SPECIES ASSESSMENT FOR DWARF SHREW (*SOREX NANUS*) IN WYOMING

prepared by

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Introduction

The dwarf shrew (*Sorex nanus*) is one of the smallest mammals in the world, and inhabits a variety of habitats in western North America. Very little is known about this shrew, and relatively few specimens have been collected. Like most members of *Soricidae*, the dwarf shrew has a long and pointed nose, small eyes and ears, and a small body. It is difficult to distinguish from other shrews and generally has to be identified by dental characteristics. The dwarf shrew occurs primarily in mountainous areas, apparently preferring rock outcrops and talus slopes in alpine, subalpine, and montane settings. However, it has been occasionally found in lower and more arid environments such as shortgrass prairie, shrub-steppe, and stubble fields. Dwarf shrews are active throughout the year and feed primarily on insects, soft-bodied spiders, and other small invertebrates. The dwarf shrew nests in underground burrows and usually breeds in late June to early July. First litters of 6-7 young are born in late July to early August, with second litters following in late August and early September. The population status and trends of the dwarf shrew are not well known; it is generally regarded as a rare species, but this may be an artifact of under-sampling and the overall difficulty of detecting such a small and cryptic species.

Natural History

Morphological Description

There are 9 species of shrew known to occur in Wyoming. With the possible exception of the relatively large and dark water shrew (*Sorex palustris*), all Wyoming shrews are superficially alike in appearance with small bodies, long pointed snouts, small eyes and ears, and dusky gray-brown pelage (Figure 1). Shrew teeth are generally white with black or dark red pigmentation on the tips.

Shrews are difficult to identify to species without detailed examination of dentition. The dwarf shrew is one of the smallest of all mammals, with adults weighing only 1.8 to 3.2 g and having total body lengths of 82 to 105 mm. The hind foot length of adults varies only slightly from 10 to 11 mm (Hoffman and Owen 1980, Clark and Stromberg 1987). Sexes apparently do not differ in size. The dwarf shrew has an olive brown fur on its back that extends down its sides where it merges sharply with a smoky gray or buffy underside (Ridgway 1912). Winter pelage is lighter and grayer, especially on the back. The dwarf shrew has a long (27-40 mm) tail that is indistinctly bicolored to the tip, dark above and lighter below (Hoffman and Owen 1980).

The dwarf shrew can usually be identified by dentition, although as with all shrews it is difficult to identify old individuals to species because of excessive tooth wear. In dwarf shrews the third unicuspid on the upper tooth row is smaller than the fourth, and both the third and fifth upper unicuspids are easily visible (Clark and Stromberg 1987). The accessory cusp on the first upper incisor is well developed and heavily pigmented. The condylobasal length of the skull of the dwarf shrew is less than 15.2 mm, with a rather flat profile (Hoffman and Owen 1980).

As discussed below, Hoffman and Owen (1980) considered *S. nanus* to be the Rocky Mountain dwarf shrew and *S. tenellus* to be an allospecies, the Great Basin-centered Inyo shrew. The ranges of the 2 species do not overlap (Figure 2). No known morphological characters will reliably separate the two taxa, although *S. tenellus* tends to be slightly larger and have somewhat paler pelage. Within its known range, the dwarf shrew is especially difficult to distinguish from the pygmy shrew (*S. hoyi*) and vagrant shrew (*S. vagrans*) (Clark and Stromberg 1987; WYNDD unpublished data). In contrast with the dwarf shrew, the third and fifth unicuspids of the pygmy shrew are difficult to see, and while the vagrant shrew's hind foot length is over 11 mm (Clark and Stromberg 1987). Masked (*S. cinereus*) and Merriam's (*S. merriami*) shrews have distinctly

bicolored tails (Hoffman and Owen 1980). Habitat information may also be useful in identifying various species of shrews, although the general lack of specimens and knowledge of shrew life history make such extrapolations tenuous at best. Refer to Clark and Stromberg (1987) for a detailed key on how to differentiate and identify various species of shrews in Wyoming.

Taxonomy and Distribution

Taxonomy

Hoffman and Owen (1980) suggested that *S. tenellus* and *S. nanus* were allospecies belonging to the *S. ornatus* species group, each being monotypic (Jackson 1928). Hall (1981) agreed that *S. nanus* and *S. tenellus* are closely allied, and believed that they are monotypic because their ranges do not overlap and are separated by several hundred miles (Figure 2). However, George (1988) suggested that *S. nanus* has only recently diverged from *S. tenellus*, and may not yet be a separate species. Jones et al. (1992), and Hutterer (in Wilson and Reeder 1993) listed *S. nanus* and *S. tenellus* as separate species. See George (1988) for an electrophoretic study of systematic relationships among *Sorex* species. Dwarf shrews have no recognized subspecies (Hoffman and Owen 1980).

Distribution

Dwarf shrews have a fossil record that suggests that they once inhabited rubble slopes and coniferous forests as far east as Kansas and as far south as southern New Mexico, when glaciers covered much of the Rocky Mountains. Currently it appears that the dwarf shrew occurs in small and isolated populations where suitable "relict" habitat remains, such as the mountains of the Great Basin and Rocky Mountain region (Clark and Stromberg 1987; Figure 2). Rangewide, dwarf shrews can be found locally across central Montana to northwestern Wyoming; southeastern

Montana (along the northern edge of the Black Hills); southwestern South Dakota in the plains adjacent to the Black Hills; the Rocky Mountains from southeastern Wyoming, south across much of western Colorado and southeastern Utah to south-central New Mexico; in the Kaibab Plateau, White Mountains, and San Francisco Peaks of northern Arizona (Durrant and Lee 1955, Hoffman and Taber 1960, Spencer and Pettus 1966, Pattie and Verbeek 1967, Hoffman et al. 1969, Thomspon 1977, Cinq-Mars et al. 1979, Hoffman and Owens 1980, MacCracken et al. 1985, Hoffmeister 1986, Clark and Sttromberg 1987, Raphael 1988, Berna 1990, George 1990, Backlund 1995, Elliott et al. 1997, Kirkland et al. 1997, Rickart and Heaney 2001, Hafner and Stahlecker 2002; WYNDD unpublished data).

Wyoming forms part of the core of the dwarf shrew's known range (Figure 2). In Wyoming dwarf shrews have been captured in the Medicine Bow, Big Horn, Beartooth, Absaroka, and Uinta mountain ranges, and in Yellowstone and Grand Teton National Parks. The dwarf shrew has been documented in the Bridger/ Teton, Shoshone, Bighorn, Medicine Bow, and Wasatch National Forests. It has also been documented in Lincoln county in grassy areas and in Sweetwater county in sagebrush flats (Clark and Stromberg 1987; WYNDD unpublished data). There are also 2 records in the WYNDD database for Campbell and Laramie counties; however these records are somewhat questionable because it is not certain if these specimens were identified properly (Figure 3). Dwarf shrews are known from southeastern Montana and the southern foothills of the Black Hills in South Dakota, so it is possible that the dwarf shrew inhabits more of eastern Wyoming than has been previously assumed.

Habitat Requirements

Year-round

The majority of dwarf shrew specimens come from alpine (up to 3350 m elevation), subalpine, and montane settings, but some are from relatively low elevations (1370 - 1680 m) in foothills zones. A few specimens were collected at about 740 m in grassland adjacent to the Black Hills (Hoffman and Owen 1980). Habitats in which dwarf shews have been captured include alpine rubble slopes, subalpine forest and meadow (Thompson 1977, Berna 1990), *Pinus ponderosa* stands (George 1990), shortgrass prairie (Cinq-Mars et al. 1979, Backlund 1995), dry stubble fields, marshes, dry brushy hillsides (Spencer and Pettus 1966, MacCracken et al. 1985), and pinyon-juniper woodlands (Clark and Stromberg 1987; WYNDD unpublished data). This rather diverse list suggests that the dwarf shrew is a true habitat generalist, but it is important to note that they have been reported most often from rocky habitats in alpine tundra and subalpine coniferous forests (Hoffman and Owen 1980, Berna 1990, George 1990, Rickart and Heaney 2001). Fitzgerald et al. (1994) stated that dwarf shrews in Colorado occur at elevations >1600 m in coniferous forests, bogs, open woodlands, and alpine meadows. Brown (1967) collected dwarf shrews at considerable distances from water, suggesting that they may be more tolerable of drier settings than other Soricids.

In Wyoming dwarf shrews have been found in riparian areas, tundra, fell fields, talus, and other moist sites that support large amounts and varieties of invertebrates and small mammals (Hoffman and Taber 1960, Thompson 1977, MacCracken et al. 1985). The dwarf shrew also uses pinyon-juniper woodlands, stubble fields, sagebrush grasslands, alkaline sagebrush flats, and shortgrass prairie in Wyoming (WYNDD unpublished data). Brown (1967) found dwarf shrews in alpine and subalpine rockslides and alpine tundra in the Medicine Bow Mountains. Kirkland et

al. (1997) captured dwarf shrews in sagebrush-steppe habitat and in grasses and forbs at two reclaimed coal mines in Lincoln county (see also Parmenter et al. 1985). MacCracken et al. (1985) found litter cover to be an important habitat component for shrews in Montana.

Territoriality and Area Requirements

Dwarf shrew populations may be able to persist in rather small (ca. 2 ha) patches of suitable habitat, especially if such patches are centered on undisturbed exposures of broken rock that support large numbers of small mammals and invertebrates (Stromberg 1983). Home range size for the dwarf shrew has not been reported, but masked shrew home ranges are 0.02 ha and those of the vagrant shrew are 0.06 - 0.4 ha (Clark and Stromberg 1987). It is assumed that dwarf shrew home ranges are of similar sizes.

Landscape Pattern

As discussed above, dwarf shrews are found in a variety of vegetation communities, usually within the alpine and subalpine life zones and associated with fields of exposed rock. As would be predicted for such a small mammal, dwarf shrews probably require relatively small patches of suitable habitat in which to persist. Thus a relevant ecological "landscape" for this species is probably a rather fine-scale mosaic of microenvironments, rather than a kilometer-scale mosaic of distinct land cover types. The specific characteristics of such a landscape are difficult to define with the paucity of information on dwarf shrews; exposed rock fields and a high biomass of invertebrate, and possibly small vertebrate, prey (Rickart and Heaney 2001) are likely important components. Doug Backlund (South Dakota Natural Heritage Program, personal communication) suggested that intensive land management activities (e.g., timber harvesting, road building) could disrupt the movement of dwarf shrews between subpopulations, and that this in turn could threaten especially small subpopulations that depend on occasional immigration for persistence.

Movement and Activity Patterns

Daily Activity

Shrews have among the greatest food requirements per gram of body mass of all mammals, and as a result they must continually search for food both day and night. Most shrews are thought be solitary except for brief periods during breeding season and when tending litters (Clark and Stromberg 1987).

Broad-scale Movement Patterns

The dwarf shrew is considered non-migratory. Local movements and home range shifts in response to changes in food availability are expected. The dwarf shrew is active throughout the year and does not hibernate (Hoffman and Owen 1980). Winter activities are primarily subnivean.

Reproduction and Survivorship

Breeding Behavior and Phenology

Very little is known of the breeding habits of most shrews, and the dwarf shrew is no exception. High-elevation populations probably begin breeding in late June or early July. By late July or early August, the first litters are born in nests located in underground burrows, and adult females become pregnant again (Hoffman and Owen 1980, Clark and Stromberg 1987, Wyoming Game and Fish Department 1997). Second litters are born in late August and early September. Early snowfall and cold temperatures may exact heavy mortality on these second litters. At lower elevations breeding probably starts earlier in the spring, and litter size and numbers of litters may be greater (Clark and Stromberg 1987).

Fecundity and Survivorship

There is no evidence that juvenile females breed in their first summer of life; it is generally assumed that females breed only in their second year and produce 1 to 2 litters of 6-7 young each (Hoffman and Owen 1980, Clark and Stromberg 1987). Gestation is probably 20-23 days, like other closely related species of *Sorex* (Foresman 1989). Adult males in breeding condition have been captured throughout July and August on the Beartooth Plateau. It is unknown how early in the season adult males come into breeding condition (Hoffman and Owen 1980). Cinq-Mars et al. (1979) captured two adult males in low elevation grasslands in mid June that were in breeding condition. There is some evidence that juvenile males in Colorado may attain reproductive maturity late in the summer of their first year (Hoffman and Owen 1980). Berna (1990) captured several juvenile dwarf shrews in July and August, and believed that this was the period of juvenile dispersal. The known life span of the dusky shrew (*S. monticolus*) is no greater than 16 months, and usually by autumn all overwintering adults have died (Clark and Stromberg 1987). In the absence of more specific evidence, it is assumed that dwarf shrew life span is similar.

Population Demographics

Limiting Factors

Ultimate population constraints are difficult to identify due to lack of information on life history. The general association between dwarf shrews and fields of exposed and broken rock suggests the availability of such environments on the landscape may set some upper limit to abundance. The biomass of invertebrate prey may determine density in any given in area; climatic events affecting invertebrates (e.g., early or late cold spells, drought) may therefore have large impacts on dwarf shrew populations.

Metapopulation Dynamics

Dwarf shrews appear to form small subpopulations that are likely linked through occasional immigration, but the extent to which they form true metapopulations is unknown. Until more information is developed regarding the synchrony of subpopulation dynamics, and the frequency of immigration between subpopulations, dwarf shrew populations are probably best referred to as "patchy populations" rather than formal metapopulations.

Genetic Concerns

Very little is known regarding dwarf shrew genetics at local, regional, or continental scales. As with any taxon that forms patchy populations, occasional immigration between subpopulations may be important for maintaining local genetic diversity. Also, because some extant populations may be isolated Pleistocene relicts, it is possible that the combined forces of founder effect, genetic drift, and local adaptation have caused genetic divergence at a regional scale. These issues require further study.

Food Habits

Food items

All shrews are primarily insectivorous. Dwarf shrews in the wild are known to feed on insects, spiders, and other small invertebrates (worms, mollusks, centipedes). They may also consume vegetable matter as well as some small vertebrates like salamanders and mice (Hoffman and Owen 1980). Dwarf shrews in pitfall traps in Arizona ate spiders and carabid beetles (Berna 1990). Captive dwarf shrews have been observed to eat carrion of several species of small mammals, but seem to prefer soft-bodied spiders and insects (Clark and Stromberg 1987). Captive individuals seem to ignore slugs, and they have been observed to cache extra prey in

corners of their cages (Spencer and Pettus 1966). In general, shrew diets include virtually all animal protein available in a given environment (Hoffman and Owen 1980).

Foraging Strategy

Like most shrews, dwarf shrews are very active hunters that incessantly search for food. They have very high metabolic rates that demand large amounts of highly digestible, high-protein food. Dwarf shrews are probably entirely terrestrial and search for food on the ground surface using runways in vegetation and litter. They probably depend mostly on tactile senses to locate prey (Clark and Stromberg 1987).

Community Ecology

Predators

Martin (1971) recovered a dwarf shrew mandible from barn owl (*Tyto alba*) pellets. Other species of shrew are preyed upon by weasels, hawks, snakes, and foxes (Clark and Stromberg 1987), and it is assumed that dwarf shrews are also taken by these predators. Coyotes (*Canis latrans*) and red fox (*Vulpes vulpes*) are known to occasionally kill, but not consume, some shrews (G. Beauvais, personal observation).

Competitors

Spencer and Pettus (1966) observed that a decline in the density of *S. cinereus* and *S. monticolus* did not accompany an increase in the density of *S. nanus*. This was interpreted as evidence of little competition between these species. In contrast, MacCracken et al. (1985) believed that both intra- and interspecific competition for food and space limited shrew distribution in Montana. The dwarf shrew is sympatric with *S. hoyi*, *S. merriami*, *S. cinereus*, and *S. monticolus* in Wyoming, but apparently does not compete with them (Hoffman and Owen 1980;

WYNDD unpublished data). In the La Sal Mountains of southeastern Utah, Rickart and Heaney (2001) found a rich assemblage of shrews living in the same areas. Kirkland (1991) believed that syntopic species of shrews differ enough in body size and relative abundance to result in trophic separation and different patterns of habitat utilization.

Parasites and Disease

Very little is known about parasites and diseases that affect dwarf shrews. Pfaffenberger (1984) discovered the parasite *Ixodes soricis* on 3 dwarf shrews in Union county, New Mexico. It is not known what affect this parasite had on these shrews.

Symbiotic and Mutualistic Interactions

Very little is known regarding potential symbiotic and mutualistic interactions of shrews.

Conservation

Conservation Status

Federal Endangered Species Act

The USDI Fish and Wildlife Service does not give any special status to the dwarf shrew at this time.

Bureau of Land Management

The Wyoming State Office of the USDI Bureau of Land Management (BLM) developed their Sensitive Species list in 2001, and included the dwarf shrew on that list. The BLM developed the list to "ensure that any actions on public lands consider the overall welfare of these sensitive species and do not contribute to their decline." Sensitive species management will include: determining the distribution and current habitat needs of each species; incorporating sensitive

species in land use and activity plans; developing conservation strategies; ensuring that sensitive species are considered in National Environmental Policy Act analyses; and prioritizing necessary conservation work (USDI Bureau of Land Management 2001).

Forest Service

The USDA Forest Service (USFS) - Region 2 includes the dwarf shrew on its Sensitive Species list. "Sensitive species" are defined by the USFS as "those animal species identified by the Regional Forester for which population viability is a concern as evidenced by: (a) significant current of predicted downward trends in population numbers or density, and/or (b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution" (USDA Forest Service 1994). The Region 2 area in Wyoming includes the Bighorn, Black Hills, Medicine Bow, and Shoshone National Forests and Thunder Basin National Grassland.

State Wildlife Agencies

The Wyoming Game and Fish Department (WGF) classifies the dwarf shrew as NSS3. This ranking means that habitat is restricted or vulnerable (but no recent or significant loss has occurred); populations are declining or restricted in numbers and or distribution (but extirpation is not imminent); the species may be sensitive to human disturbance (Oakleaf et al. 2002). Management decisions should consider this ranking and all available information on the species.

Heritage Ranks and Wyoming Contribution Rank

The dwarf shrew has been assigned a rank of G4/S4 by the Wyoming Natural Diversity Database (WYNDD; University of Wyoming). The G4 rank indicates that the full species *S. nanus* is apparently secure rangewide; similarly, the S4 rank indicates the full species *S. nanus* is

apparently secure within the state of Wyoming. It is important to note, however, that these rankings are based on very limited field data.

The Wyoming Contribution rank for the dwarf shrew is Very High. This is based on a ranking system developed by the WYNDD (Keinath and Beauvais 2003) that measures the contribution of Wyoming populations of a taxon to the rangewide persistence of that taxon, and considers several factors. For the dwarf shrew, these factors include: (1) the species is a resident native in Wyoming, (2) the species has a restricted continental range, (3) the state encompasses a large percentage of that continental range, and (4) the status of Wyoming populations relative to populations in other areas is unknown.

Biological Conservation Issues

Abundance

Dwarf shrews can easily escape snap traps and standard live traps used in small mammal inventories, and thus were rarely collected in the past. From 1895 to 1960 only 18 specimens were known from the species' entire range. Since pitfall traps have become more commonly used, dwarf shrews have been captured more frequently (Clark and Stromberg 1987). Currently there are least 98 specimens known to have been collected in Wyoming (Figure 3; WYNDD unpublished data). Dwarf shrews seem to be locally abundant in some parts of their range. Brown (1967) collected 25 specimens in the Medicine Bow Mountains of southeastern Wyoming, and Armstrong et al. (1973) captured 81 dwarf shrews in the Arkansas River watershed of Colorado over the course of two years. Armstrong et al. (1973) stated that their high rates of capture per pitfall trap indicated that dwarf shrews may sometimes be common. Kirkland et al. (1997) suggested that dwarf shrew abundances and known habitats may be a result of sampling bias

because investigators generally sample for shrews in forested habitats rather than drier habitats that may support the species.

Dwarf shrews are classified as "rare" in Montana and Utah, and should be considered rare in Wyoming as well (Clark and Stromberg 1987, Finch 1992, WYNDD unpublished data).

Trends

Abundance

Trends in abundance of the dwarf shrew are unknown due to very low numbers of trapped specimens and the rarity of studies that have sampled in any given area for any length of time. As trapping methods improve more dwarf shrews are likely to be captured, but such an increase should not be interpreted as an increase in abundance. WYNDD categorizes the abundance trends of the dwarf shrew within Wyoming as Uncertain (Rank = U; Keinath et al. 2003); confidence in this rank is Moderate.

Population Extent and Connectivity

It is difficult to assess the population extent and connectivity trends for the dwarf shrew. The known distribution of the dwarf shrew at this time is best characterized as widespread but patchy (Hoffman and Owen 1980). The known range of the dwarf shrew has undergone several expansions, especially in recent years, as more small mammal inventories have used methods (i.e., pitfall traps) that are more successful at capturing shrews. The exact continental range of the dwarf shrew is still somewhat unknown at this time, and will probably continue to expand as more studies are conducted.

Habitat Availability

Very little is known about habitat trends for the dwarf shrew in Wyoming. Some habitat has probably been lost to urbanization, road building, mining, and other activities, but a substantial amount probably remains in many areas of the state.

Range Context

The dwarf shrew is endemic to the Rocky Mountains, Colorado Plateau, Great Basin, and the northern Great Plains where it occurs in apparently small and isolated populations (Clark and Stromberg 1987). WYNDD estimates that Wyoming encompasses >20% of the core of the species' known range (Keinath et al. 2003).

Extrinsic Threats and Reasons for Decline

Anthropogenic Impacts

Very little is known about human impacts on shrews. Habitat loss and fragmentation via various human activities may be a problem for dwarf shrews in some highly-impacted portions of their range. Road building, timber harvest, human recreation, fire, and urban or agricultural development all may be potential local threats to dwarf shrew habitat.

Invasive Species

There is virtually no information pertaining to the effects of exotic and invasive species on shrews.

Genetic Factors

As currently understood, there is no reason to suspect hybridization or genetic introgression is a threat to dwarf shrew populations. It is possible that extremely small and isolated populations

may lose genetic diversity over time, which could threaten their persistence, but dwarf shrew populations are not well-understood enough to identify if and where this may be a problem.

Stochastic Factors

Dwarf shrews seem to be tolerant of a wide variety of ecological conditions (Hoffman and Owen 1980). Heavy snowfalls and very cold temperatures in the spring and early fall may be detrimental to dwarf shrews (Clark and Stromberg 1987), possibly by reducing densities of invertebrate prey as well as directly stressing the shrews themselves. Snowfall in late fall or early winter can be especially detrimental to young dwarf shrews.

Natural Predation

The barn owl (*Tyto alba*) is the only known predator of the dwarf shrew (Martin 1971), although several other vertebrate predators likely take the species (Clark and Stromberg 1987). There is no data indicating predation rates for the dwarf shrew.

WYNDD Extrinsic Threat Rank

The dwarf shrew within Wyoming is probably only slightly threatened by extrinsic threats (Rank = C; Keinath et al. 2003), meaning that threats potentially exist but are not likely to affect population numbers in the state to a great degree. The confidence in this rank is Moderate.

Intrinsic Vulnerability

Habitat Specificity

Despite an apparent preference for subalpine and alpine conditions, dwarf shrews can live in a variety of vegetation communities across a rather broad elevational range (Hoffman and Owen 1980, Clark and Stromberg 1987, Rickart and Heaney 2001). They are known from arid sites and seem to be more tolerant of dry situations than many of their congeners. Rockslides, talus slopes,

and other large exposures of broken rock appear to be important habitat elements (Rickart and Heaney 2001).

Territoriality and Area Requirements

In areas that produce a high biomass of invertebrates and small vertebrates dwarf shrews require small areas, possibly as small as 2 ha, to support viable populations (Stromberg 1983). Habitat extent is likely not constraining dwarf shrew populations in Wyoming.

Susceptibility to Disease

Our current knowledge of dwarf shrews does not indicate that disease is a significant problem. This is similar to other life history issues, however, in that more investigation is needed for more confident conclusions.

Dispersal Capability and Site Fidelity

The dwarf shrew does not migrate per se, but probably moves locally in response to food availability. Young probably disperse in late July to early August; although exact dispersal distances are not known, they are likely to be very small.

Reproductive Capacity

Females probably breed only in their second year, producing 1-2 litters of 6-7 young each (Hoffman and Owen 1980, Clark and Stromberg 1987). At lower elevations, breeding may start earlier in the spring and litter size and numbers of litters may be greater (Clark and Stromberg 1987). Dwarf shrews are fairly prolific breeders during their relatively short life spans.

Sensitivity to Disturbance

Some researchers suggest that dwarf shrews are sensitive to habitat disturbances (Hoffman and Owen 1980, Stromberg 1983), but there is very little information regarding this subject.

WYNDD Intrinsic Vulnerability Rank

WYNDD categorizes the intrinsic vulnerability of the dwarf shrew as Unknown (Rank = U; Keinath et al. 2003). Limited data suggests that dwarf shrews exist at generally low densities in patchy populations, and have rather low mobility and dispersal capabilities. This suggests a high intrinsic vulnerability, but more data is needed before a confident rank can be established.

Protected Areas

Several dwarf shrew occurrences in Wyoming are in the Medicine Bow National Forest (one in the Medicine Bow Peak Special Interest Area); two are in the Shoshone National Forest; one is in the Bighorn National Forest; one is in Grand Teton National Park; and four are within Yellowstone National Park.

WYNDD Protected Areas Rank

WYNDD categorizes the current protected status of the dwarf shrew within Wyoming as good (Rank = B; Keinath et al. 2003) as several of the known breeding sites within the state are protected by federal management. The confidence in this rank is Moderate.

Formal Population Viability Analyses (PVAs)

We are not aware of any formal population viability analyses that have been conducted for the dwarf shrew.

Conservation Action

Existing or Future Conservation Plans

Existing Regulatory Mechanisms, Management Plans, and Conservation Strategies

Beyond the broad stipulations of BLM and USFS sensitive species management, and WGF nongame status, we are unaware of any regulatory mechanisms or management plans that directly target the dwarf shrew.

Conservation Elements

Key Elements

This is a difficult topic to address since very little is known about dwarf shrew habitat requirements and life history. Maintaining existing habitat around sites of known occurrence is a general recommendation, but uncertainty over specific habitat requirements makes implementation of this recommendation difficult. At the very least managers should recognize that talus slopes and other exposures of broken rock may be important habitat features for dwarf shrews, and design management actions accordingly. At this point, basic field inventories and studies of habitat use are most needed to inform management and conservation of the dwarf shrew.

Inventory and Monitoring

Field inventories for dwarf shrews should employ pitfall traps, as dwarf shrews can escape both snap- and live-traps. Some experts recommend baiting pitfalls with meat or blood-baits. Pitfall traps should be routinely used in environmental assessments to better assess shrew populations on a regular basis (Stromberg 1983, Foresman 1989). Because some information

suggests that dwarf shrews are more tolerant of arid environments than other shrews, sampling should be extended into drier sites when possible to better understand habitat use.

Information Needs

Very little is known about the dwarf shrew, and therefore almost all field data is of use to resource conservationists and managers. Information on life history, distribution, abundance, habitat use, and demographics is needed throughout the species range, as well as in Wyoming. Regional investigations into the genetic diversity of dwarf shrews may reveal unique intra-species taxa, possibly extending to subspecies. Such information would be important to managers and conservationists interested in maintaining all significant units of biological diversity in western North America.

Tables and Figures

Figure 1: An adult dwarf shrew (*Sorex nanus*). Photograph by Don Pattie.

Figure 2: Known global distribution of the dwarf shrew (*Sorex nanus*) in green, and the Inyo shrew (*S. tenellus*) in purple.

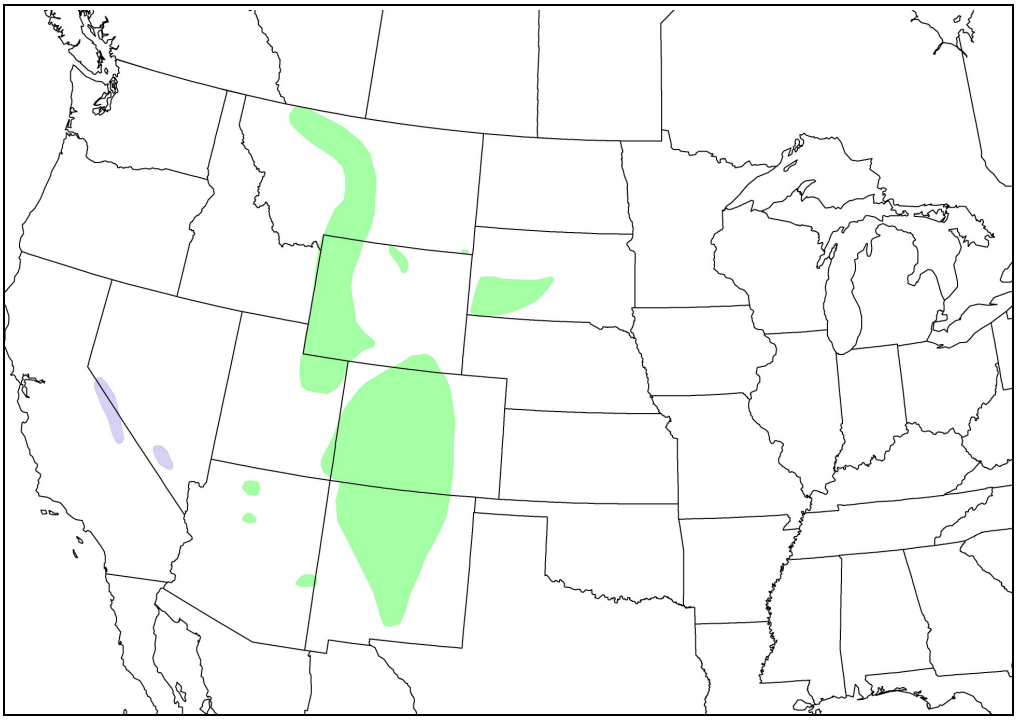
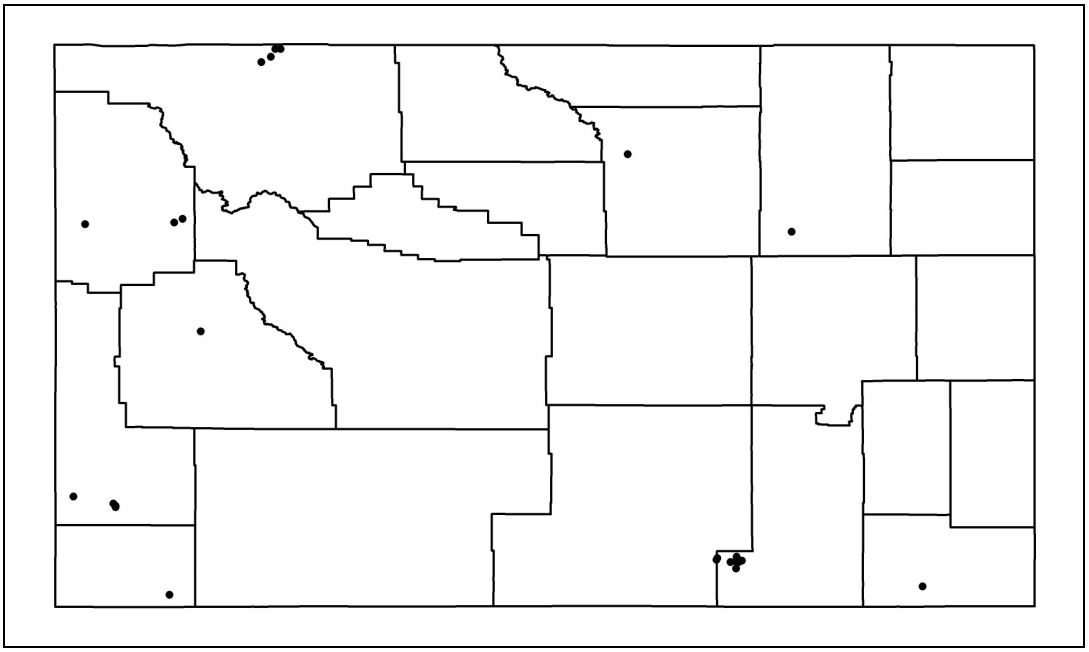


Figure 3: Known Wyoming distribution of the dwarf shrew (*Sorex nanus*) in green. Black dots indicate points where dwarf shrews have been observed in the state. All data on file at the Wyoming Natural Diversity Database, University of Wyoming.



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