

## MERRIAM'S SHREW

### *Sorex merriami*

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#### **Description**

Large compared to other shrews, Merriam's shrews are still tiny animals.

Merriam's shrew has pale gray pelage with whitish feet and white underparts. The tail is bicolored and sparsely haired. The shrew molts in spring and fall. Flank glands are prominent on males during the breeding season, and thought to be responsible for the shrew's strong odor (Armstrong and Jones 1971). Johnson and Clanton (1954) suggest this odor may be associated with attracting a mate.

Merriam's shrews are large and heavy-bodied relative to shrews that co-occur with them in Colorado (D. Armstrong, pers. comm.), yet they are still tiny animals: total length measures 88 to 107 mm, including tail length of 33 to 42 mm. Adults weigh between 4.4 to 6.5 g (Armstrong and Jones 1971). Distinguishing Merriam's shrew from other shrews is subtle work; familiarity with shrews in the museum collections is recommended before attempting field identifications (D. Armstrong, pers. com.).

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#### **Natural history and behavior**

Merriam's shrews are solitary insectivores. Their natural history is poorly known.

Merriam's shrews are active at all hours, and like other shrews, often need to consume more than their body weight in prey per day. The diet consists of spiders, beetles, caterpillars and other small invertebrates, and perhaps vertebrate carrion. Runways and burrows of small rodents are used extensively for foraging (Armstrong and Jones 1971). Runways and burrows of sagebrush voles are important to Merriam's shrews in localities where the two species occur together (Johnson and Clanton 1954).

Merriam's shrews do not hibernate. They breed during spring and early summer and produce perhaps one or two litters a year, with 5 to 7 young per litter (Fitzgerald et al. 1994). The gestation period is about 3 weeks. The female fashions a small nest under a log, rock, or similar shelter, lined with hair or plant material. The young are naked and blind at birth, mature rapidly, and may remain with the mother for a short while after emerging from the nest. There is little evidence of any social structure for these shrews and the details of their mating interactions are unknown (Findley 1987).

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#### **Population trends**

No long-term census effort has been performed in Colorado or rangewide.

Long-term population trends of Merriam's shrew in Colorado and rangewide are unknown.

A literature review and synthesis by Dobkin and Sauder (2004) suggested that Merriam's shrews were present at only 8 of 39 (17 percent) of the localities they were expected to occupy in the Great Basin and Columbia Plateau. Although Merriam's shrews have traditionally been considered rare, the review raises concerns about the status, distribution, and habitat requirements of the species throughout its range.

**Range**

Merriam's shrew remains extant in the states where it historically occurred.

Overall range map reproduced from Fitzgerald et al. (1994) by permission.



The range of Merriam's shrew encompasses the Great Basin; the Columbia Plateau; the Colorado Plateau; the Great Plains steppe of Montana, the western Dakotas, and western Nebraska; the Wyoming Basins into northwestern Colorado; and from a few localities in the foothills of Colorado's Front Range. No data documenting historic continental-scale shifts in distribution of this species exist.

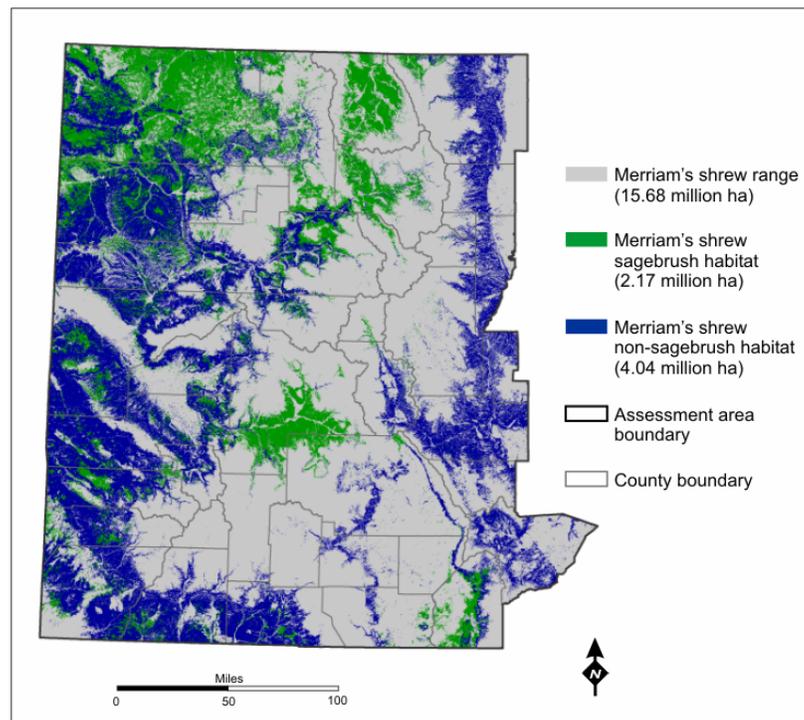
Given that Merriam's shrew is a facultative sagebrush shrubsteppe species across its range, and that this habitat has undergone significant decline in the last century (Knick 1999), it is possible that the range and distribution of this species has responded accordingly.

**Colorado distribution patterns & abundance**

Merriam's shrews are thought to occur in Colorado in appropriate habitat between 4,500 and 9,600 feet (Fitzgerald et al. 1994).

The range of Merriam's shrew in the assessment area encompasses the entire assessment area (approximately 15.68 million ha), with an estimated 6.21 million ha of suitable habitat.

Merriam's shrews occur in appropriate habitat in northwest and southwest Colorado, and in central Colorado along the Front Range. Centers of abundance are unknown. Specimens have been taken in Moffat, Routt, Rio Blanco, Garfield, Gunnison, Larimer, El Paso, Teller, Boulder, Fremont, Custer, and Montezuma counties (Armstrong et al. 1973; Armstrong and Jones 1971; Fitzgerald et al. 1982; Fitzgerald et al. 1994). The distribution of Merriam's shrew has probably not changed significantly in Colorado since European settlement.





sagebrush shrublands (see figure in Colorado Distribution Patterns and Abundance).

Home range, dispersal distances, and minimum patch size for the Merriam's shrew are unknown.

In northwestern Colorado, they are thought to occur most typically in "well-maintained sagebrush ecosystems" (Fitzgerald et al. 1982). The highest rate of capture of Merriam's shrews in Colorado was in montane shrublands in Custer and Fremont counties (Armstrong et al. 1973; Fitzgerald et al. 1994).

In the Columbia Plateau, Great Basin, and the Wyoming Basins Ecoregions, Merriam's shrews have been captured in sagebrush-dominated habitats, mountain shrub, and shortgrass prairie (Dobkin and Sauder 2004). Verified specimens from New Mexico were taken in white fir/Douglas-fir/ponderosa pine (Findley 1987) and in sagebrush steppe (BISON 2005). In Arizona, specimens have been taken in or near open ponderosa pine woodlands, spruce-fir stands, and grasslands with patches of aspen and spruce (BISON 2005). Mullican et al. (2004) captured two Merriam's shrews in South Dakota sagebrush shrubsteppe on two of 35 sites sampled, noting that "the percent grass cover was higher and the total number of shrubs was lower on those areas where the shrew was captured compared to those areas where it was absent." The easternmost record of Merriam's shrew is from a wet meadow adjacent to a xeric grassland in western Nebraska where *Artemisia* sp. was present (McDaniel 1967).

It is important to note that Merriam's shrews have not been captured in sufficient numbers to provide statistically significant correlations between shrew occurrence/abundance and community physiognomy or floristics. Merriam's shrews were consistently trapped in fewer numbers relative to rodents and other insectivores collected during the same studies, and typically hundreds, sometimes thousands of trap-nights are required to capture a single animal (Dobkin and Sauder 2004).

### Threats & sensitivities

Nothing is known about the response of Merriam's shrews to grazing, range management practices, or habitat degradation in sagebrush shrubsteppe, in Colorado or rangewide.

In western Colorado, where sagebrush makes up about 35 percent of Merriam's shrew suitable habitat, threats to sagebrush are a major concern.

In the Colorado sagebrush assessment area, where sagebrush makes up about 35 percent of Merriam's shrew suitable habitat, threats to sagebrush are major concerns. Merriam's shrew sagebrush habitat in the assessment area is at risk of four widespread threats modeled in the Colorado sagebrush conservation assessment and strategy: pinyon-juniper encroachment, encroachment by invasive herbaceous plants, residential development, and energy development.

Residential development probably poses the lowest threat of the four, with an estimated 2 percent of Merriam's shrew sagebrush habitat at high risk, 2 percent at moderate risk, and 15 percent at low risk. About 82 percent of Merriam's shrew sagebrush habitat is at no risk of residential development based on our predictive model. Residential development threats to sagebrush are fairly scattered, with hot spots around Craig, Steamboat Springs, Granby, the Eagle River Valley, Aspen Valley and the Roaring Fork Valley, Hotchkiss and Cedaredge in Delta County, Cortez, Mancos, and Durango.

Pinyon-juniper encroachment risk is also relatively low. Our predictive model estimated 18 percent of Merriam's sagebrush habitat is at high risk of pinyon-juniper encroachment. Pinyon-juniper encroachment is not anticipated to be a serious threat to Merriam's shrew because the species tolerates scattered trees in its habitat.

Risk of energy development is broadly moderate in Merriam's shrew sagebrush habitat. About 58 percent of Merriam's shrew sagebrush habitat is at moderate

See [Chapter 6](#) for more detail about habitat estimates and predictive threats modeling for Merriam's shrew sagebrush habitat in the Colorado assessment area. [Chapter 4](#) presents rule sets for threats modeling in sagebrush habitat.

risk of energy development in the Colorado sagebrush assessment area, 34 percent is at low or no risk, and 8 percent is at high risk. Energy development can result in destruction, degradation, and fragmentation of habitat via mechanisms described in [Chapter 2](#). The effects of shrubland habitat fragmentation and perforation on Merriam's shrew populations have not been studied. Roads, especially divided highways, are likely major barriers to dispersal of small mammals. Sagebrush habitat at highest risk of energy development is scattered throughout the western-most counties in the assessment area, with larger hot spots clustered in Rio Blanco, Garfield, and southern La Plata Counties.

Over 99 percent of Merriam's shrew sagebrush habitat is at some degree of risk of encroachment by invasive herbaceous plants. Our model predicts 24 percent at high risk, 18 percent at moderate risk, and 58 percent at low risk. Sagebrush habitat at moderate or high risk of invasive herbaceous plant encroachment in Merriam's shrew range is mostly broadly scattered across the western-most counties at lower elevations. Moffat and Rio Blanco counties contain the largest contiguous patches of sagebrush habitat at high risk.

Dobkin and Sauder (2004) suggested that Merriam's shrew populations may be sensitive to grazing in sagebrush shrubsteppe, based on documented effects on other soricids in a variety of habitats through soil compaction, litter reduction, and microhabitat alteration. Cattle may compress soils and trample burrows and runways of sagebrush voles, which are thought to be important to the Merriam's shrew's foraging patterns. Livestock grazing is associated with the introduction of exotic plants and potentially influences structural or floristic shifts in the plant community. How such shifts might affect the Merriam's shrew is unknown, and whether or how invasions of exotic herbaceous plants affect the Merriam's shrew is unknown as well.

Responses of Merriam's shrews to chemical or mechanical treatments on sagebrush range are undocumented. The toxicity to Merriam's shrews of herbicides applied to sagebrush is unknown. Equipment used for mechanical treatments may destroy Merriam's shrew nests with young.

The effects of fire in shrubsteppe on the Merriam's shrew are uncertain. In burned sagebrush shrubsteppe in southwestern Wyoming, Kirkland et al. (1997) captured 3 Merriam's shrews in 73,000 trap-nights (0.004 percent success rate). In adjacent unburned sagebrush shrubsteppe, two Merriam's shrews were captured in 14,600 trap-nights (0.013 percent success rate). At a separate unburned sagebrush shrubsteppe site, the trapping success rate was 0.002 percent. Trapping was conducted over a seven-year period, with the burn occurring in year 5. Burned areas exhibited "considerable regrowth" of rabbitbrush, bitterbrush, and perennial grasses and forbs by the second year following the burn. In the same study, Merriam's shrews were trapped with a success rate of 0.018 percent on a reclaimed coal mine site dominated by forbs. This rate was higher than trap success rates on both burned and unburned sagebrush shrubsteppe sites.

No data are available regarding the effects of agricultural conversions of sagebrush shrubsteppe on Merriam's shrew. Such conversions are assumed to result in direct habitat loss.

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The effects of predation on Merriam's shrew populations are unknown. Merriam's shrew remains have been reported in owl pellets (Armstrong and Jones 1971 citing others).

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### Research needs

No comprehensive baseline population estimates or trend data exist across any part of the species' range. Detailed studies of habitat requirements and responses to habitat degradation are lacking. Virtually nothing is known of the natural history of the Merriam's shrew in Colorado.

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### Management issues

The potential effort and expense of a statistically powerful population census, let alone a long-term trend estimate, explains why so little is known about Colorado's Merriam's shrew populations or natural history.

Merriam's shrew is a potential indicator of habitat integrity in sagebrush ecosystems (Fitzgerald et al. 1982). That potential will remain unfulfilled until a better understanding of the natural history and ecology of the species in Colorado is established.

About 45 percent of Merriam's shrew sagebrush habitat in the Colorado sagebrush assessment area is controlled by private landowners, posing a challenge for effective, integrated habitat management for the species. Nevertheless, about 73 percent of the sagebrush habitat managed by non-private entities is managed by the BLM, making it the public entity best-positioned to have a positive impact on the species.

Our threats analysis did not consider non-sagebrush vegetation types, which provide a significant amount (about 63 percent) of Merriam's shrew habitat. Ideally, conservation planning and management of species of concern should consider all significant habitat types. Such an approach is beyond the scope of this assessment.

The effects of research activities on local Merriam's shrew populations are undocumented, although high mortality rates are a concern. Snap-traps, which kill the sampled fraction of the population, have long been the method of choice for small mammal census, though this method has declined in popularity in recent years. Pitfall traps are more effective for capturing shrews, but survival rates can be quite low; animals confined in live traps without food die within 3 or 4 hours.

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