mines in the vicinity of this capture location that warrant further investigation. Similarly, all bat captures were made in mist nets over water sources and information on roost locations in the survey area for most species is not known.

Further survey effort focused on pocket mice (*Perognathus* spp.) in the survey area is also warranted. We did not capture any pocket mice, despite considerable effort in apparently suitable habitat. Previous efforts in the study area have captured the olive-backed pocket mouse (*P. fasciatus*) (Bogan *et al.* 1988; Finley and Bogan 1995; Anderson *et al.* 2000), and the Great Basin pocket mouse (*P. parvus*) (Bogan *et al.* 1988; Bogan and Finley 1995; Anderson *et al.* 2000; Falck *et al.* 2003). We did not, however, trap in the area west of the Green River where *P. parvus* is expected, but we did trap within the range of *P. flavescens* and *P. fasciatus* in the study area. Also, snap traps were not used in the current study as they were in others, which may have provided more captures than using live traps and some pitfall traps.

The sagebrush vole is another species that we expected to capture more often than we did. Allen *et al.* (1997) had success capturing this species in pitfall traps as opposed to live traps in a study in Montana. Greater use of pitfall traps in areas we considered to be suitable for this species may have been warranted.

Shrews remain one of the least-known groups of any mammals in Colorado. We were unsuccessful in capturing any of the target shrew species this year (*Sorex hoyi* and *S. nanus*), although their ranges did not significantly overlap the study area. Continued effort to better understand the distribution and population status of shrews in Colorado is needed.

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Appendix I. Museum specimen data. All specimens have been submitted to the Museum of Southwestern Biology at the University of New Mexico.

Scientific Name	Location	Collection Date
Order Insectivora		
<i>Sorex monticolus</i>	Moffat Co., Freeman Reservoir	6/21/04
<i>Sorex cinereus</i>	Moffat Co., Freeman Reservoir	6/21/04
<i>Sorex</i> sp.	Rio Blanco Co., east of Ripple Creek Pass	7/16/05
<i>Sorex</i> sp.	Rio Blanco Co., east of Ripple Creek Pass	7/16/05
<i>Sorex</i> sp.	Rio Blanco Co., east of Ripple Creek Pass	7/16/05
<i>Sorex</i> sp.	Rio Blanco Co., east of Ripple Creek Pass	7/16/05
<i>Sorex</i> sp.	Rio Blanco Co., east of Ripple Creek Pass	7/16/05
<i>Sorex</i> sp.	Rio Blanco Co., along Oak Creek	7/18/05
<i>Sorex</i> sp.	Rio Blanco Co., along Oak Creek	7/18/05
<i>Sorex</i> sp.	Rio Blanco Co., along Oak Creek	7/18/05
<i>Sorex</i> sp.	Rio Blanco Co., along Oak Creek	7/18/05
Order Chiroptera		
<i>Myotis ciliolabrum</i>	Moffat Co., Little Snake River	6/4/04
Order Rodentia		
<i>Thomomys talpoides</i>	Moffat Co., Brown's Park State Wildlife Unit, Cold Springs Unit, Cottonwood Springs	6/6/04
<i>Microtus longicaudus</i>	Moffat Co., Brown's Park State Wildlife Unit, Cold Springs Unit, Cottonwood Springs	6/6/04
<i>Thomomys talpoides</i>	Moffat Co., Pole Gulch	6/20/04
<i>Thomomys talpoides</i>	Moffat Co., Pole Gulch	6/21/04
<i>Lemmiscus curtatus</i>	Moffat Co., Elkhead Reservoir	6/22/04
<i>Microtus montanus</i>	Moffat Co., Elkhead Reservoir	6/21/04
<i>Phenacomys intermedius</i>	Moffat Co., northwest of the Town of Dinosaur	5/10/05
<i>Peromyscus crinitus</i>	Rio Blanco Co., Intersection of County Roads 88 and 89	5/18/05
<i>Neotoma lepida</i>	Rio Blanco Co., Intersection of County Roads 88 and 89	5/18/05
<i>Microtus longicaudus</i>	Rio Blanco Co., Piceance Creek State Wildlife Area, Piceance Creek	5/19/05
<i>Microtus montanus</i>	Rio Blanco Co., East of Ripple Creek Pass	7/16/05
<i>Reithrodontomys megalotis</i>	Moffat Co., Morgan Gulch near Yampa River	7/18/05