IN THE OFFICE OF ENDANGERED SPECIES
U.S. FISH AND WILDLIFE SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

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Black Hills mountainsnail
(*Oreohelix cooperi*)

Biodiversity Conservation Alliance
PO Box 1512
Laramie, WY 82073
(307) 742-7978

Center for Native Ecosystems
PO Box 1365
Paonia, CO 81428
(970) 527-8993

Native Ecosystems Council
PO Box 2003
Rapid City, SD 57709
(605) 348-8404

Prairie Hills Audubon Society
of Western South Dakota
PO Box 792
Rapid City, SD 57709
(605) 787-6466

The Xerces Society
4828 NE Hawthorne
Portland, OR 97215
(503) 534-2706

Jeremy Nichols
PO Box 2137
Laramie, WY 82073

PETITIONERS

Petition for a Rule to list the Black Hills mountainsnail (*Oreohelix cooperi*) as THREATENED or ENDANGERED under the Endangered Species Act 16 USC 1531 et seq. (1973 as amended) and for the designation of Critical Habitat.

Dated: September 24, 2003

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EXECUTIVE SUMMARY

The Black Hills mountainsnail is a rare and critically imperiled land snail species that is endemic to the forests of the Black Hills (i.e., only known to exist in the Black Hills). The Black Hills are an isolated mountain range located in western South Dakota and northeastern Wyoming and are nearly two million acres in size. Described as an "island in a sea of plains," the Black Hills ecosystem supports a host of animal species, such as the Black Hills mountainsnail, that exist nowhere else in the world.

Native to undisturbed forest and riparian habitats primarily in the northern Black Hills, the Black Hills mountainsnail is most often associated with springs, mature (i.e., old growth) forest, and plant communities that are associated with moist areas. The snail also requires soils with high calcium levels for shell growth and maintenance and is associated with limestone and dolomite substrates in the Black Hills. The species is extremely sensitive to habitat destruction and degradation and is vulnerable to the effects of desiccation, or the loss of life sustaining moisture. Because of this and because the snail moves relatively slowly, recovery after the effects of natural and human-caused disturbances is slow, if it even happens at all.

The Black Hills mountainsnail is an integral part of the Black Hills ecosystem and is considered an excellent indicator of ecosystem health. Because of its presence in high quality and undisturbed forest and riparian habitats, its slow movement, and its vulnerability to disturbances and/or anthropogenic habitat destruction and degradation, the species is sensitive to and responds quickly to the effects of ecological change. The status of the species therefore provides a window into the overall health of the Black Hills ecosystem, an invaluable relationship that provides innumerable social and environmental benefits.

While the species is now considered rare, the snail was once more widespread and abundant in the Black Hills. Extensive habitat destruction and degradation is believed to have caused the snail's decline and endangerment. Today, the snail is found only in areas that have remained relatively undisturbed. Most of these areas have remained undisturbed (and therefore viable as habitat for the mountainsnail) because of happenstance, not because of a conscious effort to protect the species. Conservation concern over the Black Hills mountainsnail arose in the early 1990's when the species was being considered for listing under the Endangered Species Act. Because of the species' rare status, extensive habitat destruction and degradation throughout the Black Hills, and other factors threatening the species, leading experts recommended that the species be listed under the Endangered Species Act in 1993. However, no action has been taken by the U.S. Fish and Wildlife Service to list the species or to address the threats to this unique snail. Since then, the status of the species has continued to deteriorate with inadequate or no action from state, federal, and local agencies. Population declines have continued, habitat destruction and degradation has continued, and the species is reported to be edging closer toward extinction. Now, more than ever, the Black Hills mountainsnail is in need of Endangered Species Act protection.

The Black Hills mountainsnail meets several criteria for listing under the Endangered Species Act:

- **The present or threatened destruction, modification, or curtailment of habitat or range**

The Black Hills ecosystem has experienced extensive habitat loss and degradation over the last century, leading to a substantial curtailment of range and habitat. Continued habitat destruction and degradation due to domestic livestock grazing, logging, road construction, pesticide and herbicide application, mining, spring development, groundwater extraction, and recreational activities threatens to further destroy, modify, and/or curtail the habitat and range of the species.

- **Overutilization for commercial, recreational, scientific, or educational purposes**

There is no indication that collecting poses any threat to the survival of the Black Hills mountainsnail.

- **Disease or predation**

The Black Hills mountainsnail is preyed upon by rodents, other small mammals, amphibians, reptiles, birds, insects, and insect larvae. The species may also be parasitized by insect larvae. Because colonies of Black Hills mountainsnail have been reduced in size and extent and have become isolated due in part to habitat destruction and degradation, disease and predation may now pose a much greater risk to the survival of the species.

- **The inadequacy of existing regulatory mechanisms**

The Black Hills mountainsnail and its habitat receives no protection on private lands and state and city laws are entirely inadequate to protect the snail and its habitat. Federal agencies have further failed to provide adequate protection to the Black Hills mountainsnail and its habitat on their lands and are doing nothing to recover the species and its habitat. Most egregiously, is that the United States Forest Service, which is charged with managing the majority of Black Hills mountainsnail colonies, has failed to emplace measures that effectively and assuredly protect and recover the species and its habitat despite years of concern over the status of the snail.

- **Other natural or manmade factors affecting its continued existence**

Colonies of Black Hills mountainsnail have been reduced in size and extent and have become isolated due in part to habitat destruction and degradation, making the species more susceptible to extinction. Habitat fragmentation also poses significant threats to the species, making recovery of the species and its habitat difficult – if not impossible – in some instances. Floods and other natural stochastic events also pose risks to the species. Naturally occurring and human-caused fires also threaten the species and may pose greater risks as a result of extensive logging and thinning in the Black Hills. Climate change also threatens the Black Hills mountainsnail and its habitat.

Protecting the Black Hills mountainsnail under the Endangered Species Act will lead to many benefits. Most notably, protection under the Endangered Species Act will ensure the species and its habitat will receive adequate protection from the threat of continued habitat destruction and degradation. And, because there is a direct link between healthy populations of the species and a healthy ecosystem, protection of the Black Hills mountainsnail will ultimately lead to increased protection for the Black Hills ecosystem. This has the potential to not only bring increased protection for the snail and its habitat, but increased protection for several other imperiled species that also depend upon a healthy Black Hills ecosystem for their continued survival. Finally, protection of the Black Hills ecosystem now will also help to secure a foundation for future and possibly more widespread ecosystem protection and restoration in the Black Hills.

I. INTRODUCTION

Pursuant to the Endangered Species Act ("ESA"), 16 USC § 1531 et seq. and regulations promulgated thereunder, the Administrative Procedures Act, 5 USC § 553(e), and the First Amendment to the Constitution of the United States, Biodiversity Conservation Alliance, Center for Native Ecosystems, Native Ecosystems Council, Prairie Hills Audubon Society, The Xerces Society, and Jeremy Nichols hereby petition for a rule to list the Black Hills mountainsnail (*Oreohelix cooperi*) as threatened or endangered under the ESA. Pursuant to 16 USC § 1631 et seq., 5 USC § 553(e), and 50 CFR § 424.14 (1990), petitioners further request that Critical Habitat be designated for the species concurrent with the listing as required by 16 USC § 1533(b)(6)(C) and 50 CFR § 424.12.

Petitioners understand this petition action sets in motion a specific process placing definite response requirements on the U.S. Fish and Wildlife Service ("USFWS") and specific time constraints upon those responses. See 16 USC § 1533(b).

II. PETITIONERS

Biodiversity Conservation Alliance is a Laramie, Wyoming-based nonprofit conservation organization dedicated to protecting and restoring native species of plants and animals throughout the Rocky Mountain Region, including the Black Hills of South Dakota and Wyoming. Using outreach, education, science, comments, administrative appeals, and litigation, Biodiversity Conservation Alliance works to protect and restore biodiversity, prevent the loss of native species and their habitat, and raise the threshold of public knowledge and appreciation of biodiversity and ecological health.

Center for Native Ecosystems is a Paonia, Colorado-based non-profit, science-based conservation organization dedicated to protecting and recovering native and naturally functioning ecosystems in the Greater Southern Rockies, Great Plains, Black Hills, and elsewhere. Using the best available science, Center for Native Ecosystems participates in policy and administrative processes, legal actions, and public outreach and education programs to protect and restore imperiled native plants and animals.

Native Ecosystems Council is a Rapid City, South Dakota-based, unincorporated, non-profit, science-based conservation organization dedicated to protecting and restoring the health of the Black Hills ecosystem. Members and supporters of Native Ecosystems Council use and enjoy the Black Hills for wildlife viewing, recreation, and scientific study.

Prairie Hills Audubon Society of Western South Dakota is a South Dakota-based, nonprofit organization with almost 200 members in the Black Hills region. Members of Prairie Hills Audubon Society use and enjoy the Black Hills for, among other things, wildlife viewing and have been involved with efforts to protect and restore wildlife on the Black Hills for many years.

The Xerces Society is an international nonprofit organization dedicated to preserving the diversity of life through the conservation of invertebrates. The Society works with scientists, land managers, and citizens to protect invertebrates and their habitats by producing information materials, presenting educational activities, implementing conservation projects, and advocacy.

Jeremy Nichols is a Laramie, Wyoming resident who has worked to protect and restore biodiversity in the Black Hills for several years. Mr. Nichols and his family use and enjoy areas like the Black Hills primarily for viewing wildlife, fishing, hiking, and camping.

III. AN INTRODUCTION TO LAND SNAIL ECOLOGY IN WESTERN NORTH AMERICA

An understanding of the Black Hills mountainsnail and its status is not complete without a discussion of general land snail ecology in western North America.[1] The Black Hills mountainsnail species shares similarities with other land snail species of western North America in terms of its ecological niche. Further, the conditions that support Black Hills mountainsnail, as well as other land snail species in the west, are typically representative of a healthy ecosystem. Thus, an understanding of general land snail ecology in western North America helps to better understand the conditions that most favor the Black Hills mountainsnail as well as overall ecosystem health.

Cover, effective moisture availability, and geologic history are reported to be significant factors in determining where land snails are located (Frest and Johannes 1995a). Most land snail species, including the Black Hills mountainsnail, are calciphiles, which means species are usually restricted to limestone, dolomite, or other substrates containing high levels of the element calcium (Frest and Johannes 1995a, 2002). Moist edaphic (or soil) conditions are also favored by land snails and soil pH may also be a factor in determining suitable land snail habitat (Frest and Johannes 1995a). Indeed, desiccation is the primary factor in land snail mortality (Solem 1974, 1984, Frest and Johannes 1995a). Frest and Johannes (1995a) report, "…moist forests, slope bases, north slopes, springs and seeps, edges of floodplains, and rock taluses are areas of [land snail] concentration" (p. 22). Areas with vegetative or other forms of cover (e.g., rock overhangs, caves, etc.) that provide shade are also usually preferred by land snails (Frest and Johannes 1995a, b, 2002). Abundant down woody debris is also very important (Frest and Johannes 1995a). Well-vegetated locales with high vegetative diversity are typically preferred by land snails, including the Black Hills mountainsnail (Frest and Johannes 1995a, 2002). According to Frest and Johannes (1995a), "…land snails…require relatively undisturbed vegetational cover appropriate to the habitat involved, which may range from closed canopy forest to sage scrub or open, rocky talus" (p. 22).

[1] North America is generally split into eastern and western "Divisions" by those studying mollusks because of differences in mollusk fauna (Frest and Johannes 1995a). In this case, western North America refers to the western "Division," which extends from the west coast of North America eastward to the Rocky Mountains.

Most land snails avoid areas with strong insolation or exposure, often ceasing activity during dry or exceptionally hot or cold conditions (Frest and Johannes 1995a).

Viable land snail colonies may occupy small areas and may support only a few thousand individuals (Frest and Johannes 1995a). Frest and Johannes (1995a) report, "While the size of long-term viable populations is still somewhat a matter of dispute, examples are known of survival with as few as 1,500 adults in a colony (Frest 1984)" (p. 22). The two caution though, "…somewhat larger buffers are evidently necessary to maintain such small sites in the long run" (p. 22). Land snail colonies are considered to be long-term, with some colonies reported to be in existence for at least 10,000 years (Frest and Johannes 1995a).

Western land snails, such as the Black Hills mountainsnail, are typically herbivores, but some may consume animal matter. Frest and Johannes (1995a) report, "Land snails contribute substantially to nutrient recycling and breakdown of plant detritus and animal waste" (p. 24). Land snails are considered primary higher and lower plant and animal waste recyclers wherever they exist (Frest and Johannes 1995a). Land snails are in turn preyed upon extensively by small mammals, reptiles, amphibians, birds, and insects (Frest and Johannes 1995a, 2002, Hall et al. 2002).

Migration of land snails is generally slow (Frest and Johannes 1995a). Passive and active dispersal are reported to be factors in land snail migration (Frest and Johannes 1995a). Frest and Johannes (1995a) report:

> Most typically, spread occurs the hard way, by crawling; and land snails may typically journey only as far as a 20' radius from their place of birth in a lifetime. Passive transport by stream or flooding, by animals, wind, etc. has been observed; but how typical and successful such events are in establishing long-term range changes needs more study. (p. 26)

Land snails are "exceptional indicators" of ecosystem health (Frest 2002a, p. 48), and are an "especially practical group for use in assessing the general health of the terrestrial…ecosystem" (Frest and Johannes 1995a, p. 35). Land snails are present in many environments, have specialized habitat needs, and are essentially sessile. Land snails also typically respond quickly and are more vulnerable to disturbances and/or anthropogenic habitat change (Frest and Johannes 1995a, Frest 2002a). The status of land snail populations therefore provides a window into the overall health of an ecosystem, an invaluable relationship that provides innumerable social and environmental benefits. For instance, an understanding of the health of land snail populations can aid in understanding overall ecosystem health, in assessing ecosystem restoration projects, in assessing the status and health of other species, and in measuring the effects of land management activities. Furthermore, because there is a direct link between healthy land snail populations and a healthy ecosystem, protection of land snails ultimately protects the ecosystems upon which they depend.

IV. THE GENUS *OREOHELIX*, THE "MOUNTAIN SNAIL," IN WESTERN NORTH AMERICA AND THE BLACK HILLS

The genus *Oreohelix*, commonly called the "Mountain Snail," is endemic to western North America (Pilsbry 1939). Its distribution ranges from southwestern Canada, including southern Saskatchewan and British Columbia, to western Chihuahua in northern Mexico (Pilsbry 1939). The genus' easternmost distribution extends into the Black Hills of South Dakota (Pilsbry 1939, Frest and Johannes 2002). In terms of the biogeographical distribution of land snails, North America is generally split into Eastern and Western American "Divisions" (Pilsbry 1948), while each division is further divided into land snail provinces (Pilsbry 1948, Frest and Johannes 2002). The biogeographical distribution of the mountainsnail includes the Rocky Mountain, Washingtonian, and Southwestern Provinces of the western Division of North America (Frest and Johannes 1995a, 1997, 2002). The Black Hills are within the Rocky Mountain Province of the Western American Division, of which the mountainsnails are a characteristic element (Frest and Rhodes 1981, Frest and Johannes 2002).

Mountainsnail species and subspecies vary in size, height of shell spire, degree of carination, width of umbilicus, and in color (Pilsbry 1939). The level of endemism among mountainsnail species and subspecies is also notable and is believed to be associated with unique geology, soils, and vegetation (Frest and Johannes 1995b). Areas of high mountainsnail endemism include the Hells Canyon area of Oregon, Idaho, and Washington, the lower Salmon River drainage of Idaho, the Wasatch Range in Utah, and in northwestern portions of Montana (Frest and Johannes 1997). Isolated geographic localities, such as "island" mountain ranges, also appear to support endemic species of mountainsnails (Frest and Johannes 1993a, 2002, Hendricks 2003). The Black Hills of South Dakota and Wyoming, which are described as an "island in the plains" (Raventon 1994), support three endemic mountainsnail species – the Black Hills mountainsnail (*Oreohelix cooperi*), the Pahasapa mountainsnail (*Oreohelix* new species 1), and the Bear Lodge mountainsnail (*Oreohelix* new species 2) (Frest and Johannes 2002). The Pahasapa mountainsnail and the Bear Lodge mountainsnail are currently being described, meaning they are being subjected to peer review and other tests to prove they are distinct species (Black 2003). There is no reported disagreement with the proposed species designations and in all likelihood the Pahasapa and Bear Lodge mountainsnails will soon be widely recognized as distinct species (Frest 1997, 2003). The Black Hills mountainsnail is already recognized as a distinct species (Binney 1859, Pilsbry 1916, Frest and Johannes 2002)

V. THE BLACK HILLS MOUNTAINSNAIL (*Oreohelix cooperi*)

A. An Introduction

Commonly called the Black Hills mountainsnail or Cooper's rocky mountainsnail, the species *Oreohelix cooperi* (Binney 1859) is endemic to the Black Hills of western South Dakota and northeastern Wyoming (Frest and Johannes 1991, 1993a, 2002). See, Figure 1. While the snail is currently considered rare in the Black Hills, there is evidence that the species was once more common (Frest and Johannes 1993a). The Black Hills mountainsnail has been the subject of conservation concern for several years. In 1991, the species was designated a category 2 Candidate species and in 1994, the USFWS reiterated this status (USFWS 1991, 1994). A category 2 Candidate species was defined as a species:

> for which information now in the possession of the [U.S. Fish and Wildlife] Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which persuasive data on biological vulnerability and threat are not currently available to support proposed rules. (59 Fed. Reg. 58982)

Prior to and as a result of the species' Candidate status, survey efforts were undertaken in 1991 and 1992 to better understand the status of the species and its threats. Based on surveys, in 1993 it was recommended the species be listed under the ESA (Frest and Johannes 1993a). Additional survey efforts later in the 1990s also revealed increased threats to the species and reiterated the need for immediate and strong conservation action (Frest and Johannes 2002).

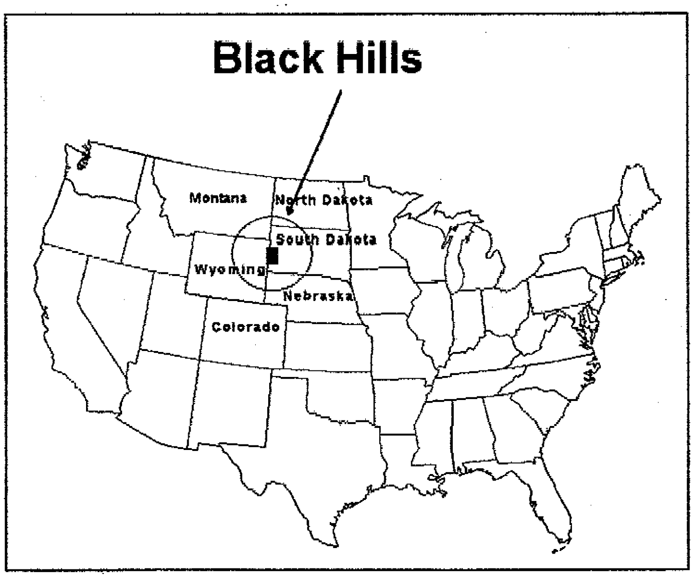

Figure 1. Location of Black Hills.

Unfortunately, despite strong recommendations for conservation action, the existence of numerous threats to the species, and significant habitat destruction and degradation, little to no action has been taken to conserve the Black Hills mountainsnail. In 1996, the species was dropped as a Candidate species due to the elimination of the category 2 Candidate designation (USFWS 1996). Since then, no further action has been taken by the USFWS to protect the species under the ESA. Additionally, the U.S. Forest Service ("USFS"), which is responsible for managing most Black Hills mountainsnail colonies and habitat, has failed in many regards to adequately protect the species and prevent its decline toward extinction (see e.g., USFS 1999). The agency has been criticized on more than one occasion for its inadequate management of the Black Hills mountainsnail and its habitat in the Black Hills National Forest ("BHNF") (Frest and Johannes 1993a, 2002, USFS 1999). Current BHNF management direction continues to ignore the biological needs of the species and exacerbate the threats to the snail. On private lands, where many Black Hills mountainsnail colonies exist, no measures whatsoever exist to protect the species and ensure its survival. The species continues to decline toward extinction (Frest and Johannes 2002)

B. History of the Species

Oreohelix cooperi was one of the first land snails in the western United States to be described (Binney 1859, Frest and Johannes 2002). Collections of the species were first taken in the Black Hills of South Dakota where the species was originally described as *Helix cooperi* (Binney 1859, Binney and Bland 1869, Pilsbry 1916). The name *Helix* was eventually changed to *Oreohelix*, with the first catalogue of *Oreohelix* species published in 1916 (Pilsbry 1916, 1939). While the species was based solely on Black Hills specimens, material from other areas of the western United States were originally included as *cooperi* (Binney and Bland 1869), a range that was later found to include many *Oreohelix* species (Frest and Johannes 2002). As more analysis was completed, material outside of the Black Hills was ascribed to other *Oreohelix* species based on anatomical and morphological criteria (Pilsbry 1934, 1939). Much of the material outside of the Black Hills originally described as the *cooperi* taxon was determined to be primarily *Oreohelix subrudis* and *Oreohelix strigosa depressa*, based in part on anatomical distinctions between the male genitalia (Pilsbry 1939). Pilsbry (1939) states, "Dissection of many individuals collected by Dr. H. B. Baker shows that the Black Hills *cooperi* is specifically distinct from the common snail of the Rocky Mountains long passing under that name, and now known as *O. subrudis* (Pfr.)" (p. 444). Analysis has further determined that *Oreohelix subrudis* represents at least three distinguishable taxa (Rees 1988, Rees and Hand 1990, 1991, 1993).

While Pilsbry (1916) originally agreed with Binney's (1859) conclusion that the *cooperi* taxon was best regarded as a distinct species (i.e., *Oreohelix cooperi*), he later ascribed the taxon as a subspecies of

Oreohelix strigosa (i.e., *Oreohelix strigosa cooperi*) (Pilsbry 1934), a move originally proposed by Shimek (1890). However, later studies reveal that the *cooperi* taxon is best regarded as a distinct species (Frest and Johannes 1993a, 2002), as originally documented by Binney (1859), and supported by Binney and Bland (1869) and Pilsbry (1916).

C. Description of the Species

Binney (1859) describes the Black Hills mountainsnail as follows:

> Shell umbilicated, elevated, globose: solid, with oblique incremental stirae intersected with delicate spiral lines; color white, variously marked with a single narrow band, or broader longitudinal and spiral patches of reddish-brown; suture impressed; spire elevated; whorls five, convex, the last rounded, very decidedly deflected at the aperture; umbilicus moderate, pervious, 1/5th the greater diameter of the shell; aperture very oblique, circular; peristome simple, thickened, reflected at the umbilicus, with its extremities very nearly approached and joined by a heavy white callus. Greater diameter 15, lesser 23, height 9 millimeters. (p. 115).

Pilsbry (1939) elaborates:

> The striation is moderately strong and irregular; spiral striation varies from distinct to practically obsolete. The periphery is well rounded, never angular in front. The umbilicus does not vary much from one-fifth of the diameter in the extremes measured. The two principal bands of *Oreohelix* are generally present, but the upper or more rarely both may be wanting. The base usually has few or many bands, or rarely none. There is more or less fleshy mottling in both banded and bandless shells. (p. 443).

Frest and Johannes (2002) also describe the juvenile and adult forms of the species as follows:

> Juveniles of this comparatively thick-shelled subspecies (sic) generally hatch at 2-2 ¼ whorls. They are even brown, moderately convex above, and have a weakly pronounced keel. Most range between 3.5 to 4.0 mm in diameter. For the first two whorls, the ornament consists of fine but distinct and regular subequal spiral ribs and transverse ribs, with rib width being generally equal to interspace width. In the last quarter to one-half whorl, several larger low transverse riblets (lirae) appear, usually three on the upper surface and six on the lower. Intersections of lirae and radial ribs are accentuated by low, triangular perostracal hairs. These are the most prominent on the keel, and continue until the 3-3 ½ whorl stage is reached. Transverse striation on the adults is usually noticeable, but patchy. Radial striation is most distinct on adults (i.e., specimens with more than 3 to 5 ¾ whorls). As is typical of *Oreohelix*, the striation (actually accentuated growth lines as much as ornament; hence the irregularity) is the most strong on the upper half whorl, and somewhat subdued below. Accurate counts are difficult because of unequal and irregular development, but 4 per mm on the last half whorl of adult specimens is typical. Most adults have 5-5 ¾ whorls. (p. 85)

The Black Hills mountainsnail is the largest mountainsnail species in the Black Hills, one characteristic that distinguishes the species from the Pahasapa mountainsnail (*Oreohelix* new species 1) (Frest and Johannes 2002). See, Figure 2.

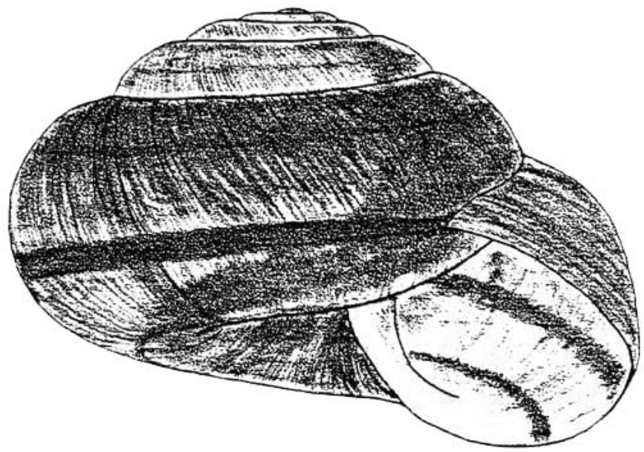

Figure 2. Black Hills mountainsnail (*Oreohelix cooperi*), x8 (Frest and Johannes 1993a).

D. Systematics

1. Introduction

The *cooperi* taxon was originally described as a full species, *Oreohelix cooperi* (Binney 1859), but later assigned to the subspecies *Oreohelix strigosa cooperi* (Shimek 1890). However, *cooperi* appears to have been incorrectly assigned as a subspecies of *Oreohelix strigosa* (Frest 1997, Frest and Johannes 2002), and is more appropriately recognized as a distinct species. Furthermore, the *cooperi* taxon is morphologically and/or anatomically distinct from other related *Oreohelix* forms, a factor that further supports recognition as a full species (Frest and Johannes 2002).

2. Problems with subspecies assignment

While Frest and Johannes (2002) cite Pilsbry's (1939) motivation "to retain traditional usage as much as possible" as one reason for regarding *cooperi* as a subspecies, the two have also found the type *strigosa* species, or the form that was the basis for all subspecies assignments, is invalid. Frest and Johannes (2002) state:

> Assignment of this taxon to *Oreohelix strigosa* as a subspecies was dependent upon the identity of the nominate subspecies, also the type species of the genus. The Washington types were from a vague locality, and several malacologists made considerable efforts to fix the type locality and collect live topotypes. Pilsbry (1939) accepted the conclusion of Smith (1937) that the type locality was near the Columbia River, probably at the mouth of the Entiat River. We have

> collected this area extensively, and found *Oreohelix* at perhaps 20 sites. We have also looked at material from many other nearby sites collected by USDA Forest Service personnel, especially that in the hands of Tom Burke (Wenatchee National Forest). The forms in this area are not closely related to other forms considered by Pilsbry (1939) to be true *strigosa*, including specimens from around the Spokane area (which, incidentally, do resemble South Dakota specimens somewhat in shell and soft part morphology but are definitely another taxon). It is obvious from Pilsbry (1939) that he considered the Spokane area specimens as typical *strigosa*, and that he thought the forms resembling this occurred at Entiat. This does not appear to be the case. The Entiat material is more closely related to *Oreohelix junii* Pilsbry 1934 (Grand Coulee, Washington type locality) and to *Oreohelix jugalis* (Hemphill, 1890: type locality: lower Salmon River, Idaho). The Gould type specimen of *Oreohelix strigosa strigosa* still survives (NMMH 5411): our examination indicates shell morphology identical to some Entiat "*junii*" specimens. Thus, *cooperi* is in our opinion incorrectly assigned to *Oreohelix strigosa*. (p. 84).

In a 1997 letter, Frest also explained:

> The problem lies with strigosa itself. There is such an entity: but the usage of the nominate form in the literature may be wrong. Gould based his species on specimens from the type locality, which is near the Entiat River in Washington, on the western periphery of the genus' range. Pilsbry (1939) used material from around Spokane WA (quite some distance away) as if it were typical *strigosa*. he (sic) also described a new species, *junii*, from Washington, including sites close to the Entiat type locality for *strigosa*. We in the last 10 years have extensively collected parts of WA for *Oreohelix* and are the first to get live, dissectable material from near Entiat in some years. We compared this to the shell holotype of Gould and topotypes of ***junii***. This indicates that the Entiat snail is in fact the same as *junii* (with type locality in the Grand Coulee area, WA) and that this snail is not the same species as that occurring around Spokane. This means that the *strigosa* subspecies will have to be assigned elsewhere.

Other experts have similarly questioned the validity of the type species of *strigosa*, specifically in relation to *Oreohelix* in the State of Idaho (Frest and Johannes 2002). Thus, *cooperi* cannot be assigned as a subspecies of *Oreohelix strigosa* because the type *strigosa* species does not appear to be valid (i.e., a distinct species) (Frest and Johannes 2002).

3. Distinctiveness of the *cooperi* taxon

Although the best scientific information strongly indicates the *cooperi* taxon cannot be assigned as a subspecies of *Oreohelix strigosa*, the taxon is also distinct from related *Oreohelix* forms (Pilsbry 1939, Frest and Johannes 1993a, 2002), further supporting Binney's (1859) original findings and Frest and Johannes' (1995a, 1997, 2002) later findings. Recognition of the *cooperi* taxon as a distinct species, rather than a subspecies of *Oreohelix strigosa*, even appears to have been foreseen by early researchers. As Pilsbry (1916) stated, "It seems likely that some forms now considered subspecies of *O. strigosa* will be elevated to specific rank when their areas are well explored, and their soft anatomy worked out" (p. 356).

a. The *cooperi* taxon is distinct from *Oreohelix subrudis*

Pilsbry (1939) distinguished the *cooperi* taxon from *Oreohelix subrudis*, which had both previously been considered the same taxon (Frest and Johannes 2002), stating:

> By the shell alone I cannot distinguish topotypic *cooperi* from some lots of *O. subrudis*. Fortunately, it is very easy to open the penis and note the diagnostic difference, the internally ribbed part occupying decidedly less than half the length in *cooperi*, half or more than half in *O. subrudis*. (p. 444)

Frest and Johannes (2002) also state, "Some dwarfed populations of *subrudis* can be very similar in shell shape to *Oreohelix cooperi*; but the radial ribbing, umbilical proportions, and male anatomy, as noted by Pilsbry (1939), are quite distinct."

b. The *cooperi* taxon is distinct from *Oreohelix strigosa depressa*

Pilsbry (1939) distinguished the *cooperi* taxon from *Oreohelix strigosa depressa*, which also had both previously been considered the same taxon, stating:

> *O. s. cooperi*, which is anatomically like *depressa*, differs by its higher shape and smaller umbilicus, and it seems to be separated geographically, being mainly well east of the Rocky Mountain system. (p. 432)

c. The *cooperi* taxon is distinct from *Oreohelix* new species 2

The *cooperi* taxon is distinguished morphologically from the Bear Lodge mountainsnail *Oreohelix* new species 2, a Black Hills *Oreohelix* form that is closely related (Frest and Johannes 1993a, 2002). *Oreohelix* new species 2 has finer and more regular radial ribs that continue across the whole whorl and is smaller, has different banding and color (Frest and Johannes 2002). Frest and Johannes (2002) also describe *Oreohelix* new species 2 as having "distinct and regular spiral (transverse) striation that gives the whole shell a weakly beaded appearance under the microscope" and a "narrow, well-like umbilicus" (Frest and Johannes 2002, p. 86, 100). Frest and Johannes (2002) also state:

> …the distinct and subregular fine radial ribs and persistent even finer lirae (which intersect to give the adult shell a finely beaded appearance) are also distinctive of *Oreohelix* n. sp. 2. None of these features are shown by our large collections of *Oreohelix cooperi* and *Oreohelix* n. sp. 1…therefore …these two taxa are each distinct at least to the subspecific level. (p. 100)

d. The *cooperi* taxon is distinct from *Oreohelix* new species 1

The *cooperi* taxon is also distinguished morphologically from *Oreohelix* new species 1, another Black Hills *Oreohelix* form that is closely related (Frest and Johannes 1991, 1993a, 2002). Previously, *Oreohelix* new species 1 was considered to be a smaller form of the *cooperi* taxon (Pilsbry 1939, Frest and Johannes 1991, 1993a), although the size difference between the two species, lack of co-occurrence between the two species, differences in shell morphology, and differences in habitat preferences suggests two separate taxa (Frest and Johannes 2002). Frest and Johannes (2002) state, "Our Black Hills *Oreohelix* fall into two distinct forms that were clearly distinguishable by size in the field….We found the size of groups to be statistically significantly different at a high level of probability (Frest and Johannes 1991); this has held despite collection of much new material over the entire range of both forms" (p. 86). While Frest and Johannes (2002) remain "cautious" in recognizing *Oreohelix* taxa based on size, they also state:

> This is the only case in *Oreohelix* that we have investigated so far that has withstood more than casual scrutiny; usually, intermediate-sized populations were readily found when sought. However, we have now collected most possible sites and have abundant material from some: the differences cited by Frest and Johannes (1991) have remained salient. (p. 87)

Other morphological features distinguish the *cooperi* taxon from *Oreohelix* new species 1 (Frest and Johannes 1991, 1993a, 2002). Frest and Johannes (2002) state:

> The smaller form [*Oreohelix* n. sp. 1] is most often mature at 5 whorls (5 ½ is average for *Oreohelix strigosa cooperi*); many colonies of this form have little or no spiral striation on adults, while most *Oreohelix cooperi* are quite distinctly, though patchily, spirally striate. The large form (*cooperi*) is quite often less distinctly banded: and the smaller form (n. sp. 1) is much less likely to have the small, flesh-colored patches that are typical of most *cooperi* specimens. (p. 87)
>
> Frest and Johannes (2002) finally state, "It may be of some importance that the two groups appear to show some degree of geographic separation" (p. 87). According to Frest (1997, 2003), there is no current disagreement over recognizing *O.* n. sp. 1 as a distinct form and it is highly likely that *O.* n. sp. 1 will be recognized as a distinct species in the near future.

e. The *cooperi* form is distinct from other closely related *Oreohelix* forms

Based on shell characteristics, the *cooperi* taxon has also been distinguished from other closely related *Oreohelix* forms. Frest and Johannes (2002) state:

> *Oreohelix variabilis* Henderson, 1929 has a different shape and color pattern; and the radial ribs in that taxon and an undescribed related form from Oregon (see Frest and Johannes 1995a) are stronger, more irregular, and more widely spaced. We have examined the types and recollected *variabilis* extensively in Oregon (1987-2000). The radial ribs of *Oreohelix peripherica* (Ancey, 1881) are more regular and more prominent; also, this species (actually species complex) has juvenile sculpture suggesting only distant relationship to the *strigosa* complex. We examined the types of *peripherica* in 1991 and collected new material in Utah in 1990. (85-86).

The *cooperi* taxon also differs from Berry's mountainsnail (*Oreohelix strigosa berryi*) in that *berryi* has finer and more regular radial ribs that "continue with equal strength across the whole whorl" (Frest and Johannes 2002, p. 86), is smaller, and has different banding and color (Frest and Johannes 1993a, 2002). Frest and Johannes (1997) also discovered an undescribed member of the *strigosa* complex in western Idaho that is somewhat similar to *Oreohelix peripherica* and the *cooperi* taxon, although Frest and Johannes (2002) state, "…the Idaho taxon is very likely an independently-evolved convergent form, imperfectly homeomorphic with *cooperi*" (p. 86). Based on morphological comparisons in earlier works (e.g., Binney 1859, 1869, Pilsbry 1916, 1934, 1939), and more recent works (e.g., Frest and Johannes 1993a), Frest and Johannes (2002) believe there is "ample warrant for regarding it [the *cooperi* taxon] either as a subspecies or full species" (p. 87).

4. Genetics

Anderson (2002) suggests that the *cooperi* taxon is not morphologically distinguishable from other Black Hills *Oreohelix* species based on genetic analysis. However, her "preliminary" report does not discuss or address the validity of comparisons put forth by Frest and Johannes (1991, 1993a, 2002) and earlier works (e.g., Pilsbry 1939) that support distinguishing *cooperi* from other Black Hills forms based on several morphological distinctions. Furthermore, graduate student Kathleen Sims, who completed the genetic analysis referred to by Anderson (2002), also indicated the genetic results must be interpreted with extreme caution. She indicated that the sample size of her analysis was extremely small (only 10 snails) and that the sites where the speciments were collected were unknown to her, raising questions over whether her sample composition adequately represented the Black Hills *Oreohelix* forms at question (Sims 2003).

Anderson (2002) also cautions in her report:

> At this point, these [genetic] results must be interpreted with extreme caution, for the following reason. Different sections of the DNA may evolve at different rates, so when all samples are the same, it may be that the evolutionary rate for that section of DNA may not be fast enough to show differences among the individuals being compared. Additional sections of DNA that have a faster evolutionary rate must be examined in order to determine the relationships among the groups. (p. 5)

Indeed, Sims' analysis consisted of sequencing only the "CO1 (cytochrome oxydase one) region of the mitochondria" (Anderson 2002, Sims 2003), a methodology that malacologists have found not to be entirely accurate or reliable (Lydeard et al. 2002, Frest 2003b). As Frest (2003b) states:

> The MtCOI Folmer fragment has sometimes been useful in mollusks but sometimes has produced anomalous results. Part of the reason is that this gene is unusually short in mollusks (1/3 the length in vertebrates, for example), and also has some weird structural modifications in mollusks, the significance of which is not yet clear. Many times the results of MtCOI analysis look good in mollusks; but a certain proportion of studies just turn out goofy. I tend to discount studies based solely upon one-gene analysis and prefer a consensus approach….Part of the problem with mollusks so far is that there is no consensus either as to how much sequence divergence "equals" species. Moreover, there are almost no studies of other *Oreohelix* to compare.

Rees (2003) also stated:

> I'd be a little hesitant to make management decisions based upon information from one gene, especially one that is from the mitochondria. Ideally, one would like genetic data from both mitochondria and nuclear genomes.

Furthermore, there appears to be a general rule that mollusk species should not be defined solely on the basis of molecular evidence (Davis 1994, Davis et al. 1995, Davis et al. 1995, Davis et al. 1998). As Davis (1994) remarked:

> Beware of those who grind-run gels, publish without studying the patterns and processes of morphological diversification, life history diversification and ecological diversification throughout the clade of concern and in sister clades. There is so much more involved in understanding species differentiation than examining a genetic distance and extrapolating taxonomic rank…It is clear that a single measure of genetic distance cannot be used to discriminate among taxa. (pp. 5, 20)

Rees (2003) also stated:

> …morphology can frequently give information as good as DNA sequences, and it's a whole lot less expensive to measure. With the two species I was working on, the morphology of the reproductive tract, esp. the male genitalia, was concordant with the electrophoresis data. It is true that there was some overlap between species, and morphology was not strictly diagnostic, but if you find differences here, then you might really have three distinct groups [in the Black Hills].

The best available science therefore indicates that, while the preliminary findings of Anderson (2002) may be insightful, they are inconclusive at best. Given the findings of others (e.g., Binney 1859, Pilsbry 1916, 1939, Frest and Johannes 1993a, 2002), there is ample evidence for regarding *cooperi* as a distinct taxon and, more appropriately, as a distinct species (Frest and Johannes 2002).

E. Habitat

In describing the habitat of the Black Hills mountainsnail, Frest and Johannes (2002) state:

> All sites are on calcareous soils; in most cases, this means restricted to soils developed on the Pahasapa Limestone; but in some parts of lower Spearfish Canyon, the Orodivician Whitewood Formation serves equally well. Most localities are lowland wooded areas and talus slopes, generally but not always with northern or eastern exposure. Many colonies, including most of the largest, are developed in forests in the *Pinus ponderosa* [ponderosa pine] community series. Most frequently, these are partially closed-canopy forests with a common secondary deciduous tree component (including *Alnus* [alder], *Acer* [box elder], and *Betula* [birch]). Quite frequently, the understory is diverse (common plant associates include *Aralia* spp., *Viola Canadensis*, and *Aconitum* sp.), though often not as much so as at *Oreohelix* n. sp. 1 sites. *Picaea glauca* [white spruce] may be locally common at some sites. Some substantial riparian woodland colonies are also known, often in areas with adjacent steep rocky slope bases. Plants common in such areas may include *Picaea* [spruce], *Pinus* [pine], *Cornus stolonifera* [dogwood], *Equisetum* spp. [horsetail species], *Sambucus pubens* [elderberry], and *Salix* spp. [willow species]. This species often occurs at somewhat drier sites than *Oreohelix* n. sp. 1, i.e. at sites with more insolation, slightly more open canopy, and less litter. (p. 88)

Intact and undisturbed riparian areas are very important to the Black Hills mountainsnail (Frest and Johannes 1993a, 2002). Many Black Hills mountainsnail colonies are also associated with springs (Frest and Johannes 2002). Upland sites with "mature" forest plant communities are also reported to be important for the Black Hills mountainsnail (Frest and Johannes 2002). Abundant coarse woody debris is usually an important component of Black Hills mountainsnail habitat, often serving as a refuge for snails in areas where extensive habitat degradation has occurred or is occurring (Harmon et al. 1986, Olson 1992, Frest and Johannes 2002).

F. Biology and Ecology

The Black Hills mountainsnail feeds primarily on decayed deciduous tree leaves and other degraded herbaceous vegetation. The species has been observed to crawl on downed wood, tree trunks, and limestone talus blocks (Frest and Johannes 2002), although the species is not physically capable of moving beyond suitable habitat due to the threat of desiccation and predation, and because of the species' forage needs. (Frest and Johannes 1995a, 1997, 2002). It is thought that it takes up to two years for the Black Hills mountainsnail to mature and that they may live anywhere from 2-6 years (Frest and Johannes 1991, 2002). The species breeds at least once during a lifetime and usually breeds only once a year, depending on environmental conditions (e.g., moisture, temperature). *Oreohelix* species do not lay eggs, but rather the young hatch internally within adult snails (Frest and Johannes 2002).

The Black Hills mountainsnail may co-occur with other rare land snail species including the callused vertigo (*Vertigo arthuri*) and Cockerell's striate disk (*Discus shimeki*), both of which are identified as species of concern on the Black Hills (Frest and Johannes 1993a, 2002). The Black Hills mountainsnail is also reported to co-occur with several plant species that are considered rare and/or disjunct in the Black Hills.

The Black Hills mountainsnail is extremely sensitive to environmental change (Frest and Johannes 2002). Indeed, no colonies have been observed in heavily grazed or logged areas (Frest and Johannes 1993a, 2002). Road construction, domestic livestock grazing, logging, and forest fires have all adversely affected colonies in the Black Hills (Frest and Johannes 1991, 1993a, 2002). The species is preyed upon by rodents, other small mammals, amphibians, reptiles, birds, insects, and insect larvae (Frest and Johannes 2002, Hall et al. 2002). The Black Hills mountainsnail may be preyed upon by the endemic Black Hills red-bellied snake (*Storeria occipitomeoculata pahasapae*) (Hall et al. 2002), a former category 2 Candidate subspecies and a subspecies of concern in the Black Hills (USFWS 1994, USFS 1996a). Parasitism by insect larvae may also cause mortality of *O. cooperi* (Pilsbry 1939, Frest and Johannes 2002).

G. Species' Status

The Black Hills mountainsnail is endemic to the Black Hills of western South Dakota and northeastern Wyoming (Frest and Johannes 1993a, 2002). Earlier reports of the species in Idaho, Oregon, Utah, Washington, Arizona, New Mexico, Wyoming, Colorado, and Alberta, Canada have been discounted (Pilsbry 1939, Solem 1975, Beetle 1988, Brandauer 1988, Frest 1997a, Frest and Johannes 1993a, 2002).

1. Population status

While the Black Hills mountainsnail is rare in the Black Hills, it is believed the species was once more common and widespread (Frest and Johannes 1993a, 2002). Indeed, the species' range and habitat have undergone significant declines in the past century (Frest and Johannes 2002). Through extensive surveys, Frest and Johannes (2002) identified the Black Hills mountainsnail at 39 sites in the Black Hills in the states of South Dakota and Wyoming. Another Black Hills mountainsnail site is historically reported from the Deadwood area (Pilsbry 1939). Of the 39 colonies discovered in surveys by Frest and Johannes (1991, 1993a, 2002), only shells were found at 7 sites, showing that these sites had recently been extirpated. Additionally, the species has not been relocated from the Deadwood area despite survey efforts (Frest and Johannes 2002). Thus, only 32 extant Black Hills mountainsnail colonies are currently known to exist on the Black Hills. This represents at least a 20% reduction in the overall population of the species, although the decline is most likely larger as it is thought many extirpated sites were never identified (Frest and Johannes 2002). Furthermore, of the 32 extant colonies known to exist, the species was found to be rare or uncommon at 18 colonies – 56% of the extant population[2]. The species was

[2] According to Frest and Johannes (2002), "rare would indicate less than 1 individual per m^2; uncommon, about 1-5 per m^2; common ca. 5-10 per m^2; abundant 10-20 or more per m^2; very abundant = or > 20-40 per m^2" (pp. 15-16).

somewhat abundant or moderately common at 5 colonies, 16% of the extant population. The species was considered abundant or common at only 9 sites. See, Table 1. Although the species has been found in other parts of the Black Hills, primarily in the northern portion of the mountains, it is common only in Spearfish Canyon (Frest and Johannes 2002).

Table 1. Status of Black Hills mountainsnail colonies in the Black Hills of South Dakota and Wyoming (Pilsbry 1939, Frest and Johannes 2002).

Total known historic colonies:	**40**
Total extant colonies:	**32**
Rare or Uncommon:	**18 (56%)**
Somewhat abundant or moderately common:	**5 (16%)**
Abundant or common:	**9 (28%)**

2. Habitat status

The habitat of the Black Hills mountainsnail has undergone significant declines over the past century. Most riparian habitat in the Black Hills has been destroyed or seriously degraded, correspondingly destroying and degrading the habitat of the mountainsnail (Parrish et al. 1996, USFS 1996a, Frest and Johannes 1993a, 2002). Frest and Johannes (2002) reported, "Completely intact riparian communities were not encountered: however, a number of sites had remnants of such communities, usually with a strong *Pinus ponderosa* or *Picaea glauca* representation" (p. 50). Frest and Johannes (2002) also reported nearly every spring and seep site encountered to be "heavily impacted" (p. 50). The two report, "…the vast majority of spring sites in the Black Hills National Forest have been either troughed or so heavily impacted by grazing as to exterminate all or nearly all land snails" (p. 50). The entire Black Hills have experienced extensive and intensive domestic livestock grazing, logging, road construction, mining, and other development (e.g., subdivision development, spring development, recreation site development) (Graves 1899, Mehl 1992, Shinneman 1996, USFS 1996a, Shinneman and Baker 1997, Marriott et al. 1999, Marriott and Faber-Langendoen 2000, Hall et al. 2002). These activities are all reported to adversely impact the Black Hills mountainsnail and its habitat (Frest and Johannes 1993a, 2002). The Black Hills mountainsnail has experienced a corresponding decline in numbers and distribution, and is now in danger of extinction (Frest and Johannes 1993a, 2002). Frest and Johannes (2002) state:

> Much of the Black Hills National Forest has been heavily logged in the past. Much has also been heavily grazed. Various other human activities, including practices typical of and in National

> Forests, can have serious negative impacts on land snail species. Very few land snails survive such usages as heavy grazing and clear-cut logging, and many taxa likely originally widespread in the Black Hills National Forest are now rare, likely as a result. (p. 114)

3. The results of surveys in the 1990's

In 1993, it was recommended that the Black Hills mountainsnail be listed as threatened under the ESA (Frest and Johannes 1993a). Frest and Johannes (1993a) stated:

> At present, none of the known colonies can be regarded as secure. Relatively few of them are large and most are in vulnerable situations, i.e. on floodplains subject to human modification, near existing major roads, or in areas that could be subject to roadside spraying, grazing, or logging. It is quite likely that this species occurred very commonly throughout lower Spearfish Canyon, Grand Canyon, and the limestone areas of the Rapid Creek drainage, as well as in the area around Deadwood and the limestone gulches between Spearfish Creek and Grand Canyon. It may also have been common on the intervening uplands. As noted in 1991 and in the site descriptions below, the species is now essentially extirpated from the uplands and most of Rapid Creek and Grand Canyon. (p. 70)

Domestic livestock grazing, logging, road construction, riparian habitat degradation, herbicide application, mining, and other damaging activities were reported to be the cause of the species' extirpation in the uplands and were reported to pose significant threats to the well-being of the species (Frest and Johannes 1993a). Indeed, in surveying for land snails and potential land snail habitat in the Black Hills in the early 1990's, several survey sites were reported to suffer from excessive domestic livestock grazing, logging, road construction, and other damaging activities (Frest and Johannes 1993a).

Since 1993, the status of the Black Hills mountainsnail has only worsened (Frest and Johannes 2002). While eight new Black Hills mountainsnail colonies were found since 1993, it was also reported that two colonies had become extirpated since that time (Frest and Johannes 2002). Additionally, three colonies that had previously been reported as *O. cooperi* were reassigned as *O.* n. sp. 1, a distinct*Oreohelix* species in the Black Hills (Frest and Johannes 2002). Furthermore, nearly every Black Hills mountainsnail colony discovered since the early 1990's remains threatened and there is no indication that any colonies are truly secure. Domestic livestock grazing still poses significant threats to the species, as well as logging, mining, herbicide application, road construction, and other damaging activities (e.g., recreational activities, spring developments) (Frest 2002, Frest and Johannes 1995a, 1997b, 2002). And, because of the susceptibility of the species to desiccation and predation, and the limited motility of the species, most Black Hills mountainsnail colonies are extremely vulnerable to the effects of anthropogenic or natural environmental change (Frest and Johannes 1993a, 2002). Fragmentation of habitat and colonies has also placed significant limitations on the ability of the species to recover from the impacts of anthropogenic and/or natural environmental change (Frest and Johannes 2002). While more Black Hills mountainsnail colonies could be found in the Black Hills, it is not believed that a sufficient number will be found to justify any less concern over the status of the species (Frest and Johannes 2002). The species remains threatened with extinction (Frest and Johannes 2002).

Extant Black Hills mountainsnail colonies are primarily overseen by the USFS, which manages the BHNF, although several colonies also exist on private lands. See, Table 2. Of the 32 extant Black Hills mountainsnail colonies, 20 occur on land managed by the USFS (Frest and Johannes 2002). Additionally, two extant Black Hills mountainsnail colonies are managed by the USFWS, one extant colony is managed by the City of Spearfish, and nine extant colonies occur on private land (Frest and Johannes 2002).

Table 2. Ownership of extant Black Hills mountainsnail colonies (Frest and Johannes 2002).

Owner	Number of Colonies	Percentage of Extant Colonies
USFS	**20**	**63%**
USFWS	**2**	**6%**
City of Spearfish, South Dakota	**1**	**3%**
Private	**9**	**28%**

VI. CRITERIA FOR LISTING THE BLACK HILLS MOUNTAINSNAIL AS THREATENED OR ENDANGERED

Several sections of the regulations implementing the ESA (50 CFR et seq.) are applicable to this petition. Those concerning the listing of the Black Hills mountainsnail as threatened or endangered are as follows:

> 424.02(e) "Endangered species" means a species that is in danger of extinction throughout all or a significant portion of its range."…(k) "species" includes any species or subspecies that interbreeds when mature.
>
> "Threatened species" means a species that "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 USC § 1532(20)
>
> 424.11(c) "A species shall be listed…because of any one or a combination of the following factors:
> 1. The present or threatened destruction, modification, or curtailment of habitat or range;
> 2. Overutilization for commercial, recreational, scientific, or educational purposes;
> 3. Disease or predation;
> 4. The inadequacy of existing regulatory mechanisms; and
> 5. Other natural or manmade factors affecting its continued existence.

As documented below, at least three of the factors set forth in § 424.11(c) are applicable to the present status of the species.

A. Present and Threatened Destruction, Modification, or Curtailment of Range or Habitat.

The Black Hills mountainsnail is reported to be extremely sensitive to habitat destruction and degradation (Frest 2002, a, b, Frest and Johannes 1993a, 1995a, 1997, 2002). The species is considered vulnerable to habitat destruction and degradation because of its specialized habitat needs, physical needs and limitations (e.g., moist sites, limited motility, etc.), and vulnerability to anthropogenic and natural environmental change (Frest and Johannes 1995a, 1997, 2002). The Black Hills mountainsnail, as well as other land snail species, is considered to be an important indicator of forest ecosystem health (Frest 2002a, 2002b, Frest and Johannes 1995a, 1997, Niwa et al. 2001). Given this premise and with support from the best available science, the forest ecosystem that supports the species is severely impaired.

Extensive habitat destruction and degradation in the Black Hills of South Dakota and Wyoming has already caused a corresponding decline in the range, habitat, and population of Black Hills mountainsnail (Parrish et al. 1996, USFS 1996a, Frest 2002a, b, Frest and Johannes 1993a, 1995a, 1997, 2002). Frest and Johannes (2002) report:

> Upland areas have been selectively affected by lumbering and often also by grazing. In either case, the result is to drastically reduce snail diversity and abundance. Intact upland forest tracts were particularly difficult to locate. Some of the upland sites were chosen [for surveys] because of the presence of springs; elsewhere in *Oreohelix* range, such localities are often especially favorable for large colonies. In fact, many land snail species, especially the smaller taxa, are most readily found near springs and seeps. Hence, such sites were of particular interest, regardless of elevation or aspect. Lowland and riparian habitats are elsewhere often particularly favorable for land snails. Again, relatively undisturbed examples of such habitats are now few and far between in the Black Hills National Forest; most have been converted for grazing. (pp. 6-7).

Riparian habitat in particular is documented to have experienced significant declines in the Black Hills (Parrish et al. 1996, USFS 1996a, Marriott and Faber-Langendoen 2000). Mature, dense, and more mesic forest habitat has also experienced significant declines in the Black Hills, along with a decline in understory diversity (Shinneman 1996, Shinneman and Baker 1997, USFS 1996a). This habitat loss has led to a corresponding reduction in the range and population size of the Black Hills mountainsnail. Indeed, the number of colonies has declined by at least 20%, although the decline is most likely much higher; and a direct positive link between habitat destruction and degradation on the Black Hills and the extirpation of Black Hills mountainsnail colonies has been documented (Frest and Johannes 2002). The Black Hills mountainsnail continues to be threatened by habitat destruction and degradation caused by excessive domestic livestock grazing, logging, road construction, herbicide and pesticide application, mining, spring development, groundwater extraction, and recreation (Frest and Johannes 1991, 1993a, 2002).

1. Domestic livestock grazing

a. Introduction

Domestic livestock grazing is generally destructive to mollusks and their habitats, including the Black Hills mountainsnail, and is reported to be a major threat to the survival of the species (Armour 1991, Fleischner 1994, Belsky et al. 1999, Frest 2002a, b, Frest and Johannes 1991, 1993a, 1995a, 1997, 2002). Frest (2002a) states, "Livestock grazing is a major factor causing regional extinction or reduction of both land and freshwater mollusks" (p. 48). The USFS (2000c) also reported, "There are examples in the West where livestock grazing was the principle cause of [snail] colony extirpation" (p. 134). Grazing has adversely impacted and threatens to extirpate several *Oreohelix* colonies in the states of Idaho, Montana, Oregon, Utah, and Washington (Frest and Johannes 1995a, b, 1997, Oliver and Bosworth III 1999, Hendricks 2003). Frest and Johannes (2002) report, "Excessive grazing tended to eliminate most land snail species [in the Black Hills]. In particular, *Oreohelix* seemed unable to survive heavy grazing" (p. 46). In describing the effects of grazing on snail Species of Special Concern in the Black Hills, which includes the Black Hills mountainsnail, the two explain:

> …there is little evidence that the Species of Special Concern can survive severe or sustained grazing...Excessive grazing tends to simplify the plant community, resulting in loss of forage species. It tends to increase insolation, shrink or remove cover, litter, hibernation, and shelter sites, decrease winter ground temperature, increase summer ground temperature, decrease effective available moisture and humidity, compact soil, and physically destroy land snail individuals and colonies. (p. 105)

Frest and Johannes (2002) further explain:

> Physical compaction and trampling of soil extirpates snail colonies; it also tends to dry up springs and seeps and is a major factor inducing change in plant communities. Grazing itself (that is, physical consumption of plants by large herbivores) is likely to result in elimination of some plant species and encouragement of others, particularly waste species and heavily protected, tough, or toxic taxa. Grazing also tends to increase insolation. Locally, deposit of large quantities of manure and urine can change soil and runoff conditions, such as pH, TDS, and dissolved nitrogen and phosphorus. Soil erosion is generally enhanced in grazed areas, and litter is often largely or totally absent in heavily used sites….Even light grazing appears to have substantial negative effects on land snail diversity and abundance. In our opinion, not allowing grazing at significant snail sites is the best way to ensure survival of species of special concern. (p. 113)

b. A history of extensive grazing in the Black Hills

Domestic livestock grazing has occurred extensively in the BHNF for over century and has adversely impacted Black Hills mountainsnail colonies and habitat (USFS 1996a, Black 1998, Frest and Johannes 1993a, 2002). Black (1998) describes historic livestock grazing on the Black Hills:

> Homesteaders ran cattle on the Black Hills in the early 1880's. Grazing on public forest lands has been a main focus of Forest Service activities and expenditures since the Black Hills were set aside as a Forest Reserve in 1898. According to Forest Service staff, in the early years cattle were let loose on the forest when winter snows receded revealing thousands of acres of grass, shrubs, and sedges in spring bloom. Nearby ranchers simply herded their animals onto forest lands in the spring. There were no pastures, no watering facilities, and almost no owner supervision or herding until cattle were rounded up again with the onset of fall snows.
>
> With little direction or control, cattle wandered freely, watering in creeks and springs. They tended to remain in the stream bottoms where summer temperatures were cooler and where water was easily accessible. Problems with erosion, overgrazing, and changes in the composition of vegetation were noted by several sources. Another result of this grazing system is that grazing records for the forest in these early years are non-existent. (p. 40, citations omitted).

Frest and Johannes (1993a) report, "…the species is now essentially extirpated from the uplands and most of Rapid Creek and Grand Canyon….Grazing is a factor in most drainages, particularly in Rapid Creek and Grand Canyon, as well as possibly around Deadwood" (p. 70). Surveys have found only dead Black Hills mountainsnail specimens or no specimens at all to exist at sites that were heavily grazed (Frest and Johannes 1991, 1993a), strongly indicating that a history of extensive domestic livestock grazing in the Black Hills has caused a significant decline in the species' range and habitat.

c. Recent surveys show negative impact of domestic livestock grazing

Based on recent surveys, the threat of domestic livestock grazing has not abated (Frest and Johannes 2002). Frest and Johannes (2002) found that:

> In general 1993 sites revisited in 1999 appeared to show more grazing impact. No such sites appeared to have shown colony enhancement in either numbers or area. Most seemed to show declines in either population size, area occupied by living examples, or both. The common factor in declining areas appeared to be grazing damage. (p. 48)

Frest and Johannes (2002) report, "…the vast majority of spring sites in the Black Hills National Forest has been either troughed or so heavily impacted by grazing as to exterminate all or nearly all land snails" (p. 50, emphasis added). Domestic livestock grazing continues to be regarded as a major threat to the survival of the species (Frest and Johannes 2002).

Of 40 historically reported Black Hills mountainsnail sites (both extirpated and extant) surveyed throughout the 1990's, 9 are known to have experienced direct domestic livestock grazing impacts (Frest and Johannes 2002). See, Table 3. Of these 9 sites, the species was reported to be rare or extirpated at 8 (Frest and Johannes 2002). Additionally, domestic livestock grazing appears to have caused the extirpation of at least one Black Hills mountainsnail colony since 1993. This colony, labeled "51" by Frest and Johannes (2002), is located in the northwestern Black Hills and was once the northwesternmost Black Hills mountainsnail colony known to exist (Frest and Johannes 2002). The loss of this colony has resulted in a diminishment of the species' range, leaving the entire species more vulnerable to extinction. Domestic livestock grazing has also caused reductions in size and extent of other colonies (Frest and Johannes 2002). At one colony experiencing "heavy grazing" impacts in 1992, the species was also reported to be rare (Frest and Johannes 1993a). However, surveys in 1999 found no grazing impacts and reported the species to be "abundant" (Frest and Johannes 2002). This appears to be the only instance in which a Black Hills mountainsnail colony was adequately protected and recovered from the effects of domestic livestock grazing (Frest and Johannes 1993a, 2002). It is believed that the persistence of some Black Hills mountainsnail colonies today is the result of "serendipitous" factors (e.g., steep slope, fallen trees) that have protected colonies from domestic livestock grazing only by happenstance – not human intervention (Frest and Johannes 2002).

Table 3. Black Hills mountainsnail colonies impacted by domestic livestock grazing (Frest and Johannes 2002).

Total colonies:	40
Colonies Impacted by Domestic Livestock Grazing:	**9 (22.5%)**

Furthermore, in surveys of potential and occupied habitat conducted throughout the 1990's, no Black Hills mountainsnail colonies or individuals were found in areas that had been heavily grazed and in most cases partially grazed (Frest and Johannes 2002). Frest and Johannes (2002) also report many instances where domestic livestock grazing has degraded and/or destroyed the habitat of the Black Hills mountainsnail within the estimated range of the species.[3] See, Table 4.

[3] For the purposes of this table, survey sites located in the following United States Geological Survey 7.5' series topographic maps are estimated to be within the range of the Black Hills mountainsnail, although other locations may also have been within the historic range of the species: Red Canyon Creek, Tinton, Maurice, Spearfish, Deadwood North, Moskee, Old Baldy Mtn., Savoy, Lead, Deadwood South, Buckhorn, Crooks Tower, Nahant, Minnesota Ridge, Crows Nest Peak, Deerfield, and Rochford.

Table 4. Survey sites where domestic livestock grazing was reported to have degraded and/or destroyed Black Hills mountainsnail habitat within the estimated range of the species (Frest and Johannes 2002).

Site Number (Frest and Johannes 2002)	Location (USGS 7.5' Quad)	Comment (Frest and Johannes 2002)	Black Hills mountainsnail found?
12	Old Baldy Mtn.	"Examined from stock tank to spring source. Poorly fenced off; mostly grazed out. No *Oreohelix* or other large land snails seen" (p. A4, emphasis added).	No
13	Old Baldy Mtn.	"No *Oreohelix* or other land snails seen. Badly grazed out and dry; springs troughed and trampled" (p. A4, emphasis added).	No
15	Old Baldy Mtn.	"Partially grazed, springs troughed or badly trampled where inadequately fenced" (p. A4, emphasis added).	No
27	Spearfish	"…rather dry partly grazed slope. No or [sic] other land snails seen" (p. A7).	No
29	Spearfish	"N.-facing shallow, open, grassy, grazed slope….No *Oreohelix* or other land snails seen" (p. A7).	No
35	Maurice	"Shallow, dry, partly grazed wooded area on a slope in mixed *Quercus macrocarpa*, *Pinus ponderosa*, minor *Betula papyrifera* forest, moderate litter cover. No *Oreohelix* or other land snails seen" (p. A8, emphasis added).	No
37	Maurice	"Dry, rather level to shallow alluvial slopes on both side of FS 134.2 in heavily grazed and pastured, partially cleared areas with *Populus tremuloides* stands, scattered *Pinus ponderosa*, *Berberis, Vaccinium, Juniperus communis*….No *Oreohelix*, *Zonitoides* only" (p. A9, emphasis added).	No
41	Maurice	"No snails seen. Grazed and recently clear-cut slope" (p. A9).	No
42	Maurice	"No live snails seen, no *Oreohelix*. Recently clear-cut and grazed" (p. A10).	No
49	Red Canyon Creek	"No land snails seen. Heavily grazed" (p. A11).	No

52	Moskee	"No land snails seen. Heavily grazed area" (p. A11).	No
144	Old Baldy Mtn.	"Area grazed and logged" (p. A27)	No
147	Nahant	"Area badly grazed" (p. A27)	No
148	Minnesota Ridge	"Heavy cow grazing" (p. A28)	No
156	Deadwood South	"Badly grazed" (p. A29)	No
203	Nahant	"Noted that the area has been used by cattle" (p. A37)	No
230	Moskee	"Canyon heavily impacted by grazing, logging, recent thinning" (p. A43, emphasis added)	No
244	Old Baldy Mtn.	"No mollusks. Very badly trampled by cattle" (p. A45)	No
278	Crows Nest Peak	"Selectively cut and very heavily grazed" (p. A52, emphasis added)	No
311	Deerfield	"Area grazed" (p. A57).	No
342	Savoy	"No evidence of *Oreohelix* here. Area very heavily grazed, partly thinned" (p. A63).	No

d. Domestic livestock grazing continues to be a threat

Domestic livestock grazing continues to occur extensively throughout the Black Hills on both private and public land throughout the range of the Black Hills mountainsnail (USFS 1996a, b). Consequently, most extant Black Hills mountainsnail colonies remain threatened by domestic livestock grazing (USFS 1996a, Frest and Johannes 1993a, 2002, see also, "Inadequate Regulatory Mechanisms" discussion below).

The exact amount of domestic livestock grazing occurring on private lands is unknown, although two Black Hills mountainsnail colonies on private lands are reported to be suffering from domestic livestock grazing (Frest and Johannes 2002). Additionally, there are no regulatory mechanisms in place to protect the Black Hills mountainsnail from livestock grazing on private lands, further threatening the species (USFS 1996a, Frest and Johannes 2002).

Domestic livestock grazing on BHNF lands currently poses tremendous threats to the species throughout a significant portion of its range (USFS 1996a, Frest and Johannes 1993a, 2002). Currently, the USFS allows domestic livestock grazing in many grazing allotments in the BHNF (USFS 1996a, 1997a, b, c, d). Extant Black Hills mountainsnail colonies are known to exist within the Higgins, Pettigrew, Plateau, Reynolds Prairie, Ragged Top, Tollgate, and Wolff grazing allotments (Frest and Johannes 2002, USFS 1996b, USFS 1997c, d). See, Figure 3. Of these allotments, only the Ragged Top allotment is currently "vacant," meaning livestock grazing can occur but currently does not (Smith 2003).

Within these grazing allotments, most extant Black Hills mountainsnail colonies are not adequately protected from domestic livestock grazing and, as will be discussed further in this petition, the USFS has not implemented and is not implementing adequate protection measures (UFS 1997c, d, Frest and Johannes 1991, 1993a, 2002). The USFS has even determined that individual Black Hills mountainsnails and their habitats are likely to be impacted by domestic livestock grazing in several of these allotments (USFS 1996a, 1997b, c, d). These include the Plateau, Ragged Top, and Reynolds Prairie allotments. For example, the USFS (1997d) states, "Some Black Hills National Forest sensitive species [including the Black Hills mountainsnail] would continue to experience direct 'effects to individuals' as a result of livestock grazing" (p. 23). Similar findings are made in other USFS documents analyzing and assessing the impacts of domestic livestock grazing to the Black Hills mountainsnail (USFS 1996a, USFS 1997b, c, d). The USFS has most recently determined livestock grazing in the Pettigrew and Higgins allotments could impact individual Black Hills mountainsnails (USFS 2000a, b). These determinations strongly indicate that domestic livestock grazing on the BHNF threatens to further destroy, modify, and/or curtail the range and habitat of the Black Hills mountainsnail in all or a significant portion of its range.

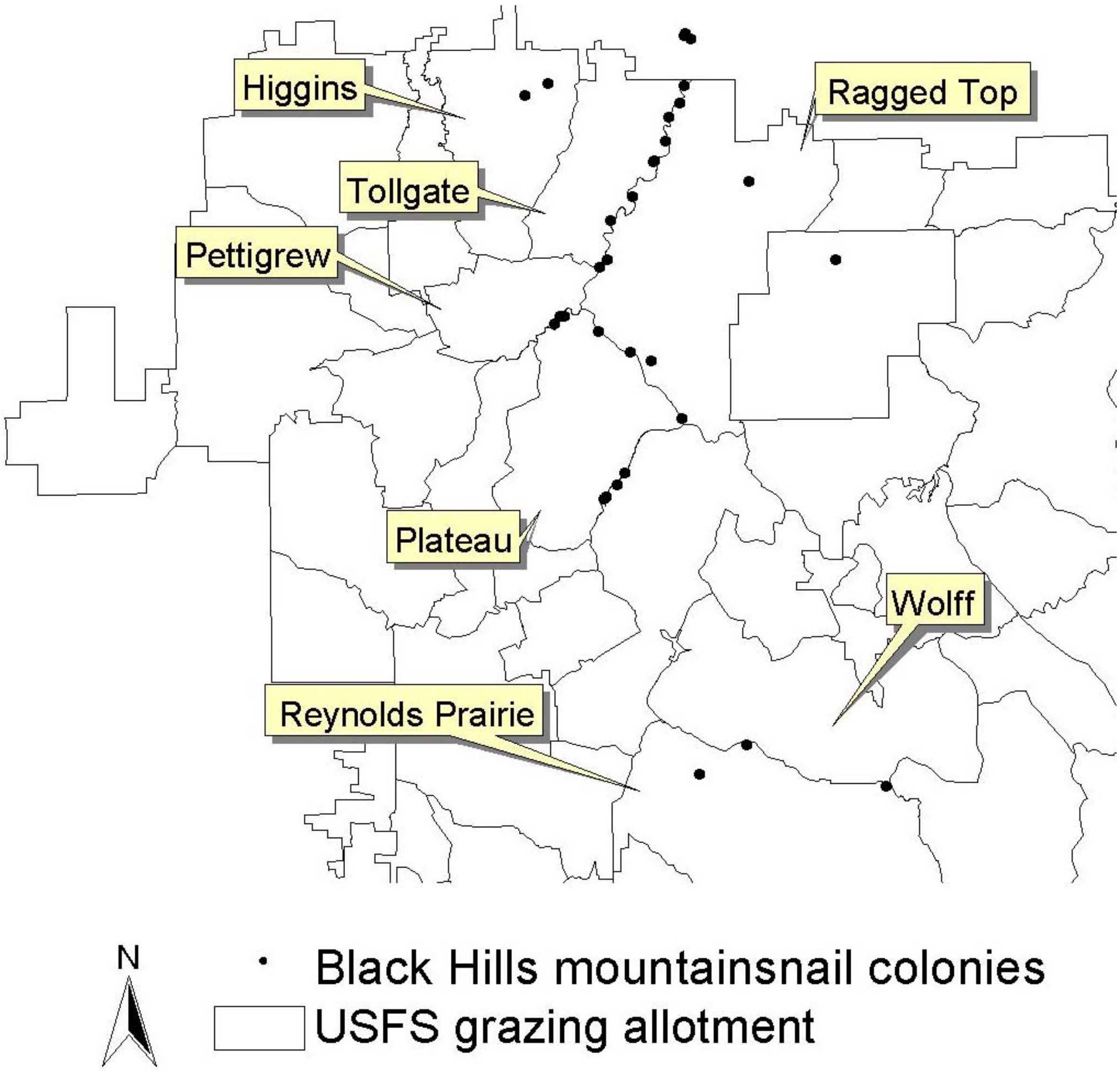

Figure 3. USFS grazing allotments containing extant Black Hills mountainsnail colonies (USFS data, Frest and Johannes 2002). Map not to scale.

2. **Logging**

   a. **Introduction**

Logging poses "essentially negative effects" to the Black Hills mountainsnail, as well as other species of land snails (Frest and Johannes 2002, p. 104; see also, USFS 1996a, Frest and Johannes 1993a, b, 1995a, b, 1997). The USFS (2000c) reported "..snails are very susceptible to timber harvest and soil compaction" (p. 134). Logging has adversely impacted and threatens to extirpate several *Oreohelix* colonies in the states of Idaho, Montana, Oregon, and Washington (Frest and Johannes 1995a, b, 1997, Hendricks 2003).

b. The impacts of logging

In generally describing the effects of logging to land snails, Frest and Johannes explain:

> Lumbering as commonly practiced increases insolation; removes cover; increases ground temperature in summer; decreases effective ground temperature in winter (i.e., increased exposure); decreased available moisture and effective humidity; removes shelter, hibernation, and egg-laying sites; removes ground cover, including forage plants for many species; simplifies community structure; and decreases diversity. (p. 104)

Frest and Johannes (2002) report, "Even the effects of selective cutting could be extirpation of sensitive species, such as the Species of Special Concern" (p. 109). The two also report, "Snails surviving in logged areas are probably also more subject to predation" (p. 54). The impacts of heavy machinery use associated with logging is also reported to be detrimental to the species (Frest and Johannes 2002). The USFS (2000c) also reported that "…activities related to timber harvesting (i.e., reducing canopy closure, soil compaction and burning slash) present a worst-case scenario for these land snails" (p. 134). In terms of the various methods of logging that are employed on the Black Hills, shelterwood cutting, clearcutting, thinning, and overstory removal are dominant (USFS 1996a). However, all forms of logging are detrimental to the species (Frest and Johannes 1993a, 2002). Frest and Johannes (2002) report:

> Lumbering, especially clearcuts, produces essentially negative effects on the Species of Special Concern…(p. 104);

> Overstory removal increases insolation to a considerable extent, and often decreases effective moisture to the extent of exaggerating fire effects. (p. 110);

> Precommercial thinning, if a prelude to further lumbering, has negative effects but not as severe as timber "harvesting"…(p. 110).

c. Indirect impacts of logging

Logging may indirectly impact Black Hills mountainsnail colonies by negatively affecting suitable habitat and local hydrology. Frest and Johannes (2002) state, "…to effectively conserve the colony, consideration must be given to the surrounding plant community, the dynamic aspect of snail colonies, and, perhaps most importantly, the geology (physiography, geomorphology, and ground water hydrology, minimally) of the site" (p. 14). According to Frest (2003), most Black Hills mountainsnail colonies are ephemeral, or shift back and forth through time. Logging therefore, may reduce vegetative diversity and degrade and/or destroy vegetation communities that support Black Hills mountainsnail, which in turn limits the ability of colonies to expand and/or disperse (Frest 2003, Frest and Johannes 2002). Logging may also adversely affect local hydrology (Frest 1984, 2003). Surface water and ground water are closely related on the Black Hills (USFS 1996a). Accordingly, logging may indirectly reduce the availability of water for absorption into the ground by increasing insolation, increasing ground temperature, increasing exposure, and decreasing moisture and humidity (USFS 1996a, Frest 1984, Frest 2003). In turn, this may reduce the availability of water for springs, seeps, or other moist areas that typically support Black Hills mountainsnail (USFS 1996a, Frest and Johannes 1993a, 2002, Frest 1984, 2003).

d. Logging in the Black Hills

Logging occurs extensively throughout the Black Hills on both private and public lands and has occurred throughout the Black Hills for over a century (USFS 1996a). Logging has occurred on nearly every acre of the Black Hills since 1874 (Graves 1899, USFS 1948, Alexander 1987, Mehl 1994, Shinneman 1996), when European-American settlement of the Black Hills began (Froiland 1990, USFS 1996a), and has greatly modified the forest structure (USFS 1996a, Shinneman 1996, Shinneman and Baker 1997, 2000, Baker and Ehle 2001, Frest and Johannes 2002). Logging is responsible for altering vegetation throughout Spearfish Canyon, where numerous extant Black Hills mountainsnail colonies currently exist (Graves 1899, USFS 2002e). This strongly indicates that logging in the Black Hills has destroyed, modified, and/or curtailed the habitat and range of the Black Hills mountainsnail throughout all or a significant portion of the species' range (Frest and Johannes 1993a, 2002).

Indeed, no Black Hills mountainsnail colonies have been found in areas that were completely or in many cases selectively logged (Frest and Johannes 1993a, 2002). And, in surveys of potential and occupied habitat conducted throughout the 1990's, Frest and Johannes (2002) report many instances where logging has degraded and/or destroyed the habitat of the Black Hills mountainsnail within the estimated range of the species.[4] See, Table 5. Furthermore, while some extant Black Hills mountainsnail colonies have not experienced impacts from logging, this is only because they are located in areas that may be unsuitable for timber harvest (e.g., near cliffs, roadsides, lack of merchantable timber, etc.) (Frest and Johannes 2002). Thus, the primary reason that some extant Black Hills mountainsnail colonies have not been affected by logging is simply by fortuitous circumstances.

[4] For the purposes of this table, survey sites located in the following United States Geological Survey 7.5' series topographic maps are estimated to be within the range of the Black Hills mountainsnail, although other locations may also have been within the historic range of the species: Red Canyon Creek, Tinton, Maurice, Spearfish, Deadwood North, Moskee, Old Baldy Mtn., Savoy, Lead, Deadwood South, Buckhorn, Crooks Tower, Nahant, Minnesota Ridge, Crows Nest Peak, Deerfield, and Rochford.

Table 5. Survey sites where logging was reported to have degraded and/or destroyed Black Hills mountainsnail habitat within the estimated range of the species (Frest and Johannes 2002).

Site Number (Frest and Johannes 2002)	Location (USGS 7.5' Quad)	Comment (Frest and Johannes 2002)	Black Hills mountainsnail found?
38	Maurice	"Cut-over slope, grazed, but now fenced, open forest with scattered *Pinus ponderosa*, *Betula papyrifera*, *Populus tremuloides*, *Berberis, Vaccinium*….No *Oreohelix*" (p. A9, emphasis added).	No
40	Maurice	"No snails found, no *Oreohelix*. Recently clear cut" (p. A9).	No
41	Maurice	"No snails seen. Grazed and recently clear-cut slope" (p. A9).	No
42	Maurice	"No live snails seen, no *Oreohelix*. Recently clear-cut and grazed" (p. A10).	No
144	Old Baldy Mtn.	"Area grazed and logged" (p. A27).	No
145	Moskee	"Area lumbered heavily" (p. A27).	No
161	Minnesota Ridge	"Site logged and pastured" (p. A30).	No
200	Deerfield	"Evidence of past logging" (p. A37).	No
206	Crows Nest Peak	"Evidence of past logging in area" (p. A38).	No
207	Deerfield	"Site is in dry drainage with lots of past logging activity" (p. A38).	No
230	Moskee	"Canyon heavily impacted by grazing, logging, recent thinning" (p. A43, emphasis added).	No
278	Crows Nest Peak	"Selectively cut and very heavily grazed" (p. A52).	No
325	Minnnesota Ridge	"Forest thinned in 1935 by CCC. Commercial harvest in 1959 when thinned for post and poles. Commercial cutting every 20 years" (p. A60).	No
342	Savoy	"Area very heavily grazed, partly thinned" (p. A63).	No

e. Logging continues to be a threat

Many extant Black Hills mountainsnail colonies remain threatened by logging, which occurs on both public and private lands throughout the range of the species (USFS 1996b, Frest and Johannes 1991, 1993a, 2002). The amount of logging occurring on private lands is unknown, although any logging that does occur on private lands poses threats to the habitat of the Black Hills mountainsnail and the species itself (Frest and Johannes 1993a, 2002). As most extant Black Hills mountainsnail colonies (nearly 2/3 of the overall population) exist on BHNF lands, logging on these lands poses tremendous threats to the overall survival of the species (USFS 1996a, Frest and Johannes 1993a, 2002).

Currently, the USFS allows logging to occur throughout the range of the Black Hills mountainsnail in the BHNF (USFS 1996a). In fact, throughout the 1990's, logging (i.e., timber sales) authorized by the USFS has occurred near Black Hills mountainsnail colonies and habitat on several occasions. In many instances, the USFS concluded that individual Black Hills mountainsnails might be impacted.[5] See, Table 6. In other instances, the USFS concluded that logging would not impact the species. However, as will be discussed further in this petition (see, "Inadequate Regulatory Mechanisms" section below), the agency relied upon and continues to rely upon entirely inadequate measures to protect the species and its habitat, and most likely erred in determining the species and its habitat would not be detrimentally impacted. Additionally, when analyzing the impacts of logging to the Black Hills mountainsnail, the USFS has not considered and continues to not consider the impacts of "edge effect," the impacts of logging to vegetative diversity in potentially suitable snail habitat, and the impacts of logging to local hydrology (e.g., USFS 2002a, b, 2003c, d). The impacts of past and present logging have therefore contributed to the present-day destruction and curtailment of all or a significant portion of the range and habitat of the Black Hills mountainsnail.

Table 6. Timber sales where USFS concluded Black Hills mountainsnail "May be Impacted."

Timber Sale or Project Name	Date Authorized	USFS Conclusion	Source
Blowdown	1993	May impact individuals	USFS 1993
Bear	1995	May impact individuals	USFS 1995b
Castle/Hughes	1995	May impact individuals	USFS 1995a
Crow Peak	1996	May impact individuals	USFS 1996c
Nichols	1996	May impact individuals	USFS 1996g
Odakota-Duck	1996	May impact individuals	USFS 1996f
Rednose	1996	May impact individuals, "…very likely that some individual snails will be killed during this [treatment] process (assuming presence)."	USFS 1996d

[5] Prior to the 1990's, the USFS paid little to no attention to the impacts of logging upon the Black Hills mountainsnail and indeed, there existed no regulatory requirement to do so. It was not until 1994, when the USFS developed a "sensitive species policy" and designated the Black Hills mountainsnail (or Cooper's Rocky Mountainsnail) a sensitive species, that the agency was required to review and document the impacts of timber sales to the Black Hills mountainsnail. See e.g., Forest Service Manual Region 2 Supplement, No. 2600-94-2 (1994).

Tollgate/Pettigrew	1996	May impact individuals	USFS 1996e
Snapper	1997	May impact individuals	USFS 1997e
Sundance	1997	May impact individuals	USFS 1997f
Coyote	1998	May impact individuals	USFS 1998a
Cub	1998	May impact individuals	USFS 1998b
Reddog/Slice	1998	May impact individuals	USFS 1998c

Finally, there are several proposed timber sales that threaten to further destroy, modify, and/or curtail the range and habitat of the Black Hills mountainsnail. See, Table 7. These proposed timber sales include the Cabin-Deerfield, Cement, Elk Bugs and Fuel, Mineral, Power, Prairie, Research-Rochford, Riflepit, and Welcome-Sand. While these timber sale proposals have not been finalized, the best available scientific information strongly indicates that these timber sales threaten to destroy, modify, and/or curtail extant Black Hills mountainsnail colonies and the species' habitat (Frest and Johannes 1993a, 2002).

Table 7. Proposed Timber Sales that May Impact Black Hills Mountainsnail Colonies and Habitat.

Timber Sale Name	Estimated Acres that May be Impacted by Logging	Potential Impacts to Black Hills mountainsnail and its habitat?	Status	Source
Cabin-Deerfield	Unknown	Possible	Pre-analysis	USFS 2003b
Cement	5484	Yes	Authorized	USFS 2003f
Elk Bugs and Fuel	15305	Yes	Analysis	USFS 2002g, 2003d
Mineral	4560	Yes	Analysis	USFS 2002f
Power	4067	Yes	Authorized	USFS 2003g
Prairie	8000	Yes	Analysis	USFS 2002c, 2003e
Research-Rochford	Unknown	Possible	Analysis	USFS 2003b
Riflepit	2665	Possible	Analysis	USFS 2002h
Welcome-Sand	4500	Yes	Analysis	USFS 2003c

3. Roads and road construction

a. Introduction

Frest and Johannes (2002) report:

> Road construction is generally strongly negative in its effects, at least temporarily, if snails (especially Species of Special Concern) are present. The overall effect is to extirpate in the roadway proper, and site preparation often extends the effects. Depending upon colony size, complete extirpation or fragmentation is one result. If a sufficient population reservoir remains in the vicinity following construction, partial regeneration of the colony is quite possible; but colonies are already fragmented and much reduced in area and numbers. Allowing continuing attrition is imprudent. Aside from direct construction effects, road building increases human traffic, including foot traffic; increases exposure and effective ground temperature; generally changes the local plant community; leads to introduction of disturbance plants and non-native and noxious plant and animal species; and stimulates damaging side effects, such as spraying. (p. 109)

b. Roads in the Black Hills

The Black Hills are covered with an extensive road system (USFS 1996a). The USFS estimates there are "5,204 miles" of total Forest Service System Roads on the BHNF (USFS 1996a, p. III-426). The agency estimates there are an additional "3,430" miles of user-created roads on the BHNF (USFS 1996a, p. III-426). Extensive road construction, including user-created road construction, has been undertaken to facilitate silviculture activities, as well as to access mining operations, private lands, and for other reasons (USFS 1996a). These roads have most likely led to the extirpation and/or fragmentation of Black Hills mountainsnail colonies and the destruction and/or degradation of the species' habitat (Frest and Johannes 1993a, 2002). Frest and Johannes (2002) state, "…colonies appear to have been negatively impacted by road construction, grazing, logging, and major forest fires" (p. 89, emphasis added). See also, Figure 4.

Indeed, many extant and extirpated Black Hills mountainsnail colonies exist very near roads, strongly indicating that road construction and associated impacts have adversely impacted colonies and habitat, and may continue to pose threats to extant colonies and habitat (Frest and Johannes 2002). At one Black Hills mountainsnail colony, labeled "213" by Frest and Johannes (2002), Frest and Johannes (2002) reported, "Site cut for road; oversteepened; sprayed; no snails close to road" (p. A40). It was also reported that a Black Hills mountainsnail colony, labeled "86" by Frest and Johannes (2002), is now "extinct" below a road (Frest and Johannes 2002, p. A17).

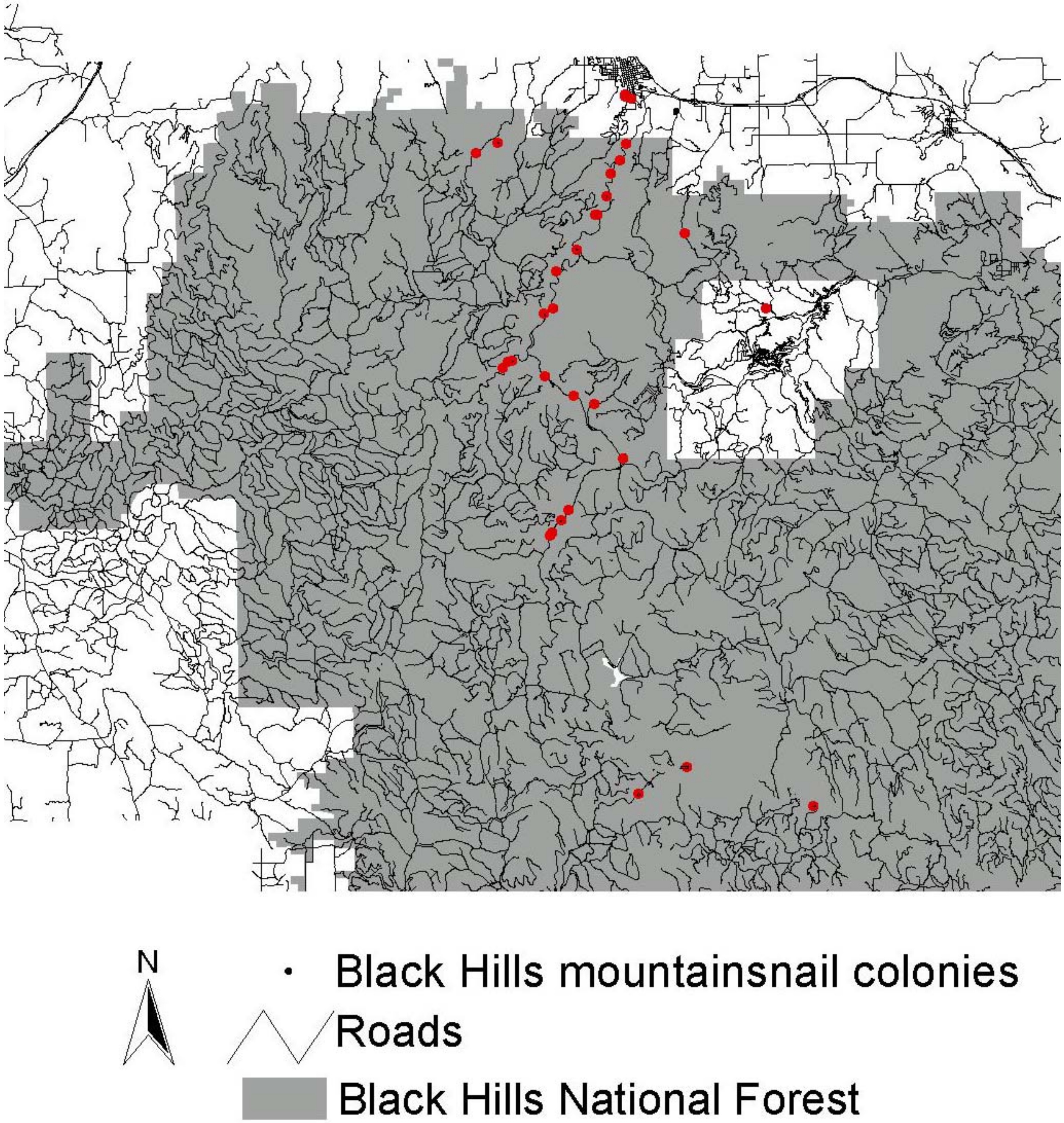

Figure 4. Roads on the Black Hills in relation to extant Black Hills mountainsnail colonies; Black Hills National Forest shaded (USFS data, Frest and Johannes 2002). Map not to scale.

c. Negative impact of U.S. Highway 14A

One road in particular, U.S. Highway 14A, which runs through Spearfish Canyon, has most likely negatively impacted many Black Hills mountainsnail colonies and much of the species' habitat in the Canyon, and continues to threaten the species. See, Figure 5. According to the USFS (2002e):

> The historical railbed built in the [Spearfish] Canyon changed the hydrology of the [Spearfish] Creek because some of it was built within the stream floodplain or prism. The modern paved road caused more impact to the Creek. <u>The following conditions would be found on Spearfish Creek because of the existence of the road through the canyon</u>:
>
> - decreased channel gradients and runoff velocities; loss of natural pool / riffle flow
> - <u>accelerated soil erosion and soil nutrient loss</u>
> - <u>dewatering of wetland sites</u>
> - <u>conversion from wetlands to uplands</u>
> - reduction of organic production and forage yields
> - impaired habitat effectiveness for wildlife
> - degraded water quality
> - reduced base flows (p. E-3, citation omitted, emphasis added)

There are at least 14 extant Black Hills mountainsnail colonies located along or very near U.S. Highway 14A and based on the USFS's assessment, this highway has most likely negatively impacted and may continue to negatively impact these colonies and their habitat in a variety of ways.

First, the Highway may be causing excessive soil erosion and soil nutrient loss, which could reduce the size and extent of Black Hills mountainsnail colonies and habitat (Frest and Johannes 1993a, 2002, USFS 2002e). Second, the Highway may be "dewatering" moist areas or wetlands (USFS 2002e), thereby reducing the availability of moisture at existing Black Hills mountainsnail colonies and increasing the risk of desiccation (Solem 1974, Frest and Johannes 2002). The "dewatering" of moist areas has most likely reduced the availability of habitat for the species in Spearfish Canyon (Frest and Johannes 2002). Indeed, many Black Hills mountainsnail colonies in Spearfish Canyon are associated with moist areas (Frest and Johannes 1991, 1993a, 2002). Finally, the Highway may have converted and may still be converting wetland habitat to uplands (USFS 2002e), thereby reducing the availability of moisture at existing Black Hills mountainsnail colonies and reducing the availability of habitat for the species. The conversion of wetland habitat to upland habitat most likely reduced the size and extent of historical and extant Black Hills mountainsnail colonies, and most likely continues to threaten to destroy, modify, and/or curtail the range and habitat of the species in Spearfish Canyon (Frest and Johannes 2002). Given the USFS's conclusions and the fact that at least 14 extant Black Hills mountainsnail colonies – or over 40% of the species' extant population – are along or very near U.S. Highway 14A, it is highly likely that this road has already destroyed, modified, and/or curtailed and threatens to destroy, modify, and/or curtail the range and habitat of the species within a significant portion of its range.

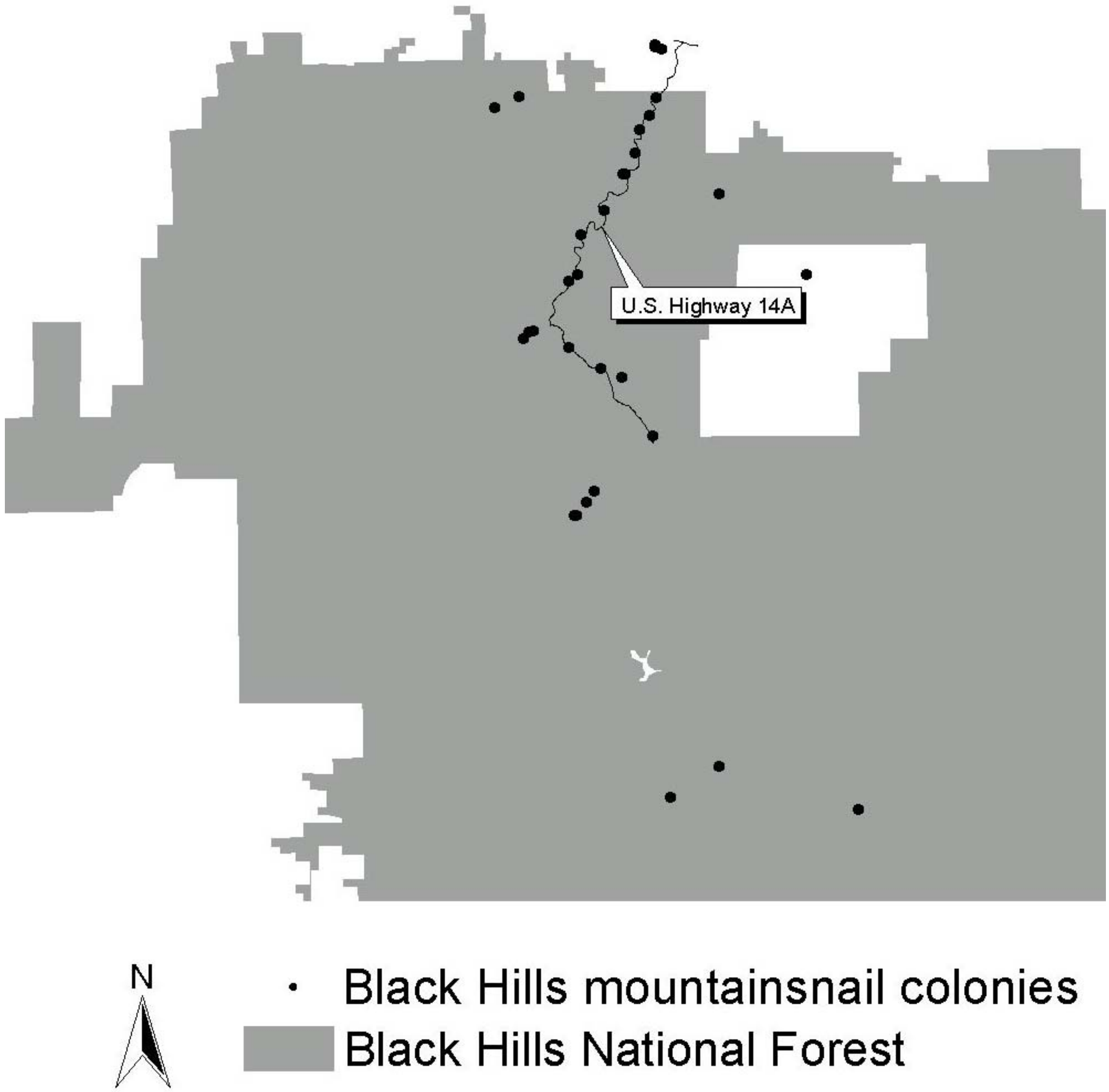

Figure 5. Extant Black Hills mountainsnail colonies in relation to U.S. Highway 14A; Black Hills National Forest shaded (Frest and Johannes 2002, USFS data). Map not to scale.

d. New road construction

Finally, the USFS is proposing to undertake many miles of road construction through several proposed timber sales that may negatively impact the Black Hills mountainsnail and its habitat throughout a significant portion of the species' range. See, Table 8. While these road construction and reconstruction proposals have not been finalized, the best available information strongly indicates that road construction and reconstruction threatens to destroy, modify, and/or curtail extant Black Hills mountainsnail colonies and habitat (Frest and Johannes 1993a, 2002).

Table 8. Proposed Road Construction that May Impact Black Hills Mountainsnail Colonies and Habitat.

Proposed Timber Sale	Miles of Proposed Road Construction (including temporary road construction and road reconstruction)	Potential Impacts to Black Hills mountainsnail and its habitat?	Source
Cabin-Deerfield	Unknown	Possible	USFS 2003b
Cement	79.98	Yes	USFS 2003f
Elk Bugs and Fuel	76.5	Yes	USFS 2002g, 2003d
Mineral	15-22	Yes	USFS 2002h
Power	7	Yes	USFS 2003g
Prairie	Unknown	Yes	USFS 2002c, 2003e
Research-Rochford	Unknown	Possible	USFS 2003b
Riflepit	15.2	Possible	USFS 2002h
Welcome-Sand	29	Yes	USFS 2003c

4. Edge effect of logging and roads

Logging, roads, and road construction that does not directly impact Black Hills mountainsnail colonies may be detrimental to the species and its habitat because of edge effect. The creation of edge effect, which is defined by Baker and Dillon (2000) as "the suite of differences in microenvironment and biota across edges between forest and nonforest or early successional vegetation" (p. 221, citations omitted), can be detrimental to land snails and their habitats (Murcia 1995). Edge effect is produced as logging, roads, and road construction create edge between cut and uncut forest (i.e., the edge) and as a result creates an environment that is different from interior or undisturbed forest habitat. Logging, roads, and road construction most often create edges between older forest and younger forest, but in some cases (i.e., clearcutting) creates edges between older forest and no forest. The creation of edges often leads to increased levels of light, increased air and soil temperatures, lower soil moisture, increased exposure to wind and other weather, and decreased diversity when compared to interior or undisturbed forest (Baker and Dillon 2000). Additionally, edges amplify or alter the effects of natural disturbances, such as fire (Baker and Dillon 2000). However, the impacts of edge effect often extend beyond the edge itself (Murcia 1995, Baker and Dillon 2000). The depth-of-edge influence, or the distance over which an edge environment differs from an undisturbed forest environment, may extend 60 meters (approximately 197 feet) or more from an edge into undisturbed forest (Baker and Dillon 2000). Thus, the detrimental impacts of logging, roads, and road construction may be experienced by Black Hills mountainsnail colonies and their habitat even though logging may be occurring 60 or more meters away.

In particular, edge effect associated with roads is most likely negatively impacting many extant Black Hills mountainsnail colonies throughout the range of the species. In a recent study of fragmentation on the Black Hills, Shinneman and Baker (2000) reported, “Roads and road edge habitat alone may cover more than one third of the study area, assuming a 100 m depth-of-edge influence” (p. 328). The referenced study area comprised 37,233 hectares (14,893 acres) of the northwestern Black Hills, all within the range of the Black Hills mountainsnail. This study strongly indicates that roads and the edge effect (including the depth-of-edge influence) associated with roads may be posing more widespread and detrimental impacts to the Black Hills mountainsnail and its habitat than has been previously reported. Indeed, many extant Black Hills mountainsnail colonies are within 100 m of a road (Frest and Johannes 1993a, 2002), strongly indicating that the edge effect of roads is a serious threat to the species and its habitat.

5. Herbicides and Pesticides

Herbicides and pesticides are generally detrimental to terrestrial and aquatic mollusks, including the Black Hills mountainsnail (Brown 1978, Frest and Johannes 1993a, 2002, South 1990, Schuytema et al. 1994). Frest and Johannes (2002) report, “Herbicide spraying is deleterious in direct proportion to its intensity and effectiveness on vegetation” (p. 112). Herbicides are typically toxic to land snails such as the Black Hills mountainsnail, and may also remove vegetative cover that prevents increased insolation and desiccation (Frest and Johannes 1997, 2002, USFS 2000c). Pesticides may cause mortality of Black Hills mountainsnails as a result of direct contact or as a result of ingestion (Schuytema et al. 1994). Weed control through the application of herbicides threatens many *Oreohelix* colonies in the states of Idaho, Montana, Oregon, and Washington (Frest and Johannes 1995a, b, 1997, Hendricks 2003).

On the Black Hills, herbicide application has been and is presently used to control the spread and proliferation of noxious and/or nonnative plant species (USFS 1996a, 2003a). To a lesser extent, insecticides have been and may continue to be used to control the spread and proliferation of “pest” insects such as the mountain pine beetle (*Dendroctonus ponderosae*) (USFS 1996a). In discussing past efforts to "control" the mountain pine beetle on the Black Hills, the USFS (1996a) states, "Large spray programs supplemented harvest activities from the late 1940s through the 1960s" (p. III-227, emphasis added). The qualifier "large" strongly indicates that extensive pesticide spraying occurred within the range of the Black Hills mountainsnail for at least nearly two decades. Past and present herbicide and pesticide application efforts on the Black Hills have therefore most likely contributed to destroying, modifying, and/or curtailing the range and habitat of the Black Hills mountainsnail (Frest and Johannes 1993a, 2002, USFS 1996a, 2003a).

Currently, herbicides pose threats to the Black Hills mountainsnail within all or a significant portion of its range. Indeed, one extant Black Hills mountainsnail colony, labeled "213" by Frest and Johannes (2002), is reported to be suffering from the effects of herbicide spraying (Frest and Johannes 2002). Additionally, the USFS (2003a) has recently developed and started implementing a Noxious Weed Management Plan for the BHNF ("BHNF Weed Plan"). The BHNF Weed Plan involves "Integrated Control" of noxious weeds, whereby herbicides and mechanical treatments will be used to treat 82,000 acres of existing noxious weed infestations and 22,300 acres of predicted noxious weed infestations on the BHNF (USFS 2003a). The USFS (2003a) concluded that the BHNF Weed Plan "may adversely impact" individual Black Hills mountainsnails (Appendix C, p. 40), strongly indicating that herbicide use authorized through the BHNF Weed Plan threatens the Black Hills mountainsnail throughout all or a significant portion of its range.

6. Mining

In discussing the impacts of mining to the Black Hills mountainsnail, Frest and Johannes (2002) state:

> …mining may have drastic effects. Areas directly mined or physically disturbed are generally sterile of land snails….Mine wastes and effluvia often contain acidic materials and heavy metals, most of which are extremely toxic to land snails. Regeneration of such areas would be expected to take place rather slowly under the best of circumstances for many species. (p. 105)

Frest and Johannes (2002) also report that, "Acid mine wastes, where exposed at the surface, are an unsuitable substrate for snails and appear to require very long periods of time to develop sufficiently alkaline soils to allow return of even common species" (p. 48). In discussing the impacts of mineral exploration, Frest and Johannes (2002) further report, "old-style prospecting and prospect pits" may negatively impact the Black Hills mountainsnail and its habitat (p. 112).

Mining has occurred extensively within the range of the Black Hills mountainsnail and is reported to have curtailed the range and habitat of the species (USFS 1996a, May et al. 2001, Frest and Johannes 2002). Indeed, no Black Hills mountainsnails were found in areas that had been mined (Frest and

Johannes 1993a, 2002). Frest and Johannes (2002) state, “Heavy mining activity in some areas also seems to have reduced snail occurrences….Typically, mined areas had snails completely extirpated, at least locally, due to removal of vegetation” (p. 48). Most significantly, mining activities are believed to have contributed to the extirpation of the Black Hills mountainsnail colony historically reported from the Deadwood area of the Black Hills (Pilsbry 1939), as well as other colonies that exist or may have existed in the area (Frest and Johannes 1993a, 2002). Frest and Johannes (2002) state, “Note that we were unable to relocate the historic Deadwood *Oreohelix cooperi* colony and that we found no others in the area or others heavily affected by recent mining” (p. 105). The loss of this colony strongly indicates that mining activity within the Deadwood area has curtailed the historic range and habitat of the Black Hills mountainsnail. As Figure 6 shows, the loss of the colony in the Deadwood area has pushed the range of the Black Hills mountainsnail westward and concurrently reduced the overall population of the species. Mining activity in other areas of the Black Hills has also most likely contributed to the destruction, modification, and/or curtailment of range and habitat of the Black Hills mountainsnail (USFS 1996a, Frest and Johannes 2002). Mining activity in the Spearfish Creek drainage has occurred in the past, resulting in direct ground disturbance, disturbance of Black Hills mountainsnail habitat (e.g., riparian areas, mature forest, springs and seeps), and acid mine drainage (USFS 1996a, May et al. 2001, Frest and Johannes 2002). Riparian habitat on the Black Hills is also reported to have been degraded or destroyed from the impacts of mining activities (Parrish et al. 1996, Marriott and Faber-Langendoen 1999).

Mining activity on the Black Hills continues to threaten the Black Hills mountainsnail and its habitat. The USFS (1996a) reports:

> Most of the gold production in the Black Hills has occurred in the Lead-Deadwood area, and current activity now centers within a 10-mile radius of Lead. In the next 10 years, exploration for and development of gold will probably be concentrated in the Lead-Deadwood and western Galena areas. New mine developments or expansions in the historic mining districts will probably be open-pit mines with either heap-leach or conventional milling to recover precious metals; it is predicted that most new developments will be expansions of existing mines.

Based on the USFS’s report, two extant Black Hills mountainsnail colonies are most likely threatened by mining activities in the Lead-Deadwood area. One colony is located in Blacktail Gulch north of Blacktail and is labeled “31” by Frest and Johannes (2002) and the other colony is located on a slope in False Bottom Creek west of Tetro Rock and is labeled “28” by Frest and Johannes (2002). Both colonies are within a 10-mile radius of Lead and are most likely to be negatively impacted by future mining activity in the Lead-Deadwood area (USFS 1996a, Frest and Johannes 2002).

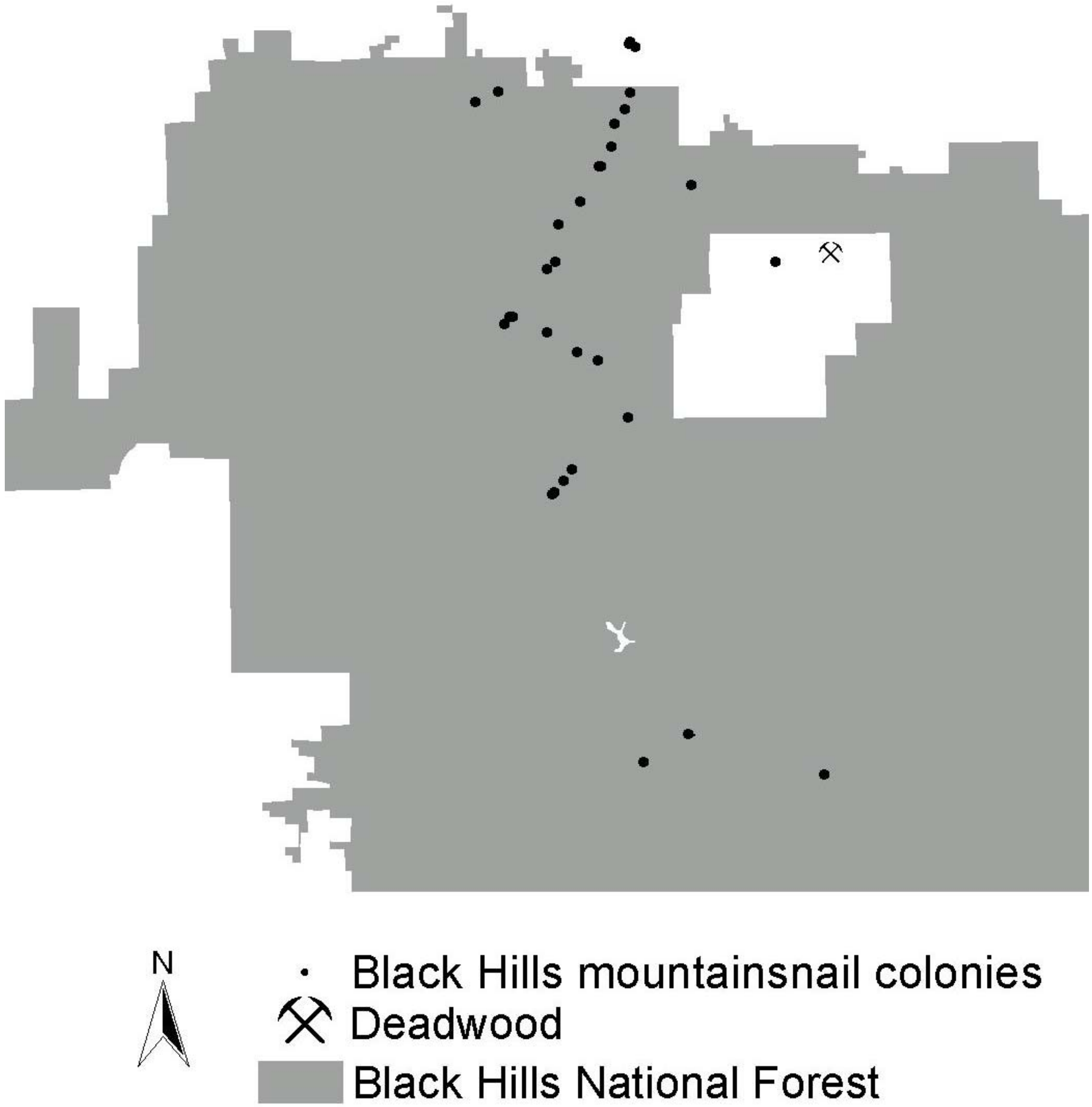

Figure 6. Location of Deadwood in Relation to extant Black Hills mountainsnail colonies (USFS data, Frest and Johannes 2002). Map not to scale.

7. Spring/Water developments

Frest and Johannes (2002) report:

Spring development generally results in loss of all or many freshwater mollusk and associated terrestrial forms. Effects include drying out of nearly all of the original spring area; disruption of soil, rock, and vegetational cover; encouragement of stock visits, with concomitant trampling

> effects and effects of "acidic" manure likely to accumulate in such settings. Unless some part of the source area is left intact and carefully protected, the effect of development is generally to completely extirpate the native freshwater mollusk fauna, as well as most of the diversity in other animal and plant groups. (p. 110).

Frest and Johannes (1995) also explain, "Perhaps the single most deleterious activity in arid and semi-arid ecosystems to both terrestrial and freshwater [snail] forms is development of springs" (p. 61).

Extensive spring development has occurred and continues to occur in the Black Hills (USFS 1996a, 1997a, b, c, d, Frest and Johannes 1993a, 2002). Frest and Johannes (2002) report:

> Spring and seep sites had land snail faunas unless heavily impacted, as nearly all were. In some cases, the fauna included potential candidates, such as *Oreohelix* spp. or *Vertigo arthuri*. Unfortunately, the vast majority of springs sites in the Black Hills National Forest has been either troughed or so heavily impacted by grazing as to exterminate all or nearly all land snails. (p. 50)

Many Black Hills mountainsnail colonies are associated with springs (Frest and Johannes 1993a, 2002), strongly indicating that the species has already been negatively impacted by spring development in the Black Hills. Spring development is reported to have caused the extirpation of some Black Hills mountainsnail colonies (Frest and Johannes 2002). Indeed, no live Black Hills mountainsnails have been found at sites where springs have been developed (Frest and Johannes 2002), strongly indicating that spring development has contributed to the species' decline and endangerment. At one site, labeled "14" by Frest and Johannes (2002), the species was found to be "long-dead" and the two reported, "Springs troughed or badly trampled where inadequately fenced" (p. A4), demonstrating that spring development has adversely impacted Black Hills mountainsnail colonies and continues to threaten the species and its habitat.

As stated above, no live Black Hills mountainsnails have been found at sites where springs have been developed (Frest and Johannes 2002). In surveys throughout the 1990's, Frest and Johannes (2002) report many instances where spring developments have degraded and/or destroyed the habitat of the Black Hills mountainsnail within the estimated range of the species.[6] See, Table 9. Although the two did not make a concerted effort to document every spring development within the range of the species, their findings consistently and strongly indicate that spring developments have destroyed, modified, and/or curtailed the range and habitat of the Black Hills mountainsnail.

[6] For the purposes of this table, survey sites located in the following United States Geological Survey 7.5' series topographic maps are estimated to be within the range of the Black Hills mountainsnail, although other locations may also have been within the historic range of the species: Red Canyon Creek, Tinton, Maurice, Spearfish, Deadwood North, Moskee, Old Baldy Mtn., Savoy, Lead, Deadwood South, Buckhorn, Crooks Tower, Nahant, Minnesota Ridge, Crows Nest Peak, Deerfield, and Rochford.

Table 9. Survey sites where spring developments were reported to degrade and/or destroy Black Hills mountainsnail habitat within the estimated range of the species (Frest and Johannes 2002).

Site Number (Frest and Johannes 2002)	Location (USGS 7.5' Quad)	Comment (Frest and Johannes 2002)	Black Hills mountainsnail found?
12	Old Baldy Mtn.	"Examined from stock tank to spring source. Poorly fenced off; mostly grazed out. No *Oreohelix* or other large land snails seen" (p. A4).	No
13	Old Baldy Mtn.	"No *Oreohelix* or other land snails seen. Badly grazed out and dry; springs troughed and trampled" (p. A4).	No
15	Old Baldy Mtn.	"Partially grazed, springs troughed or badly trampled where inadequately fenced" (p. A4).	No
144	Old Baldy Mtn.	"Spring has been troughed in the past and is now dry" (p. A27).	No
184	Crows Nest Peak	"Piped spring. Spring not marked on USGS map. No mollusks found" (p. A34).	No
187	Moskee	"Spring. No snails seen. Spring destroyed" (p. A34).	No

Spring development in the Black Hills continues to threaten the Black Hills mountainsnail throughout all or a significant portion of its range (Frest and Johannes 2002). Currently, there are no restrictions on spring development on privately owned lands, lands owned by the City of Spearfish, and lands owned by the Fish and Wildlife Service. Additionally, while the USFS currently prohibits development of springs where the Black Hills mountainsnail is known to exist (USFS 2001c), this measure fails to recover and restore habitat and colonies that have already been negatively impacted by spring development. Furthermore, this measure is flawed in other regards, which are discussed in detail further in this petition (see, "Inadequate Regulatory Mechanisms" section below).

8. Groundwater extraction

Springs and seeps that may provide habitat for the Black Hills mountainsnail or may support colonies of the species may be adversely impacted by groundwater extraction in and around the Black Hills. Spring and seep flows may be reduced due to groundwater extraction (USFS 1996a, Driscoll et al. 2002), which may reduce the availability of suitable habitat for the species (Frest and Johannes 2002). The USFS (1996a) states:

> Increasing population growth and suburbanization of the Black Hills will lead to increased water consumption. As the aquifers are tapped, there may be less water available for springs and for subsurface flow to streams. If the draw on groundwater increases enough, stream regimes may change from perennial to intermittent, or from intermittent to ephemeral in some locations. Groundwater extraction along the Carmel River in California led to severe bank erosion due to the riparian vegetation die-off and the subsequent loss of root stabilization. (p. III-57)

Indeed, groundwater extraction has been linked with reduced water levels in thermal springs and the endangerment of the Bruneau Hot springsnail (*Pyrgulopsis bruneauensis*) in the State of Idaho (USFWS 1993a). This strongly indicates that groundwater extraction in the Black Hills may similarly reduce water levels in springs and threaten the Black Hills mountainsnail.

Currently, groundwater extraction is occurring throughout the Black Hills region. The city of Rapid City, South Dakota receives water from Pactola Reservoir on Rapid Creek in the Black Hills and from groundwater from nine wells (Rapid City Water Division 2001). Custer, South Dakota currently receives water from two wells on the Upper French Creek watershed in the Black Hills and other wells that are recharged from subsurface flow from the French Creek watershed (USFS 1996a). Additionally, the City of Spearfish is developing a "deep-well program," indicating the city is utilizing groundwater in and around the Black Hills (USFS 1996a). The towns of Lead, Deadwood, and Central City in the northern Black Hills also rely to some extent on groundwater for consumption (USFS 1996a). The best available science strongly indicates that groundwater extraction in and around the Black Hills may have already reduced the flows of springs and seeps that may have supported the Black Hills mountainsnail (USFS 1996a), resulting in the degradation and/or destruction of the species' habitat (Frest and Johannes 2002). Additionally, the best available science strongly indicates that groundwater extraction currently threatens springs and seeps that may support extant Black Hills mountainsnail colonies and their habitats (USFS 1996a, Driscoll et al. 2002), and that these threats will continue due to continued groundwater extraction in and around the Black Hills and by continued "suburbanization" of the Black Hills (USFS 1996a).

9. Recreational activities and developments

In generally discussing the potential adverse impacts of recreational activities and developments to the Black Hills mountainsnail, Frest and Johannes (2002) report:

> …there is a real potential for difficulties in certain limited areas, such as Spearfish Canyon, or in remaining mature forests or other plant communities. Ironically, the most attractive features of some areas, e.g., relatively undisturbed forests, deep valleys, and absence of large-scale consumptive operations, to humans for recreational uses coincide with their attractiveness to other species as well. In general intense recreational usage will extirpate snail colonies. But intensity in part depends upon purpose. Camp grounds, for example, generally have more

> negative results than picnic grounds or day use areas. Fragmentation of populations is a minimum result in almost all cases. As before, no disturbance is the best policy. (p. 106)

Specifically, Frest and Johannes (2002) report:

> Hiking trail construction and maintenance, as well as use of such trails, is quite capable of extirpating snail colonies. One instance of human trail use destroying a population of the Endangered Iowa Pleistocene snail has been documented (see Frest, 1984, 1991, and references therein). The disturbance-induced small size and limited distribution of many of the Species of Special Concern must again be pointed out. Examples of snail colonies surviving trails across them can also be adduced; but conservative management should be the norm. Colony size is relevant here: larger colonies are more likely to be fragmented than completely extirpated. Other effects involve increased insolation, import of non-native plants; and side effects of greater access.
>
> Picnic area reconstruction. In general, snail colonies can survive low-use and low-impact picnic areas, although colony fragmentation and very local extinction occur; but increasing usage will cause extirpation. Colonies are unlikely to survive in such areas proper; and areas bordering picnic facilities will be impacted. Any considerable usage will be damaging. Other effects involve increased insolation, import of non-native plants; and side effects of greater access. (p. 109)

Several extant Black Hills mountainsnail colonies exist near well-developed and popular recreation areas, especially in Spearfish Canyon and along U.S. Highway 14A, where hiking trails, picnic areas, and other facilities have been constructed and continue to be maintained to facilitate recreational use (USFS 1996a, City of Spearfish Campground 2003, Frest and Johannes 1991,1993a, 2002). The USFS (1996b) reports, "This section of U.S. Highway 14A [through Spearfish Canyon], from the city of Spearfish to Cheyenne Crossing, receives very high recreational use throughout the year, but especially during the summer and fall" (p. III-53). Three Black Hills mountainsnail colonies, labeled "22," "23," and "226" by Frest and Johannes (2002), are located near the Roughlock Falls Picnic Area near the confluence of Spearfish Creek and Little Spearfish Creek, which is owned and managed by the Homestake Mining Company (Frest and Johannes 2002, USFS 2002e). The Roughlock Falls Picnic Area is a popular recreation area in Spearfish Canyon (USFS 2002e). One Black Hills mountainsnail colony, labeled "139" by Frest and Johannes (2002), is located near the Dead Ox Creek Picnic Area along Spearfish Creek (Frest and Johannes 2002). Two more Black Hills mountainsnail colony, labeled "26" and "190" by Frest and Johannes (2002), are located near a picnic area north of Bridal Veil Falls along Spearfish Creek (Frest and Johannes 2002). Finally, one Black Hills mountainsnail colony is located within the Spearfish City Campground (Frest and Johannes 2002), which is considered to be "one of the most popular facilities in the Black Hills" (City of Spearfish Campground 2003). The proximity of these colonies to well-developed, popular, and well-used recreation areas strongly indicates that recreational activities and developments may have already modified, destroyed, and/or curtailed the species' range and its habitat and threatens to modify, destroy, and/or curtail the species' range and habitat.

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

While Black Hills mountainsnails have been collected for scientific and educational purposes (Anderson 2002, Frest and Johannes 1991, 1993a, 2002), there is no indication that collecting poses any threat to the survival of the species (Frest and Johannes 1993a, 2002).

C. Disease or Predation.

The Black Hills mountainsnail is preyed upon by rodents, other small mammals, amphibians, reptiles, birds, insects, and insect larvae (Frest and Johannes 2002, Hall et al. 2002). The Black Hills mountainsnail may be preyed upon by the endemic Black Hills red-bellied snake (Hall et al. 2002), a former category 2 Candidate subspecies and a subspecies of concern in the Black Hills (USFWS 1994, USFS 1996a, Hall et al. 2002, USFS 2000c). Parasitism by insect larvae may also cause mortality of the Black Hills mountainsnail (Pilsbry 1939, Frest and Johannes 2002).

D. Inadequacy of Existing Regulatory Mechanisms.

Existing regulatory mechanisms are woefully inadequate to protect the Black Hills mountainsnail and its habitat. On private lands, the snail and its habitat receive no protection whatsoever. Thus, 9 extant colonies, or 28% of the extant population, are entirely unprotected. And as will be discussed below, the USFS and USFWS have taken entirely inadequate steps to protect and recover the Black Hills mountainsnail and its habitat in the Black Hills of South Dakota and Wyoming. Furthermore, the States of Wyoming and South Dakota and the City of Spearfish have absolutely no measures in place to protect the Black Hills mountainsnail and its habitat.

1. U.S. Forest Service

The USFS is responsible for managing most Black Hills mountainsnail colonies and their habitat on the BHNF in South Dakota and Wyoming (USFS 1996a, Frest and Johannes 2002). The USFS is required to maintain viable and well-distributed populations of native vertebrate species of wildlife in accordance with the National Forest Management Act ("NFMA") implementing regulations at 36 CFR § 219.19, although this requirement may soon be repealed (USFS 2002j). USFS policy has also relegated this protection to invertebrate species, such as the Black Hills mountainsnail. See, Forest Service Manual 2670.5(10) (1994) (defining "fish and wildlife" as "Any nondomesticated member of the animal kingdom including, without limitation, any mammal, fish, bird, amphibian, reptile, mollusk, crustacean, arthropod, or other invertebrate, and including any part, product, egg, or offspring, thereof, or the dead body or parts thereof."). However, given that the NFMA implementing regulations specifically relegate protection only to vertebrates, it is questionable whether this policy carries any weight.

The maintenance of viable populations of native species is supposed to occur through implementation of a Land and Resource Management Plan ("forest plan"), which directs management activities on the BHNF in accordance with NFMA implementing regulations. The purpose of a such a plan is to guide management of the BHNF. That management must occur such that the viability of native species is maintained.

a. 1997 BHNF Revised Land and Resource Management Plan and Environmental Impact Statement

Unfortunately, the Chief of the USFS ruled in 1999 that the 1997 Revised Land and Resource Management Plan and Environmental Impact Statement for the BHNF failed in many ways to ensure viable populations of native wildlife species (USFS 1999). With regards to the Black Hills mountainsnail, the USFS (1999) specifically stated:

> There is fairly strong language in the Frest [1993a] report relative to the declining status and potential extirpation of some of these species or subspecies from the planning area. In the case of one designated as MIS and sensitive, the BHNF constitutes potentially all or a significant portion of its range (Vol. R-34, p. 1489). Also, the authors made recommendations for listing some of the other surveyed species under the ESA. I am concerned that despite this information, the forest did not explicitly address these findings in the biological evaluation or elsewhere in the record. The biological evaluation (FEIS Appendix H) provided a good description of the habitat requirements of the two species listed as MIS and sensitive, along with a generic discussion of potential threats, but failed to adequately describe the current population and habitat status. Maps of the Forest showing habitat capability for these two species display suitable and optimal habitat (FEIS Appendix H, pp. H-149 through H-150), without addressing the findings in the Frest report that indicated much of the existing habitat area had been substantially modified by grazing or logging, leaving it unsuitable for these species (Vol. R-34, p. 1483, 1485). These shortcomings are further compounded by the lack of clearly stated population and habitat objectives and lack of a species-specific monitoring plan and monitoring objectives. The adequacy of standard 3103 in providing for the short-term or long-term viability of these species was not supported in the record. The determination (FEIS Appendix H, pp. H-142) that the proposed action "[m]ay adversely impact individuals but [is] not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability rangewide" appears to be unsupported.

The species referred to by the USFS (1999) includes the Black Hills mountainsnail and Cockerell's striate disk (*Discus shimeki*), both of which are considered "sensitive species" (USFS 1996a).

b. Phase I Amendment

Subsequent to the Chief's 1999 ruling, the USFS attempted to correct some inadequacies identified by the Chief through an interim "Phase I Amendment" to the 1997 forest plan. The only measure developed to specifically address the Black Hills mountainsnail is Standard 3103, which states:

> Ensure that all identified colonies (as indicated in Frest 1993, and subsequent Frest report [expected in 2001]) of…Oreohelix strigosa cooperi (Binney, 1858)…are protected from adverse effects of livestock use and other management activities. (USFS 2001c, p. E-15)

However, while Standard 3103 may look good on paper, in reality it does very little to actually protect the Black Hills mountainsnail on the ground.

To begin with, Standard 3103 relegates protection only to colonies identified in Frest and Johannes' reports (1993a and 2002). Therefore, Standard 3103 entirely fails to ensure any recovery of the species and its habitat and essentially maintains the status quo. This, despite the fact it is well-documented that the species has declined in both population and range throughout all or a significant portion of the species' range and is most likely not viable (Frest and Johannes 1991, 1993a, 2002). Furthermore, by protecting only known colonies, Standard 3103 forecloses protection for any potentially undiscovered Black Hills mountainsnail colony. While Frest and Johannes (2002) believe that very few Black Hills mountainsnail colonies remain to be discovered, the two report, "We fully expect that additional colonies of some or all of the Species of Special Concern could be found in the Black Hills" (p. 114). The USFS (2001c) even has recognized, "Unknown colonies may still be affected, but the overall population would be maintained over the next 5 years" (Appendix G, p. 38). Thus, there is a possibility that previously undiscovered colonies will be adversely impacted and possibly extirpated under current USFS management direction on the BHNF.

Most significantly though, is that Standard 3103 fails to provide any well-defined and substantive direction for how colonies of Black Hills mountainsnail will actually be protected on the ground. According to the USFS (2001c) , "The word 'protected' generally infers that the area would be deferred from timber harvest and/or fenced from livestock grazing, recreation, or other activities. Colonies would be protected such that activities would not occur on those sites" (Appendix G, p. 38). However, this statement seems only to underscore the failure of Standard 3103 to provide well-defined and substantive direction meant to protect the Black Hills mountainsnail. For instance, the USFS (2001c) does not define what "area" will actually be "protected," how this "area" will be determined, and who will make this determination. Also, the USFS (2001c) overlooks the species' habitat needs, as there is no direction provided to ensure the protected "area" includes the species' habitat. There is no indication that, as implemented on the ground, Standard 3103 will protect an adequate "area" that will ensure the long-term survival of Black Hills mountainsnail colonies. And, while fencing Black Hills mountainsnail colonies from grazing, recreation, and other activities could potentially benefit the species, there is no direction given to ensure an adequate "area" is fenced or that fencing takes place at all.

Recently, Standard 3103 has been applied as a buffer around known colonies, although as Standard 3103 is written, there is no requirement that a buffer be emplaced. For instance, the USFS (2001a) proposed to, "Protect all known snail colony locations with a 200 foot buffer of no disturbance" (p. 2-11). In another instance, the USFS (2002i) implemented a "100-foot no activity buffer" around snail species of concern colonies. However, the USFS has provided no scientific support for the effectiveness of such buffers and there is no indication that a 100 or even 200 foot buffer is adequate (Frest and Johannes 1993a, 2002). Indeed, experts have criticized the use of a flat buffer because the practice usually fails to consider and protect key habitat components that support Black Hills mountainsnail colonies (Frest 1984, 2003, Frest and Johannes 2002). Furthermore, the USFS's use of inconsistent buffers (e.g., 100 and 200 feet) underscores the failure of Standard 3103 to provide well-defined and substantive protection to Black Hills mountainsnail colonies and the overall inadequacy of this regulatory mechanism.

Often though, project-level protection of Black Hills mountainsnail colonies has relied on measures that are as vague as Standard 3103. For instance, through the recently authorized Mercedes timber sale, the USFS (2002b) simply proposed to:

> Protect three identified colonies (Frest 1993, Frest 2001) of the following snail species (*Discus shimeki, Oreohelix strigosa cooperi, Vertigo arthuri, Vertigo paradoxa, Catinella gelida, Oreohelix strigosa n. subspecies and Oreohelix strigosa berryi* from adverse effects caused by vegetation management activities, livestock grazing, road maintenance/building activities, noxious weed treatments and prescribed fire (Standard 3103)

However, the USFS failed to define how the three snail colonies would actually be protected under this measure. Therefore, the measure failed to provide any well-defined and substantive protection to snail species of concern colonies. Similarly, through the recently authorized Peak timber sale, the USFS (2002a) simply asserted that it would "avoid" Black Hills mountainsnail colonies during timber harvest and road construction operations. Yet, the agency failed to describe how exactly Black Hills mountainsnail colonies would be avoided, to what extent they would be avoided, and to what extent adverse impacts would be eliminated. As is evident, Standard 3103 is applied very inconsistently by the USFS, compounding the overall ineffectiveness of this measure.

Through the USFS's grazing program on the BHNF, the agency has attempted to fulfill the requirements of Standard 3103 by fencing off some Black Hills mountainsnail colonies from livestock grazing. However, Frest and Johannes (2002) criticize this method of "protection," stating:

> In practice, however, fencing is often relatively ineffective as a protective measure. To function properly, it must be done with some care; and field crews sometimes do not exercise such care. For example, at our sites 13 and 16 fencing was initiated or increased between 1993 and our 1999 visits. This fencing was most effective at site 13, which lacked significant elements and apparently had not been fenced previously, but not at 16, which had been fenced previously and had an *Oreohelix* colony in 1993 that was extinct by 1999. Moreover, maintenance of such fences is sometimes done inadequately or haphazardly, in our experience. Fencing must be constantly and vigilantly maintained to be effective; and adequate staff and budgets for fencing and inspection must be maintained perpetually. Moreover, the right areas must be fenced to protect important elements. (p. 111)

The two further report:

> Fencing of riparian areas and allotments generally suffers from the same drawbacks as spring fencing. In practice, a certain amount of accidental and circumstantial damage and deliberate sabotage also takes place for various reasons, and is not necessarily instantly corrected. Id.

Indeed, fencing of colonies appears to have had limited success on the ground in the Black Hills. While Frest and Johannes (2002) report that fencing benefited one Black Hills mountainsnail colony, fencing around other colonies has proven ineffective (Frest and Johannes 2002). At one site, labeled "14" by Frest and Johannes (2002) inadequate fencing appears to have contributed to the extirpation of a Black Hills mountainsnail colony. Frest and Johannes (2002) also report instances in which fencing failed to protect other rare land snails in the BHNF. The two report:

> The contrast between a partly well-fenced spring site such as 16 and a poorly protected one such as 12 (conditions described in the 1991 report) was very striking. On our revisit in 1999, we noted that fencing at site 16 had proven inadequate: several cow paths now crossed the site; and *Oreohelix* n. sp. 1 now appears extirpated at this site. (p. 47)

In most instances though, the USFS has not even taken measures to fence around Black Hills mountainsnail colonies, leading to direct impacts and contributing to the extirpation of Black Hills mountainsnail colonies (Frest and Johannes 2002). Notably, colonies labeled "28," "43," "46," "51," and "154" by Frest and Johannes (2002) are all reported to lack fencing and to have experienced direct negative impacts from livestock grazing. Of these colonies, "43," "46," and "51" are reported to be extirpated. Although it is questionable whether fencing could adequately protect these colonies and their habitat or ensure their recovery, the fact that the USFS has not even attempted to protect these areas strongly indicates that Standard 3103 is inadequate to protect and recover the species. Finally, the USFS has been criticized recently for its failure to properly manage domestic livestock on the BHNF and adequately protect ecological values from the negative impacts of grazing (see e.g., USFWS 2001, USFS

1999). It is questionable whether the agency can be relied upon to ensure the Black Hills mountainsnail is adequately protected from livestock grazing.

Beyond Standard 3103, the Phase I Amendment also provides some direction to protect habitat for sensitive species associated with moist conditions, such as the Black Hills mountainsnail. Under the Phase I Amendment, the USFS is required by Standard 3104 to:

> Protect habitat for sensitive plants and animals associated with moist soil conditions. Do not develop springs or seeps as water facilities where sensitive species exist. (USFS 2001c, Appendix E, p. 16)

While Standard 3104 does provide some good direction for the protection of the Black Hills mountainsnail and its habitat, the Standard simply does not do enough. First, this measure fails to specify exactly where habitat will be protected. It is unclear whether all habitat will be protected on the BHNF or if habitat will only be protected where the species currently exists on the BHNF. Second, Standard 3104 fails to describe how habitat for sensitive plants and animals associated with moist soil conditions will actually be protected. Without well-defined and substantive direction for how habitat will be protected, it is very questionable whether the Black Hills mountainsnail and its habitat can be adequately protected. Third, although Standard 3104 prohibits spring and seep developments "where sensitive species exist," this direction misses two key points. One, that most springs and seeps have already been developed in the Black Hills (Frest and Johannes 2002), making it unlikely that this Standard will do anything to protect the Black Hills mountainsnail. And two, that protecting habitat only where the species is known to exist fails to ensure the recovery of the species and fails to protect any undiscovered colony that may be associated with springs or seeps. Finally, Standard 3104 is fatally flawed in that the measure fails to provide for any recovery and/or restoration of Black Hills mountainsnail habitat. As discussed earlier, Black Hills mountainsnail habitat has already been extensively destroyed and/or degraded, especially in upland sites of the BHNF. Standard 3104 fails to provide any direction to reverse this trend and restore habitat for the species that has been lost or altered.

c. Beyond the Phase I Amendment

Besides Phase I Amendment direction, the USFS has few regulations in place to protect the Black Hills mountainsnail and its habitat. Currently, there is no requirement that the USFS conduct surveys for the Black Hills mountainsnail before implementing projects that may adversely impact the species and its habitat (USFS 1996a, b, 2001c). And while, the Black Hills mountainsnail is currently designated as a "sensitive species" by the USFS (USFS 1996a), this designation seems to provide the species little to no protection. Sensitive species are supposed to be managed by the USFS in accordance with FSM 2670.22 which states:

> 1. Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions; 2. Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands; and 3. Develop and implement management objectives for population and/or habitat of sensitive species[.]

However, the USFS has not developed and implemented management practices to ensure the Black Hills mountainsnail does not become threatened or endangered, has failed to ensure populations are viable and well distributed throughout their geographic range, and has not developed and implemented any population and/or habitat objectives for the species (USFS 2001c, Frest and Johannes 2002). Indeed, despite these requirements, the Black Hills mountainsnail has continued to be adversely impacted by livestock grazing and other activities, has continued to disappear from its historic range, has continued to decline in population, and is still at risk of extinction (Frest and Johannes 2002). Furthermore, since the Black Hills mountainsnail was designated as "sensitive," no recovery of the species' population or range has been reported (Frest and Johannes 2002). Finally, the USFS has apparently recently proposed to remove the Black Hills mountainsnail from its list of sensitive species (USFWS 2002), making it further unlikely that the species' "sensitive" designation can provide any meaningful protection and shows o commitment by the USFS to protect the species. It is unknown why the USFS is proposing to remove the snail from the sensitive species list.

d. Inadequate monitoring

Compounding the ineffectiveness of any measure that could potentially protect the Black Hills mountainsnail and its habitat on the BHNF, is that the USFS has an entirely inadequate monitoring plan in place. To begin with, it is entirely unclear to what extent the USFS even monitors the Black Hills mountainsnail and its habitat. According to the USFS's Monitoring Implementation Plan (2001b), "index" sites, which are Black Hills mountainsnail colonies identified by Frest and Johannes (1993a, 2002), are to be monitored to determine the habitat conditions and presence of specimens. However, in describing the "Sample Design," or proposed monitoring procedure, the USFS (2001b) states, "Each 'index' site identified in the Frest report(s) that could be affected by forest management will be monitored on a rotating basis, so that each site is monitored every four years" (p. 40). Therefore, while the USFS (2001b) states that Black Hills mountainsnail colonies will be monitored, apparently only those colonies that have the potential to be "affected by forest management" will actually be monitored. Unfortunately, the discretion provided by this proposed monitoring scheme raises serious questions over its effectiveness. Indeed, the USFS (2001b) does not make clear exactly what forest management actions could negatively impact Black Hills mountainsnail colonies and fails to disclose when and where the USFS makes determinations as to whether or not forest management actions impact the Black Hills mountainsnail. For instance, while domestic livestock grazing is an ongoing activity that could potentially impact Black Hills mountainsnail colonies, there is no indication that the agency will monitor colonies within active grazing allotments. At the least, it is unclear to what extent the agency will monitor the species and detect trends and/or adverse impacts.

The USFS's (2001b) monitoring plan is further flawed in that it only requires Black Hills mountainsnail colonies be monitored every four years. It is difficult to see how the USFS's (2001b) monitoring plan can effectively detect adverse effects to Black Hills mountainsnail colonies and habitat, and make adjustments in management practices before the species is detrimentally impacted and potentially extirpated. Based on the USFS's (2001b) monitoring plan, adverse effects to colonies and habitat could go undetected for up to four years. For example, an ineffective fence closure could potentially allow a colony to be adversely impacted by livestock grazing for four years before being detected by the USFS and before any corrective action is taken. The timing of the USFS's monitoring is therefore a major flaw that fails to adequately ensure the Black Hills mountainsnail and its habitat are protected from adverse impacts.

e. Downfalls of NEPA

The USFS is also required to comply with the National Environmental Policy Act ("NEPA") when authorizing grazing, implementing logging projects, and undertaking road construction projects. NEPA requires federal agencies to consider the effects of their actions on the environment, but it does not prohibit the USFS from choosing alternatives that negatively impact the Black Hills mountainsnail and its habitat. In practice, NEPA is a procedural statute and provides no substantive protection.

f. Phase II Amendment

Finally, the USFS is in the process of making more long-term changes to the BHNF forest plan through a "Phase II" Amendment to the Revised Black Hills National Forest Land and Resource Management Plan (USFS 2001d). While not completed yet, the USFS has already proposed managing certain species on the Black Hills as "species of local concern" (Twiss 2002b, USFS 2002d). The Black Hills mountainsnail is being proposed as a "species of local concern" (USFS 2002d). However, there are no laws, regulations, or policies in place that direct how "species of local concern" are to be managed and protected. According to BHNF Supervisor John Twiss (2002b), the BHNF will manage species of local concern "through implementation of the Land and Resource Management Plan (LRMP)." The goal of the

USFS is to "address species of local concern through the LRMP planning process to provide a reasonable probability that the species will continue to persist on the Forest" (Twiss 2002b). Unfortunately, a "reasonable probability that the species will continue to persist" provides little assurance that the Black Hills mountainsnail and its habitat will be adequately protected and recovered through the Phase II Amendment. Preliminary information strongly indicates that the USFS will continue to allow the Black Hills mountainsnail and its habitat to be adversely impacted on the Black Hills through the Phase II Amendment (USFS 2002d, Twiss 2002b).

2. U.S. Fish and Wildlife Service

The Black Hills mountainsnail was designated a category 2 Candidate species in 1991 by the USFWS (USFWS 1991, 56 Fed. Reg. 58804-58836). A category 2 Candidate species was defined as a species:

> [F]or which information now in possession of the [U.S. Fish and Wildlife] Service indicates that proposing to list the species as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threats are not currently available to support proposed rules at this time (56 Fed. Reg. 58804).

However, in 1996 the category 2 Candidate designation was eliminated and the species lost its Candidate status (61 Fed. Reg. 64481-64485). Since then, the Black Hills mountainsnail has not regained its Candidate status and the USFWS has not given the species any special attention. Indeed, while the USFWS helped to fund surveys for the species in 1991 and 1992 (Frest and Johannes 1991, 1993a), the agency did not help fund surveys for the species in 1999 (Frest and Johannes 2002).

The USFWS also has the authority to manage the Black Hills mountainsnail and its habitat on their lands. Currently, two Black Hills mountainsnail colonies are located on USFWS lands at the D.C. Booth National Historic Fish Hatchery south of Spearfish, South Dakota (Frest and Johannes 2002). However, it does not appear the USFWS is utilizing its authority to ensure these Black Hills mountainsnail colonies are adequately protected (Larson 2003).

3. State of South Dakota

All extant Black Hills mountainsnail colonies exist in the State of South Dakota (Frest and Johannes 2002). However, these colonies, as well as the habitat upon which they depend, are not protected by South Dakota law and furthermore, no South Dakota law provides a mechanism for protecting and recovering invertebrates (South Dakota Statutes, Endangered and Threatened Species).

4. State of Wyoming

While no extant Black Hills mountainsnail colonies currently exist in the State of Wyoming, the species historically and very recently inhabited lands within the State of Wyoming (Frest and Johannes 2002). However, the State of Wyoming has no mechanism for protecting and recovering threatened, endangered, or other rare and imperiled species, let alone the Black Hills mountainsnail. Even the Wyoming Natural Diversity Database, which tracks and records the status of rare and imperiled species in the State of Wyoming, does not track invertebrates (Wyoming Natural Diversity Database 2003).

5. City of Spearfish, South Dakota

One extant Black Hills mountainsnail colony exists in the City of Spearfish Campground (Frest and Johannes 2002). The only "rules" that are in place at the Campground relate to protecting human visitors and reducing conflicts between campers. For instance, the Campground requires that "All pets must be leashed," that the "Speed limit in the campground is 10 mph," and that the "Checkout time is 12:00 Noon" (City of Spearfish Campground 2003). However, there are no rules that protect and/or recover rare and imperiled species and their habitats from the threat of recreational activities, from picnic area expansion, or from further campground development. Finally, the City of Spearfish has no mechanism in place to protect and/or recover any rare or imperiled species, such as the Black Hills mountainsnail.

E. Other Natural or Manmade Factors Affecting the Continued Existence of the Black Hills mountainsnail.

1. Vulnerability of small, isolated populations

Due to past and present habitat destruction and degradation, the size and extent Black Hills mountainsnail colonies have been reduced and fragmented (Frest and Johannes 1993a, 2002). The small size and isolation of extant Black Hills mountainsnail colonies now makes the species more susceptible to stochastic events and extinction (Allee et al. 1949, Petersson 1985, Goodman 1987, Lacy 1987, Brussard and Gilpin 1989, Hanski et al. 1996, Swengel and Swengel 1997, Frest and Johannes 1993a, 2002). Frest and Johannes (2002) identified 18 Black Hills mountainsnail colonies, or 56% of the entire population, where the species was "rare" or "uncommon," strongly indicating that small colony size may place the species at greater risk of extinction. Additionally, most Black Hills mountainsnail colonies exist in isolation. Frest and Johannes (2002) report, "existing colonies are often geographically restricted and isolated, with large areas of unsuitable habitat intervening" (p. 105). This isolation places serious limits on the ability of colonies to disperse, expand, and/or interact with other colonies, and the ability of the species to recover from natural and human-caused disturbances. Frest and Johannes (2002) report, "Given their comparatively small size, susceptibility to desiccation and predation, and limited motility, most Western land snails are not rapid colonizers. Hence, they are in general unable to respond quickly to environmental change" (p. 54). The isolation of Black Hills mountainsnail colonies has most likely rendered the species more vulnerable to extinction within all or a significant portion of the species' range.

2. Habitat fragmentation

Fragmentation of Black Hills mountainsnail habitat and colonies is a serious threat to the continued survival of the species (Wilcox and Murphy 1985, Knight et al. 2000, Frest and Johannes 2002). Frest and Johannes (2002) report that most land snail populations on the Black Hills, including Black Hills mountainsnail populations, are "small and fragmented with much intervening area lacking or with very limited mollusk faunas" (p. 115). The two also report:

> Land snails, as well a many other forest floor taxa, have relatively slow rates of migration (Niwa et al. 2001). In the present, largely disturbed conditions typical of the Black Hills National Forest, there remain relatively few population reservoirs for many species, and existing colonies are often geographically restricted and isolated, with large areas of unsuitable habitat intervening. Connectivity is thus a major problem, even for relatively common taxa (Stacey and Taper 1992). (p. 105)

Fragmentation of forest in the Black Hills and within the range of the Black Hills mountainsnail is reported to be a real problem (Shinneman 1996, Shinneman and Baker 2000, Frest and Johannes 2002). Fragmentation of Black Hills mountainsnail habitat and colonies most often leads to the isolation of the colonies and/or a reduction in the size and extent of colonies (Frest and Johannes 2002), making the species more vulnerable to extinction (Allee et al. 1949, Petersson 1985, Brussard and Gilpin 1989, Hanski et al. 1996, Swengel and Swengel 1997, Frest and Johannes 1993a, 2002). Additionally, fragmentation of Black Hills mountainsnail habitat and colonies most likely prevents recovery of the species as there exists a lack of connectivity between suitable Black Hills mountainsnail habitats (Frest and Johannes 2002). Therefore, the ability of the species to colonize or restore itself in suitable habitats has been seriously impaired, if not prevented altogether, within all or a significant portion of its range (Frest and Johannes 2002). Frest and Johannes (2002) report, "Recovery would be slow at best, and most likely would not occur at all at most localities" (p. 105). Fragmentation therefore poses significant risks to the well-being of the species.

3. Forest fires

Forest fires threaten Black Hills mountainsnail colonies and habitat. Frest and Johannes (2002) report:

> In general, land snails were absent from areas with recent severe forest fires (site 133 is an example). Judging by our collecting in other coniferous forest-dominated areas, land snails are generally able to tolerate light burns. However, intense fires, i.e. those which consume forest litter and downed wood as well as tree crows and shrubs, effectively sterilize the affected area of land snails. (p. 52)
>
> Severe forest fires increase insolation, destroy ground cover and litter, increase soil erosion rates, acidity the soil, drastically alter the plant community, remove shelter, hibernation, and egg-laying sites, and alter the forest floor microclimate (Agee, 1933). (p. 105)

Forest fires naturally occur on the Black Hills (Graves 1899, Shinneman 1996, Shinneman and Baker 1997, USFS 1996a), although human-caused fires have occurred throughout the forest (see e.g., Graves 1899, USFS 2001a). While low-intensity surface fires are reported to occur in the Black Hills (USFS 1996a, Brown and Sieg 1999), the natural occurrence of large-scale, stand replacing fires on the Black Hills is also well documented (Graves 1889, Duthie 1930, Shinneman 1996, Shinneman and Baker 1997). It is also believed that large-scale, stand-replacing forest fires in ponderosa pine forests, such as the Black Hills, are naturally more common than believed and reported in recent times (Baker and Ehle 2001). Thus, forest fires – whether they be low-intensity surface fires or large-scale stand replacing fires –are a very real threat to the Black Hills mountainsnail within the species' entire range.

Indeed, several instances have been reported where past fires had destroyed and/or degraded Black Hills mountainsnail habitat and potentially destroyed colonies of the species (Frest and Johannes 2002). Furthermore, fires elsewhere have been found to detrimentally impact land snails and their habitats, including *Oreohelix* species (Frest and Johannes 1995a, 1997, 2002, Beetle 1997, USFS 2001a). The Jasper Fire, which burned in the Black Hills in August of 2000, caused the extirpation of several colonies of land snails that are of conservation concern (USFS 2001a). A fire in northern California led to the complete extirpation of many land snail colonies (Frest and Johannes 2002). The 1988 fires in Yellowstone National Park also led to the extirpation of land snail colonies and decreased land snail diversity (Beetle 1997).

While forest fires are a naturally occurring event on the Black Hills, there is evidence that past and present management of the Black Hills may be leading to increases in fire intensity and occurrence. This in turn may be threatening of the species. There is evidence that logging, thinning, road construction, and domestic livestock grazing may cause increased fire occurrences and intensities (Schroeder and Buck 1977, McKelvey and Busse 1996, Sierra Nevada Ecosystem Project 1996, Belsky and Blumenthal 1997, Hann et al. 1997, Aber et al. 2000, Gorte 2000, Baker and Ehle 2001, USFS 2001a, d). Belsky and Blumenthal (1997) concluded:

> The studies we have discussed here suggest that livestock have actively participated in the destabilization of ponderosa pine and mixed coniferous forests. The hot fires that swept through forests of central and eastern Washington and Oregon during the summers of 1994 and 1996 may have been, partially, a result of a century of livestock grazing. (p. 324)

The USFS (2000d) reports, "A potential factor in the increase in fire size and severity may be related to increased incidence of human-caused ignition. Human access is likely to be increased by roads, a factor that will greatly increase the chances of both accidental and intentional human ignitions" (p. 3-74). Some of the largest fires in the recorded history of the Black Hills have burned in recent years. In many cases, these fires burned in areas that had experienced extensive logging, thinning, and road construction (see e.g., USFS 2001a). The USFS (2001a) reported:

> In recent years (since 1987) there have been many timber sales in the Jasper area including 24 large sales (greater than 1.0 mmbf [million board feet])….A total of approximately 183 mmbf of timber has been harvested in the area from these 24 sales. (p. 4-5).

The Jasper Fire was the largest fire to burn in the recorded history of the Black Hills (USFS 2001a), strongly indicating that past management of the area contributed to the unusually large and intense forest fire. Thus, while wildfires in the Black Hills inherently pose risks to the well-being of the Black Hills mountainsnail, past, present, and future forest management may be exacerbating wildfire risks to the species and its habitat.

4. Flooding

While Frest and Johannes (2002) do not report flooding to be a threat to the species, accounts from the USFS have demonstrated that flooding poses risks to the well-being of the Black Hills mountainsnail. After surveys of the Sand Creek allotment on the Bear Lodge Ranger District of the BHNF, the USFS (2000b) reported:

> The location that was given on the map was searched for snails. It appears that after the 1993 Frest report was published, a large bed-load carrying flood occurred in this location. Approximately two feet of bed-load was deposited over the site where the snails were previously located. The water would have been at least four feet in depth in order to deposit that quantity of material, which would have scoured and carried away any snail or habitat in that vicinity.

Frest and Johannes (2002) also found no snails at this particular colony in later surveys. Although livestock grazing has been reported to directly and adversely impact this extirpated colony (Frest and Johannes 1993a, 2002), the USFS's report indicates that flooding most likely contributed to the extirpation of this Black Hills mountainsnail colony.

The potential for flooding to impact other Black Hills mountainsnail colonies and the species' habitat is a very real threat to the species throughout its range (USFS 1996a). In 1972, a massive flood occurred in the Rapid Creek watershed (USFS 1996a, Carter et al. 2002). The USFS (1996a) describes the flood:

> The highest recorded discharges on Rapid Creek occurred on June 9 and 10, 1972 (Table III-7), when heavy rains falling over the east-central Black Hills broke all previous precipitation records….In less than five hours, 15 inches of rain fell near Nemo on Box Elder Creek and 14.5 inches fell near Sheridan Lake. Halligan and Longsdorf (1976) concluded that it was the steep grade of the channel descent (up to 100 feet per mile) combined with the high-intensity precipitation that led to the high flood stages and flow velocities. The damage included 238 people dead, 3,057 people injured and $164 million in property losses. (p. III-63)

While the flood of 1972 is an extreme example of the potential impacts of a large, catastrophic flood, this event strongly indicates that flooding of this nature occurs in the Black Hills and is a threat to the species' continued survival. In conjunction with other anthropogenic threats to the Black Hills mountainsnail and its habitat, flooding threatens the well-being of the species.

5. Environmental stochasticity

Because of its small, isolated, and fragmented population, the Black Hills mountainsnail may be at risk of extinction because of environmental stochasticity, which may exacerbate the effects of anthropogenic environmental change and lead to irreversible population crashes (Lande 1993, Hanski and Moilanen 1996, Frest and Johannes 2002). Frest and Johannes (2002) report, "Given their comparatively small size, susceptibility to desiccation and predation, and limited motility, most Western land snails are not rapid colonizers. Hence, they are in general <u>unable to respond quickly to environmental change</u>" (p. 54, emphasis added). The occurrence of natural, catastrophic disturbances on the Black Hills is well-documented (<u>see e.g.</u>, Graves 1899, Duthie 1930, Froiland 1990, Raventon 1994, USFS 1996a, 2001a, Shinneman and Baker 1997, Carter et al. 2002). The USFS (1996a) states, "The climate of the area is highly variable…Severe weather can occur, including hailstorms, high winds, and rare tornadoes. Heavy blizzards can occur, most often in late winter/early spring" (p. III-7). Furthermore, the Black Hills mountainsnail has already experienced reductions in range, population, and habitat and is most likely not viable and at a higher risk of extinction (Ruggiero et al. 1994). In conjunction with other threats to the species and its habitat, environmental stochasticity poses significant risks to the well-being of the species.

6. Climate change

Climate change is reported to be a significant threat to the well-being of the Black Hills mountainsnail (Frest and Johannes 2002). According to the Environmental Protection Agency ("EPA")

(1998b), “The earth’s climate is predicted to change because human activities are altering the chemical composition of the atmosphere through the buildup of greenhouse gases – primarily carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons” (p. 1). The agency reports temperature increases, changes in precipitation, soil moisture, and sea level as effects of climate change (EPA 1998a, b). Average temperatures in South Dakota and Wyoming have already been increasing from anthropogenic climate change (EPA 1998a, b). The agency predicts that over the next century, the climate may change even more. According to the EPA (1998), “Changes in climate can be expected to further stress ecosystems and wildlife such as the mountain lion, black bear, longnose sucker, fringe-tailed myotis, marten, and bald eagle” (p. 4). Climate change in South Dakota could lead to hotter, drier weather that “could increase the frequency and intensity of wildfires, decreasing the range and density of ponderosa pines, especially in the Black Hills” (EPA 1998b, p. 4). A decrease in the range and density of ponderosa pine in the Black Hills would directly decrease the availability and suitability of Black Hills mountainsnail habitat (Frest and Johannes 2002), increasing the risk of desiccation of colonies and individuals (Frest 1984, Solem 1974, Frest and Johannes 2002). The EPA (1998b) states, “Grasslands and savanna eventually could replace many of the forests and riparian woodlands in South Dakota” (p. 4), strongly indicating that climate change threatens to convert Black Hills mountainsnail habitat from suitable forest habitat to unsuitable grassland and savanna. Climate change also has the potential to push ecological zones upward, thus reducing the availability of suitable Black Hills mountainsnail habitat on the Black Hills (EPA 1998b, a, McCarty 2001). McCarty (2001) wrote, “Ongoing climate change is an additional source of stress for species already threatened by local and global environmental changes, increasing the risk of extinction” (p. 325).

VII. CRITICAL HABITAT

This petition requests that critical habitat be designated for the Black Hills mountainsnail concurrent with final ESA listing.

VIII. ECOSYSTEM PROTECTION UNDER THE ESA

The purpose of the ESA, as described by the Act itself, is to “provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved…” (16 U.S.C. § 1531(b)). The ESA was specifically intended to prevent the extinction of species such as the Black Hills mountainsnail, which now faces a high risk of extinction due to the combined threats of extensive habitat destruction and degradation on the Black Hills.

Moreover, the ecosystem protection dimension of the ESA’s purpose was not anomalous or unintentional (Rosmarino 2002). Committee reports leading up to the passage of the Act in 1973 consistently endorsed the ecosystem protection goal. A July 1973 House Report commented that "the ecologists' shorthand phrase 'everything is connected to everything else' is nothing more than cold, hard fact" (H. Rep. 93-412: 6) and a Senate Report similarly indicated that species need to be protected due to their "vital biological services to maintain a 'balance of nature'" (Sen. Rep. 93-307: 2).

In the major subsequent amendments – in 1978, 1982, and 1988 – Congress and the Supreme Court have affirmed this ecosystem protection purpose. In 1978, when the Tellico Dam controversy erupted, pitting a three-inch species of perch against a $100-million dam, the Supreme Court ruled that a species' value is incalculable, in part, because of the "unforeseeable place such creatures may have in the chain of life on this planet" (Tennessee Valley Authority v. Hiram Hill (437 US 153 (1978)), pp. 178-179). In short, given the possibility of species extinction causing ecosystem collapse and the likelihood that humans may not know about such consequences before they occur, the value of a species is incalculable and no costs should be spared in preventing its extinction (Rosmarino 2002).

In that same year, although under great pressure by economic interests to exclude "insignificant" species from the ESA's protections, Congress held firm to its commitment to prevent any species – charismatic or obscure – from being driven into extinction. In large part, Congress made this choice because of the argument that all species play roles in their native ecosystems. Senate bill manager John Culver (D-IA) stated that all species should be protected due to their participation in a "seamless web of interdependency" (1978 Floor: 21287). Sen. John Chafee (R-RI) similarly articulated the purpose of the Act as two-fold, including ecosystem protection and the conservation of endangered species and argued that charismatic species could not be protected unless one safeguarded "the network of life upon which they depend" (1978 Floor: 21147).

In 1982, Congress chastised the USFWS's discrimination against so-called "lower life forms," in listing decisions and was influenced, in part, by the argument that such discrimination was indefensible on ecological grounds. Scientists in the hearings leading up to the 1982 amendments vociferously criticized taxonomic discrimination, arguing that it violated Aldo Leopold's view that "To keep every cog and wheel is the first precaution of intelligent tinkering" (Leopold 1966). The cogs and wheels of which Leopold spoke were species, and the implicit machine of which they were a part (i.e., the subject of one's tinkering) was the ecosystem. Leopold was metaphorically rebuking the view that any species is insignificant, and his rebuke was made on ecosystemic grounds. Heeding Leopold's metaphor, House Subcommittee Chairman John Breaux (D-LA) explicitly lamented the loss of "'cogs and wheels' of the biological mechanism that sustains life on Earth" on the House Floor (1982 Floor: 12957).

In the most recent set of amendments to the ESA, in 1988, House Subcommittee chairman Gerry Studds (D-MA) endorsed the ecosystem protection purpose of the ESA by quoting John Muir, "'[w]henever we try to pick up anything by itself, we find it attached to everything in the universe.'" Sen. John Chafee (R-RI) invoked the same sentiment in the Senate (1988 Floor: 18570-71).

Despite the ecosystem protection purpose of the ESA being a prominent part of the Act's legislative history, at no point has a congressperson questioned the validity of that purpose. Nor has the ESA's purpose been altered, despite attempts to dilute it with economic concerns. Under the present terms of the ESA, the ecosystem protection purpose could be served by listing species like the Black Hills mountainsnail, which is dependent upon relatively undisturbed forest and riparian habitats and described as an "exceptional" indicator of ecosystem health (Black et al. 2001, Frest and Johannes 2002, Frest 2002a, b).

The USFWS has itself pledged to enforce the ESA in a way that maximizes ecosystem protection (USFWS 1997). We suggest that the protection of the Black Hills mountainsnail, given its dependence upon undisturbed forest and riparian habitats, would effect such ecosystem-level protection in the Black Hills. Our proposal is not an original one, but has in fact been promoted by conservation biologists and legal scholars as a method of obtaining ecosystem-level protection under the current terms of the ESA (Noss 1991, Houck 1997, Miller et al. 1998/99).

That the Black Hills mountainsnail is an excellent indicator of forest ecosystem health has been well-established by scientists (Black et al. 2001, Frest and Johannes 2002, Frest 2002a, b). Further, the snail is an indicator species facing severe and ongoing cumulative threats of habitat destruction and degradation, habitat fragmentation, isolation, small population size, climate change, and other threats, alongside a lack of adequate regulatory mechanisms at the Federal, state, and city levels (Frest and Johannes 1991, 1993a, 2002). Listing the Black Hills mountainsnail under the ESA would thus further two primary purposes of the law – to prevent the extinction of native species and to protect the ecosystems on which they depend. The USFWS should therefore promptly list the Black Hills mountainsnail as a threatened or endangered species under the ESA and protect the ecosystems on which they depend.

IX. DOCUMENTS CITED

Petitioners hereby incorporate by reference every document cited in this petition and/or cited in the References below. We are happy to provide copies of any of these documents upon request.

X. SUMMARY

The Black Hills mountainsnail (*Oreohelix cooperi*) is a critically imperiled land snail species that warrants listing as threatened or endangered and therefore warrants critical habitat designation. The benefits of ESA listing for the Black Hills mountainsnail are substantial, as we suggest throughout this petition.

- Listing will require that federal agencies enter into Section 7 consultation with FWS, and carefully consider the potential impacts of ongoing and proposed activities under their jurisdictions to the Black Hills mountainsnail. The result will be significantly improved protection on federal lands from domestic livestock grazing, logging, road construction, herbicide and pesticide use, mining, spring developments, recreational activities, and other potentially detrimental activities in the form of a proactive approach to implementing conservation actions prior to allowing any Black Hills mountainsnail habitat to be impacted.
- Projects involving a federal nexus will also require Section 7 consultation; therefore the benefits of listing will extend to populations occurring on non-federal lands as well, such as South Dakota and Wyoming lands.
- The designation of critical habitat, yet another exclusive benefit of ESA listing, will result in significant additional protection not only for occupied habitat but also for other habitat areas deemed essential to the recovery of the species. The ESA prohibits adverse modification of designated critical habitat.
- Listing will result in the development of a recovery plan aimed at biological recovery (and delisting).
- Listing will help make Black Hills mountainsnail management consistent across land management boundaries.
- Listing will require protections that are not occurring now and will not occur otherwise through requirements for Section 7 consultation and Section 9 prohibitions on take. A conservation plan that involves the states taking active and effective conservation measures seems unlikely. The State of Wyoming does not have any mechanism in place to protect rare and imperiled species and does not even monitor the status of rare and imperiled invertebrates, and the State of South Dakota has no mechanism in place to protect rare and imperiled invertebrates. Furthermore, a fair percentage of Black Hills mountainsnail habitat and populations are privately owned and even the most ambitious scenario involving state and federal agencies adopting their own conservation measures would, at best, result in the reduction of threats to the Black Hills mountainsnail, not biological recovery.
- Listing will bring much-needed protection to the habitats where the Black Hills mountainsnail currently exists and historically existed. Further, protection of the Black Hills ecosystem has the potential to benefit several other imperiled land snail species, including the Pahasapa mountainsnail, callused vertigo, Cockerell's striate disk, and others. Protection of the species also has the potential to benefit all rare and/or disjunct plants in the Black Hills. The Black Hills

red-bellied snake and other species dependent upon undisturbed forest and riparian habitat also have the potential to benefit. Protection of the Black Hills ecosystem now will also help to secure a foundation for future and possibly more widespread ecosystem protection and restoration.

The Black Hills mountainsnail has been recommended for listing under the ESA and is continuing to decline toward extinction (Frest and Johannes 1993a, 2002). While the species warrants listing under the ESA to prevent its extinction and protect the Black Hills ecosystem, at least three of the five factors set forth in § 424.11(c) are applicable to the present status of the Black Hills mountainsnail.

A. The present or threatened destruction, modification, or curtailment of habitat or range

The Black Hills ecosystem has experienced extensive habitat loss and degradation over the last century, leading to a substantial reduction and curtailment of range and habitat of the species. Continued habitat destruction and degradation due to domestic livestock grazing, logging, road construction, pesticide and herbicide application, mining, spring development, groundwater extraction, and recreational activities currently threatens to further destroy, modify, and/or curtail the habitat and range of the species.

B. Overutilization for commercial, recreational, scientific, or educational purposes

There is no indication that collecting poses any threat to the survival of the Black Hills mountainsnail.

C. Disease or predation

The Black Hills mountainsnail is preyed upon by rodents, other small mammals, amphibians, reptiles, birds, insects, and insect larvae. The species may also be parasitized by insect larvae. In conjunction with other threats to the species and its habitat, disease and predation poses risks to the well-being of the species.

D. The inadequacy of existing regulatory mechanisms

The Black Hills mountainsnail and its habitat receives no protection on private lands and state and city laws are entirely inadequate to protect the snail and its habitat. Federal agencies have further failed to provide adequate protection to the Black Hills mountainsnail and its habitat on their lands and are doing nothing to recover the species and its habitat. Most egregiously, is that the United States Forest Service, which is charged with managing the majority of Black Hills mountainsnail colonies, has failed to emplace measures that effectively and assuredly protect and recover the species and its habitat despite years of concern over the status of the snail.

E. Other natural or manmade factors affecting its continued existence

Colonies of Black Hills mountainsnail have been reduced in size and extent and have become isolated due in part to habitat destruction and degradation, making the species more susceptible to extinction. Habitat fragmentation also poses significant threats to the species, making recovery of the species and its habitat difficult – if not impossible – in some instances. Floods and other natural stochastic events also pose risks to the species and in some instances. Naturally occurring and human-caused fires also threaten the species and may pose greater risks as a result of extensive logging and thinning in the Black Hills. Climate change also threatens the Black Hills mountainsnail and its habitat.

XI. 90-DAY FINDING

Petitioners expect to receive a formal acknowledgement of this petition, expeditious finalization of a formal listing proposal and rule, and designation of critical habitat concurrent with a final rule. Petitioners expect to receive a formal acknowledgment of this petition and a decision within 90 days of its receipt.

Respectfully submitted,

Jeremy Nichols
Biodiversity Conservation Alliance
PO Box 1512
Laramie, WY 82073
(307) 742-7978
jeremy@voiceforthewild.org

on behalf of:

Jacob Smith
Center for Native Ecosystems
PO Box 1365
Paonia, CO 81428
(970) 527-8993
jacob@nativeecosystems.org

Brian Brademeyer
Native Ecosystems Council
PO Box 2003
Rapid City, SD 57709
brademey@rapidnet.com

Nancy Hilding
Prairie Hills Audubon Society of Western South Dakota
PO Box 792
Rapid City, SD 57709
nhilshat@rapidnet.com

Scott Hoffman Black
Executive Director
The Xerces Society
4828 SE Hawthorne
Portland, OR 97215
(503) 534-2706
sblack@xerces.org

Jeremy Nichols
PO Box 2137
Laramie, WY 82073

cc: Ralph Morgenweck, United States Fish and Wildlife Service Region 6 Director
Pete Gober, United States Fish and Wildlife Service South Dakota Field Office Field Supervisor
Mike Long, United States Fish and Wildlife Service Wyoming Field Office Field Supervisor

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Black Hills mountainsnail (*Oreohelix cooperi*) as Threatened or Endangered

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