REPORT ON THE CONSERVATION STATUS OF
SHOSHONEA PULVINATA, A CANDIDATE THREATENED SPECIES

Taxon Name:	Shoshonea pulvinata Evert & Constance
Common Name:	Shoshonea
Family:	Apiaceae (Umbelliferae)
States Where Taxon Occurs:	U.S.A., Montana, Wyoming
Current Federal Status:	USFWS Notice of Review, Category 2
Recommended Federal Status:	USFWS Notice of Review, Category 2
Authors of Report:	Peter Lesica and J. Stephen Shelly
Original Date of Report:	27 April, 1988
Date of Most Recent Revision:	N/A
Individual to Whom Further Information and Comments Should Be Sent:	J. Stephen Shelly Montana Natural Heritage Program State Library Building 1515 E. 6th Avenue Helena, MT 59620

This is an abridged report

For the full report please contact:

The Montana Natural Heritage Program
1515 E Sixth Ave
Helena, Montana 59620

406-444-3009

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I. SPECIES INFORMATION

1. Classification and nomenclature.

A. Species.

1. Scientific name.

a. Binomial: Shoshonea pulvinata Evert & Constance.

b. Full bibliographic citation: Evert, E.L., and L. Constance. 1982. Shoshonea pulvinata, a new genus and species of Umbelliferae from Wyoming. Systematic Botany 7: 471-475.

c. Type specimens: United States, Wyoming, Park Co., Absaroka Range, SW side of Rattlesnake Mtn., about 14.5 km W of Cody, T53N R103W S36 SW1/4, 2638 m, exposed limestone-derived soil, talus and crevices, growing with Arenaria hookeri, Astragalus kentrophyta, Castilleja nivea, Eritrichium howardii, Oxytropis viscida, Pinus flexilis, Pseudotsuga menziesii, and Senecio canus, 6 Aug 1981, E.F. Evert 3424. Holotype: RM; isotypes: MO, NY, UC.

2. Pertinent synonyms: None.

3. Common name: Shoshonea.

4. Taxon codes: PDAPI2G010 (The Nature Conservancy); 3212, SHOPUL (U.S. Forest Service, Region 1).

5. Size of genus: Monotypic genus.

B. Family classification.

1. Family name: Apiaceae.

2. Pertinent family synonym: Umbelliferae.

3. Common names for the family: Parsley Family, Carrot Family.

C. Major plant group: Dicotyledoneae.

D. History of knowledge of taxon: Shoshonea pulvinata was first collected in 1979 on the west side of Rattlesnake Mountain, Park County, Wyoming, by Erwin Evert (Evert 1577, RM). Subsequent searching in 1980 and 1981 by Evert, Ronald Hartman, Robert Lichvar, Keith Deuholm, and others revealed additional populations in Park County. The genus and species were described by Evert and Constance (1982). The taxon is now also known to occur in the Owl Creek Mountains, Fremont County, Wyoming.

Shoshonea pulvinata was first discovered in Montana by John

Pierce in 1984, near Lost Water Canyon in the Pryor Mountains, Carbon County. In 1985, Peter Lesica located a population in the Beartooth Mountains, also in Carbon County (Lesica et al. 1986). Lesica, working under contract for The Nature Conservancy, and Steve Shelly of the Montana Natural Heritage Program, searched many areas of the Pryor and Beartooth mountains unsuccessfully in 1986. During 1983, Lichvar et al. (1985) conducted a floristic study of Big Horn Canyon National Recreation Area, which includes the extreme east edge of the Pryor Mountains. They did not locate any populations of Shoshonea.

In 1987, the Montana Natural Heritage Program was contracted by the U.S. Fish and Wildlife Service to conduct a status survey of Shoshonea pulvinata in Montana (Project Agreement SE-3-P-1). In July, 1987, under subcontract, Lesica conducted additional field surveys of appropriate habitat in the Beartooth and Pryor mountains of Carbon County. In August, 1987, Lesica and Shelly were denied access to the Big Horn Mountains, on the Crow Indian Reservation in Big Horn County, by the Crow Tribal Council (Appendix A, p. 36). Although Shoshonea may be present on Crow tribal lands, no information is available for this area.

Prior to 1987, the only two occurrences of Shoshonea pulvinata known in Montana were the Grove Creek Pinnacles (Beartooth Mountains) and Lost Water Canyon (Pryor Mountains)). The latter site could not be relocated by Lesica in 1985. During the 1987 field surveys, Lesica did relocate this site, and discovered one additional population in the Pryor Mountains (Mystery Cave). No new populations were found in the Beartooth Mountains (Figs. 1, 2, pp. 3-4).

E. Comments on current alternative taxonomic treatments: There are no known current alternative taxonomic treatments.

2. Present legal or other formal status.

A. International: None

B. National.

1. United States.

a. Present designated or proposed legal protection or regulation: Currently, Shoshonea pulvinata is under notice of review for potential listing as a threatened species under the U.S. Endangered Species Act of 1973 (U.S. Department of Interior, 1985). Specifically, it is included in Category 2 (taxa for which information now in possession of the Service indicates that listing as a threatened or endangered species is possibly appropriate, but for which substantial data on biological vulnerability and threats are not currently known or on file to support listing).

Figure 1. Areas searched for Shoshonea pulvinata in the Beartooth Mtns.

○ Areas searched unsuccessfully

● Shoshonea populations

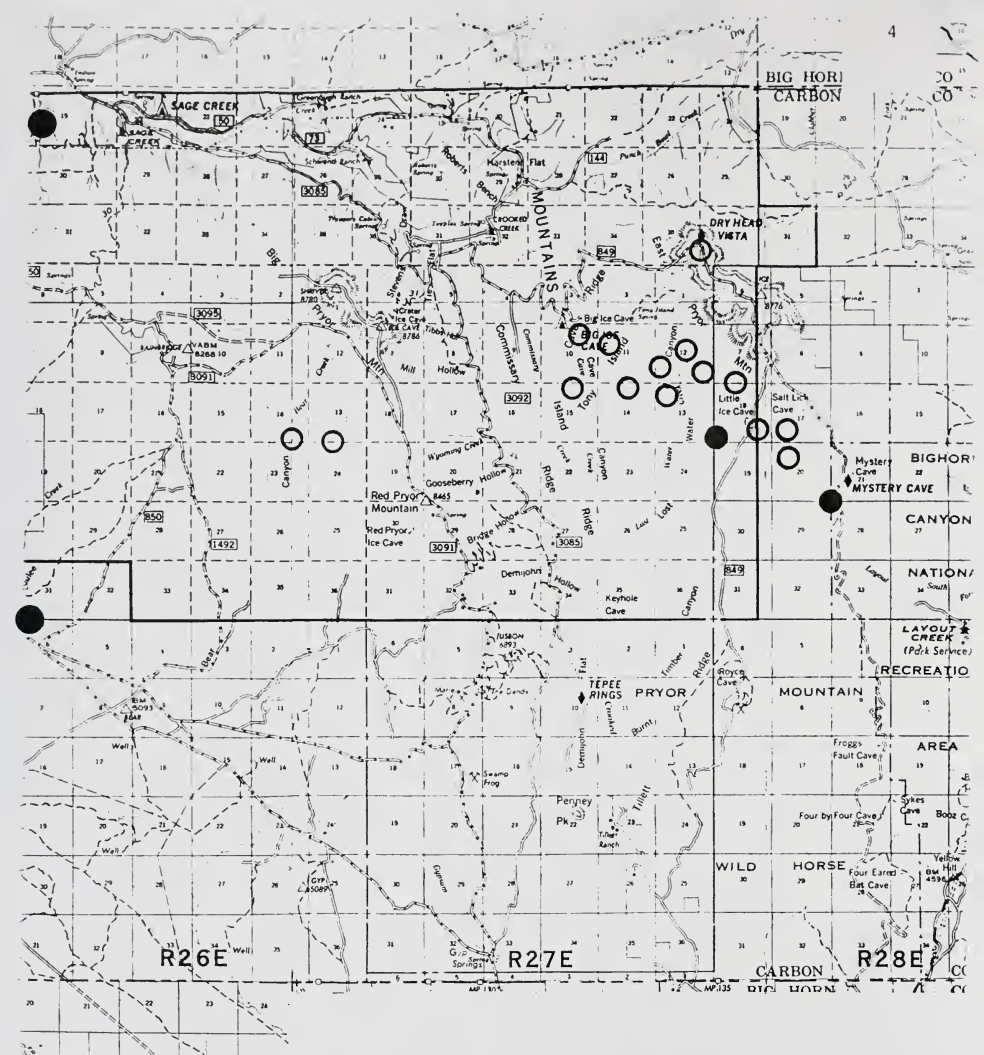


Figure 2. Areas searched for Shoshonea pulvinata in the Pryor Mtns.

○ Areas searched unsuccessfully

● Shoshonea populations

b. Other current formal status recommendations: Shoshonea pulvinata is currently listed as "endangered or threatened throughout range" (global rank = G2G3) by the Wyoming Natural Heritage Program (Hollis Marriott, personal communication) and the Montana Natural Heritage Program (Shelly 1988).

c. Review of past status: No previous history of legal or formal status.

C. State.

1. Montana.

a. Present designated or proposed legal protection or regulation: None.

b. Other current formal status recommendations: Shoshonea pulvinata is currently listed as "critically endangered" in Montana (state rank = S1) by the Montana Natural Heritage Program (Shelly 1988).

c. Review of past status: No past status.

2. Wyoming.

a. Present designated or proposed legal protection or regulation: None.

b. Other current formal status recommendations: Shoshonea pulvinata is currently listed as "endangered" in Wyoming (state rank = S2) by the Wyoming Natural Heritage Program (Hollis Marriott, personal communication).

c. Review of past status: No past status.

3. Description.

A. General nontechnical description: Shoshonea pulvinata is a low, mat-forming, herbaceous, long-lived perennial. The plants have a woody taproot and branching underground stems. The above-ground stems are 1-3 inches in length and usually clothed at the base with remnants of the previous year's leaf sheaths. The leaves are approximately 0.2-1.0 inches long and 0.2-0.8 inches wide, with a petiole approximately half the length of the leaf. The leaf blades are oddly pinnate with 5-11 divisions and oblong to oval in outline. The leaf petioles are swollen and papery at the base. The herbage is smooth to somewhat roughened. The inflorescence is a compound umbel approximately 1/2-3/4 inch in diameter. The flowers in these umbels are small (ca. 1/8 inch in diameter) and light yellow in color. The fruits are approximately 1/8 inch long, slightly roughened to the touch, and without wings.

Shoshonea forms dense cushions up to 1 1/2 feet in diameter in open, exposed sites, but is usually smaller and more loosely branched in partially shaded, less exposed sites. Plants probably begin blooming in May in exposed habitats, and some plants can still be found in bloom in July in shaded sites.

B. Technical description: The following description is taken from Evert and Constance (1982). Plants low, acaulescent, caespitose-pulvinate, scaberulous, pleasantly aromatic, herbaceous, perennial, 2-8 cm tall, from a woody taproot and branching (underground) caudices that are clothed above with the petioles from previous years. Leaves petiolate, subcoriaceous, imparipinnate, the blades ovate or oblong in outline, 5-25 mm long, 3-20 mm wide, the 2-5 pairs of leaflets linear or oblanceolate, cuspidate, 2-10 mm long, 0.5-1.5 mm wide, the lower leaflets frequently 2- or 3-lobed; petioles dilated and scarious-sheathing near the base, 5-20 mm long. Inflorescence of subcompact compound umbels 0.75-1.5 cm wide at anthesis; peduncles erect, 2-5 cm long; involucel dimidiate, the 5-8 basally connate, entire bractlets linear or lanceolate, 2-6 mm long, slightly exceeding the flowers; umbellets of 1-5 sessile perfect flowers and 2-6 pedicillate staminate flowers, the pedicels up to 4 mm long; flowers yellow, the sepals 5 (or ocassionally 4), prominent, unequal, ovate-lanceolate, 1-1.5 mm long, the petals oblong-spatulate with a narrower inflexed apex, about 1.5 mm long, the stylopodium absent, the disk semicircular, the ovary densely scaberulous. Fruit sessile, scaberulous, oblong or ovoid-elliptic, subterete to slightly compressed laterally, not constricted at the commissure, 2-4 mm long, 1.5-3 mm wide; ribs subequal, prominent to subprominent, obtuse, not winged, ovate in transection, up to 0.3 mm long, 0.3 mm wide; pericarp with lignified strengthening cells; carpophore absent or vestigial, bipartite, and usually falling with the mericarps; oil tubes small, 2-6 in the intervals, 2-6 on the commissure and frequently 1 in each rib; seed dorsally compressed, the face plane to concave. Chromosome number 2n=22 (Evert 1772).

C. Local field characters: In open habitats, the dense cushion-like habit of Shoshonea separates it from all other members of the Apiaceae with which it might co-occur. Vegetatively, Shoshonea might be confused with Astragalus kentrophyta, which is often found in similar habitats, but A. kentrophyta has three-parted leaflets. In more shaded habitats, Shoshonea might be confused with various species of Cymopterus, but the latter are generally more erect and have leaves which are either bipinnate or tripinnate. The leaves of Shoshonea are simply pinnate.

Thus, the mat-forming habit, small yellow umbels of flowers, and pinnate leaves distinguish Shoshonea from all other species.

D. Identifying characteristics of material which is in interstate or international commerce or trade: No interstate or international commerce or trade known.

E. Photographs and line drawings: Figure 3 is a copy of the illustration which accompanied the publication of Shoshonea pulvinata (Evert and Constance 1982). The color slides (p. 9) are duplicates of those taken at the sites indicated. Additional slides of Shoshonea and its habitat are housed at the office of the Montana Natural Heritage Program, Helena, Montana.

4. Significance.

A. Natural: Shoshonea is a monotypic genus. Its taxonomic position indicates that it may contain a relatively large amount of unique genetic material. The species is adapted to shallow limestone soils in harsh windswept sites. It may be important in stabilizing limestone talus slopes in some instances. Obligate relationships with other species are unknown.

B. Human: The Apiaceae is a taxonomically difficult family. The discovery of this genus may help to elucidate generic relationships within the Apiaceae. Shoshonea pulvinata may have horticultural potential as a rock garden plant. Otherwise, the species has no known agricultural, economic or other human uses or significance.

5. Geographical distribution.

A. Geographical range: Shoshonea pulvinata is currently known in Wyoming from the Absaroka Mountains, Park County, and the Owl Creek Mountains, Fremont County, and in Montana from the Pryor Mountains and Beartooth Mountains of Carbon County.

B. Precise occurrences.

1. Populations currently known to be extant.

a. Montana: Populations are listed in Table 1, p. 10; exact locations are provided in Maps 1-3, pp. 11-13.

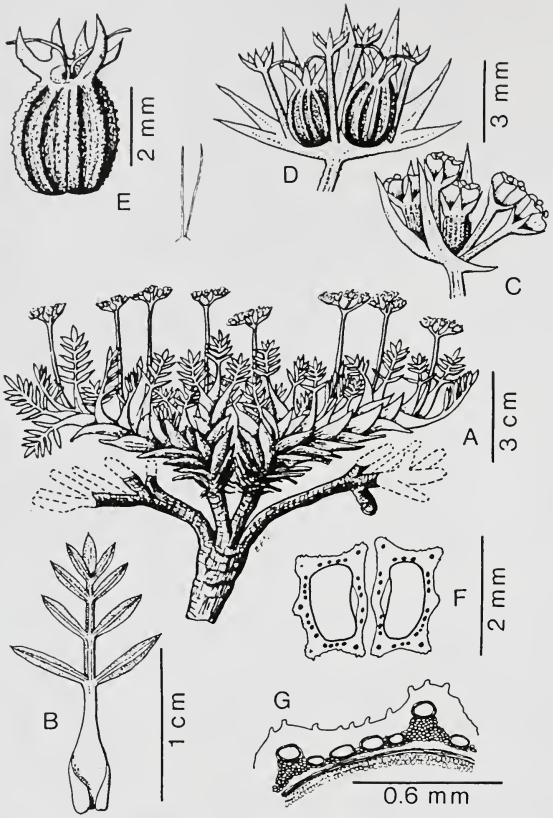
b. Wyoming: Populations are listed in Table 2, pp. 14-16. Since all of these populations have been discovered within the last ten years, they are presumed to be extant.

2. Populations known or assumed extirpated: None.

3. Historically known populations where current status is not known: Although populations in Wyoming are all presumed to be extant, survey work has not been completed in the last several years. The current status of these populations in terms of abundance and threats is not known.

4. Locations not yet investigated believed likely to support additional natural populations.

a. Wyoming: Much of the appropriate habitat in Wyoming



Shoshonea pulvinata. A. Habit. B. Leaf. C. Flowering umbellet. D. Fruiting umbellet. E. Mature fruit, with vestigial carpophore. F. Fruit transection. G. Pericarp transection, showing lignified cells. A–C from *Evert 1918*; D–G from *Evert 2067*.

Figure 3. Line drawing of Shoshonea pulvinata.

Taken from Evert and Constance (1982).

TABLE 1. Populations currently known extant, Carbon County, Montana.

Occurrence number: 001
Site name: GROVE CREEK PINNACLES (MEETEETSE SPIRES)
Latitude: 450629 Longitude: 1091339 Elevation: 7140'
Township & Range: 8S, 20E Sections: 26, N½NW¼, E½SW¼
23, W½
USGS Quad: TOLMAN FLAT
Size: 7.5 minute series
Year of initial discovery: 1985
Date of most recent observation: 1986-06-24
Directions: BEARTOOTH MOUNTAINS, CA. 5 AIR MILES SSE. OF RED LODGE; HWY. 308 FROM BRIDGER TO BELFRY, THEN HWY. 397 SOUTH 4.5 MI. TO GROVE CR. RD.; WEST 5 MI. TO RANCH, GO LEFT, THEN RT. AND CROSS SOUTH FORK GROVE CREEK.

Occurrence number: 002
Site name: LOST WATER CANYON
Latitude: 450800 Longitude: 1082113 Elevation: 7800'
Township & Range: 8S, 27E Sections: 13, SE¼
24, NE¼
8S, 28E Sections: 18, W½SW¼
19, NW¼, NE¼SW¼
USGS Quads: EAST PRYOR MOUNTAIN, MYSTERY CAVE
Size: 7.5 minute series
Year of initial discovery: 1984
Date of most recent observation: 1987-07-10
Directions: PRYOR MOUNTAINS, ALONG RIDGES EAST OF LOST WATER CANYON, 0.95-1.1 AIR MILES SW. TO SOUTH OF LITTLE ICE CAVE.

Occurrence number: 003
Site name: MYSTERY CAVE
Latitude: 450715 Longitude: 1081901 Elevation: 7480'
Township & Range: 8S, 28E Sections: 20, SE¼
21, SW¼
28, NW¼
USGS Quad: MYSTERY CAVE
Size: 7.5 minute series
Year of initial discovery: 1987
Date of most recent observation: 1987-07-13
Directions: PRYOR MOUNTAINS, ALONG RIDGES EAST OF BIG COULEE, 0.75-0.85 AIR MILES SSE. TO WSW. OF MYSTERY CAVE.

TABLE 2. Populations currently known extant, Wyoming.

Occurrence number: 001
Site name: SHEEP MOUNTAIN
County: PARK
Latitude: 442800 Longitude: 1092020 Elevation: 6800'
Township & Range: 52N, 104W Sections: 22, NE¼
24, SW¼
USGS Quad: WAPITI
Year of initial discovery: -
Date of most recent observation: 1981-07-12
Directions: ABSAROKA RANGE; NW. CORNER OF SHEEP MT. ABOVE POST CREEK.

Occurrence number: 002
Site name: STAGNER MOUNTAIN
County: FREMONT
Latitude: 432720 Longitude: 1081540 Elevation: 7500'
Township & Range: 6N, 5E Section: 34
USGS Quad: MORRISON CANYON
Year of initial discovery: 1982
Date of most recent observation: 1982-07-26
Directions: WIND RIVER RESERVATION, OWL CREEK MOUNTAINS, STAGNER MTN.

Occurrence number: 003
Site name: RATTLESNAKE MOUNTAIN CREST
County: PARK
Latitude: 443330 Longitude: 1091615 Elevation: 8950'
Township & Range: 53N, 103W Sections: 22, SE¼ TO 17, NW¼
USGS Quads: PAT O'HARA, CODY
Year of initial discovery: 1980
Date of most recent observation: 1980-06-25
Directions: TWO MILE SEGMENT OF CREST OF RATTLESNAKE MTN., 4 MILES NORTH OF BUFFALO BILL RESERVOIR NEAR CODY.

Occurrence number: 004
Site name: SW. FLANK RATTLESNAKE MOUNTAIN
County: PARK
Latitude: 443135 Longitude: 1091240 Elevation: 8650'
Township & Range: 53N, 103W Sections: 35, SW¼
36, SW¼
USGS Quad: CODY
Year of initial discovery: 1981
Date of most recent observation: 1981-08-06
Directions: SW. SIDE OF RATTLESNAKE MTN., AND NEAR SE. END, CA. 9 MI. WEST OF CODY.

TABLE 2. (cont.).

Occurrence number: 005
Site name: LOGAN MOUNTAIN
County: PARK
Latitude: 442930 Longitude: 1091920 Elevation: 5800'
Township & Range: 52N, 104W Section: 11, SE¼
USGS Quad: WAPITI
Year of initial discovery: 1980
Date of most recent observation: 1980-05-20
Directions: SOUTH SIDE OF LOGAN MTN., CA. 13 MI. WEST OF CODY AND 3/4 MI. NORTH OF U.S. HWY. 14, 16 & 20.

Occurrence number: 006
Site name: NW. FLANK RATTLESNAKE MOUNTAIN
County: PARK
Latitude: 443635 Longitude: 1092110 Elevation: 8600'
Township & Range: 54N, 104W Section: 35, SW¼
USGS Quad: PAT O'HARA
Year of initial discovery: 1979
Date of most recent observation: 1981-06-19
Directions: NW. SIDE OF RATTLESNAKE MOUNTAIN, CA. 16 MI. NW. OF CODY.

Occurrence number: 007
Site name: HEART MOUNTAIN
County: PARK
Latitude: 443955 Longitude: 1090735 Elevation: 7800'
Township & Range: 54N, 102W Section: 15, NE¼
USGS Quad: CODY
Year of initial discovery: -
Date of most recent observation: 1981-07-30
Directions: NEAR TOP OF WEST SUMMIT OF HEART MTN., CA. 20 MI. NORTH OF CODY.

Occurrence number: 008
Site name: CEDAR MOUNTAIN
County: PARK
Latitude: 442940 Longitude: 1091015 Elevation: 7680'
Township & Range: 52N, 102W Section: 8, NW¼
USGS Quad: DEVILS TOOTH
Year of initial discovery: 1981
Date of most recent observation: 1981-08-03
Directions: NEAR THE TOP OF CEDAR MTN., CA. 5.5 AIR MI. WSW. OF CODY.

Occurrence number: 009
Site name: BALD RIDGE
County: PARK
Latitude: 444800 Longitude: 1092000 Elevation: 8000'
Township & Range: 56N, 104W Section: 25, SE¼
USGS Quad: DEEP LAKE
Year of initial discovery: 1986
Date of most recent observation: 1986
Directions: BALD RIDGE, CA. 2 MI. NORTH OF DEAD INDIAN PASS, SE. RIM OF CLARKS FORK YELLOWSTONE RIVER CANYON.

has had recent floristic survey work. Erwin Evert has thoroughly surveyed the Absaroka Range in the drainage of the North Fork of the Shoshone River. Rob Kirkpatrick has surveyed the Absaroka Range from the North Fork of the Shoshone River south to the Owl Creek Range (M.S. Thesis, Department of Botany, University of Wyoming, Laramie). The Big Horn Mountains have been studied by B.E. Nelson and Ron Hartman (Nelson and Hartman 1984). Because of their location on the Wind River Indian Reservation (Arapaho and Shoshone tribes), the Owl Creek Mountains have not been thoroughly searched. In addition, the northeast corner of the Big Horn Mountains of Wyoming have not been surveyed as intensively as the rest of the range, and may harbor undiscovered populations (B.E. Nelson, Rocky Mountain Herbarium, University of Wyoming, personal communication).

b. Montana: There are two or three areas in the Big Horn Mountains in Big Horn County, on the Crow Indian Reservation, where Shoshonea might be expected to occur. These areas were not investigated, as the authors were denied access to the reservation by the Crow Tribal Council (Appendix A, p. 36). Also, Sheep Mountain, just south of Luther on the north side of the Beartooth Mountains (T7S R19E Sec 6), was not surveyed. Shoshonea might be expected to occur there; however, suitable sites both east and west of Sheep Mountain were searched without success.

5. Reports having ambiguous or incomplete locality information: None known.

6. Locations known or suspected to be erroneous reports: None.

C. Biogeographical and phylogenetic history: Unknown. Shoshonea shares morphological charcteristics with many genera of North American Apiaceae, but the relationships are not clear (Evert and Constance 1982). Shoshonea pulvinata is one of several species endemic to calcareous soils in the area of the northern Big Horn Basin. Other such species include Penstemon caryi, Erigeron allocotus, and Eriogonum lagopus.

6. General environment and habitat description.

A. Concise statement of general environment and habitat: Shoshonea pulvinata is restricted to shallow, stoney, calcareous soils associated with exposed limestone outcrops, ridgetops and talus slopes. The vegetation of Shoshonea sites is sparse and dominated by low herbaceous plants, many of which are also mat-forming. In Montana, Shoshonea occurs at elevations ranging from 6,800-7,800 feet. At this elevation the dominant zonal vegetation is Douglas fir (Pseudotsuga menziesii) forest. Shoshonea often occurs in windblast areas on the edges of these

forests, or on exposed ridges surrounded by them. Other commonly associated species include limber pine (Pinus flexilis), Howard's alpine forget-me-not (Eritrichium howardii), and curly sedge (Carex rupestris).

B. Physical characteristics.

1. Climate.

a. Koppen climate classification: Type BSw, a steppe climate with a winter dry season east of the Rocky Mountains, where winter cold prevents appreciable precipitation; and type Dfb, the Canadian climate, with snowy winters and moderately warm summers (Visher, 1954).

b. Regional macroclimate: Red Lodge, at an elevation of 5,250 feet, is approximately 5 miles northwest of the Beartooth Mountain site and 40 miles west of the Pryor Mountain sites. For the thirty year period ending in 1980, mean July maximum and mean January minimum were 79.3°F and 11.7°F, respectively. Mean annual precipitation was 25.0 inches (U.S. Department of Commerce 1982).

c. Local microclimate: Shoshonea pulvinata generally occurs in areas which are exposed to full solar insolation, and in very windswept situations. Evapotranspiration and diurnal fluctuation in temperature is expected to be high. Snow accumulation in these areas is minimal, and sites are probably free of snow early in the spring. Although these areas appear dry, the soils beneath the stoney surface may hold moisture well into the summer.

2. Air and water quality requirements: Unknown.

3. Physiographic province: Fenneman (1931) places the range of Shoshonea pulvinata in the Middle Rocky Mountain Province. Hunt (1974) also classifies this area as part of the Middle Rocky Mountain Province, within the Rocky Mountain System.

4. Physiographic and topographic characteristics: In Montana, Shoshonea pulvinata occurs on soils derived from limestones and dolomites of the Madison group of formations (Perry 1962, Richards 1955). The Madison limestones lie on top of limestones of the Jefferson Formation. Although it is possible that Shoshonea occurs on soils derived from this latter formation also, it is believed to be mainly associated with the Madison formations. Perry (1962) indicates that both the Beartooth and Big Horn Mountains have been glaciated, while the Pryor Mountains have not.

In Montana, known sites occur at elevations of 6,800-7,400

feet on the east slopes of the Beartooth Mountains and 7,200-7,800 feet in the Pryor Mountains. In Wyoming, Shoshonea occurs at elevations of 5,800-9,000 feet (Evert and Constance 1982; Hollis Marriott, Wyoming Natural Heritage Program, pers. comm.). The species is found in mountainous terrain in areas of sharp relief. In Montana, Shoshonea generally occurs on level or gently sloping ridgetops, or on the shoulders of ridges. It is occassionaly found on steeper slopes with a warm aspect. These habitats are very exposed to strong winds, and winter snow accumulation is assumed to be minimal.

In Montana, Shoshonea is found at the north end of the Big Horn Basin in the drainages of the Big Horn River and the Clarks Fork of the Yellowstone River.

5. Edaphic factors: Shoshonea pulvinata occurs in poorly developed soils derived from limestone and dolomite. Although analyses were not conducted, soils are probably highly calcareous. Veseth and Montagne (1980, p. 38) describe similar shallow soils derived from Madison Limestone in the Big Snowy Mountains of northcentral Montana. These soils are well drained, with moderately rapid runoff and moderate permeability. Soil cores have 45-90% limestone cobbles and pebbles, and a fine fraction high in silt. These soils are slightly sticky and plastic when wet, friable to very friable when moist, and slightly hard when dry. The high stone and silt content may help retain moisture during the growing season. These higher elevation azonal soils have not been classified by the Soil Conservation Service.

6. Dependence of this taxon on natural disturbance: Shoshonea appears to be confined to areas where exposure to the wind minimizes snow accumulation, and where subsequent soil and vegetation development are thus inhibited. Without the effects of wind, soils would presumably mature, and zonal vegetation (i.e., Douglas fir forest) could develop and shade out individuals of Shoshonea.

7. Other unusual physical features: None observed.

C. Biological characteristics.

1. Vegetation physiognomy and community structure: In Montana, Shoshonea pulvinata occurs in relatively barren, fellfield-like communities amidst dry forests of Douglas fir and limber pine. In these communities, scattered, small individuals of these tree species, as well as shrubby cinquefoil (Potentilla fruticosa) and Wyoming ninebark (Physocarpus monogynus), may also be present. Otherwise, the vegetation is dominated by herbaceous perennials, including graminoids such as spike fescue (Hesperochloa kingii) and curly sedge (Carex rupestris), and cushion-

forming plants such as Howard's forget-me-not (Eritrichium howardii), stemless goldenweed (Haplopappus acaulis), Sweetwater milkvetch (Astragalus aretioides), rockmat (Petrophyton caespitosum), fragrant pussy-toes (Antennaria aromatica), and kelseya (Kelseya uniflora).

2. Regional vegetation types: For Montana, Ross and Hunter (1976) place the Pryor Mountain sites in the Douglas Fir Climax Forest Zone, and the Beartooth Mountain site in the Clayey and Shallow Clay Range Sites with bluebunch wheatgrass, columbia needlegrass, and western and thickspike wheatgrass (etc.) Zone. Kuchler (1964) places both the Pryor Mountain sites and the Beartooth Mountain site in the Douglas Fir Forest Zone. The forests which compose the zonal vegetation are best described as belonging to the Pseudotsuga menziesii/Physocarpus malvaceus habitat type, possibly intergrading into the Pinus flexilis/Juniperus communis habitat type (Pfister et al. 1977).

3. Frequently associated species: All of the species frequently associated with Shoshonea pulvinata in Montana are natives. These include:

Pinus flexilis James
Pseudotsuga menziesii (Mirb.) Franco
Potentilla fruticosa L.
Petrophyton caespitosum (Nutt.) Rydb.
Eritrichium howardii (Gray) Rydb.
Erigeron ochroleucus Nutt.
Astragalus aretioides (Jones) Barneby
Astragalus miser Douglas
Haplopappus acaulis (Nutt.) Gray
Carex rupestris Allioni
Hesperochloa kingii (Wats.) Rydb.
Draba oligosperma Hooker
Erigeron compositus Pursh
Potentilla diversifolia Lehm.
Senecio canus Hooker
Phlox hoodii Richards.
Antennaria aromatica Evert
Anemone nuttalliana DC.

4. Dominance and frequency of the taxon: In the Pryor Mountains, Shoshonea pulvinata occurs in colonies of approximately 100-1,500 plants, in narrow belts of habitat on the rims above canyons. Although canopy cover of this species rarely exceeds 5-10%, total vegetation cover is low, and Shoshonea is often one of the dominant herbaceous species. In the Beartooth Mountains, Shoshonea occurs on relatively broad ridgetops, in colonies of 1,000-5,000 plants. Again, although its canopy cover is usually less than 10%, it can be one of the dominant herbaceous species, as it is on the ridge north of the North Fork of Grove Creek.

5. Successional phenomena: Although Shoshonea pulvinata sometimes occurs in partial shade at the edges of forests, plants found in these areas appear to be less vigorous than those in full light. The vast majority of plants at any one site are found in open areas. These observations indicate that Shoshonea prefers full or nearly full sunlight. Forest encroachment of Shoshonea habitat would cause increased snow cover, slower warming in spring, and lower light intensities, which could, in turn, cause extirpation of the species. Sites where Shoshonea pulvinata occurs are on ridgetops, and on the rims above the windward side of deep canyons. These sites are apparently maintained in an early successional stage by their extreme exposure to wind.

6. Dependence on dynamic aspects of biotic associations and ecosystem features: Unknown.

7. Other endangered, threatened, rare, or vulnerable species occurring in habitat of this taxon: The following species have a limited distribution in Montana, but are more widespread elsewhere.

   Astragalus aretioides (Jones) Barneby - listed as rare by Lesica et al. (1984); listed as "state endangered" (S2) by the Montana Natural Heritage Program (Shelly 1988).

   Hymenoxys torreyana (Nutt.) Parker - listed as rare by Lesica et al. (1984); listed as "state endangered" (S2) by the Montana Natural Heritage Program (Shelly 1988).

   Townsendia spathulata Nutt. - listed as "state endangered" (S2) by the Montana Natural Heritage Program (Shelly 1988).

   Physocarpus monogynus (Torr.) Coult. - listed as rare by Lesica et al. (1984); listed as "state status unknown, possibly threatened or endangered" (SU) by the Montana Natural Heritage Program (Shelly 1988).

7. Population biology of the taxon.

   A. General summary: Known populations of Shoshonea pulvinata in Montana consist of three or four subpopulations separated by less than 1/2 mile. Subpopulations consist of 100-1,500 plants in the Pryor Mountains, and 1,000-5,000 plants in the Beartooth Mountains. Small, non-reproductive plants were present at all sites, indicating that successful recruitment is occurring. Areas of seemingly appropriate habitat were observed to be unoccupied by Shoshonea, which may indicate that the species is not completely competent at colonizing new sites. The breeding system of Shoshonea is unknown. On several occasions, flies in the Family Syrphidae were observed on the flowers.

B. Demography.

1. Known populations: There are three known populations of Shoshonea pulvinata in Montana, one in the Beartooth Mountains and two in the Pryor Mountains. There are currently eight known populations in Wyoming. In Montana, population size ranges from 1,500 to 6,000 plants. Detailed demographic information is generally unknown for the Wyoming populations, but in one case (Rattlesnake Mountain Crest (003)) the species was described as "abundant."

2. General demographic details (Montana):

   a. Grove Creek Pinnacles.
      1. Area occupied by population: ca. 70 acres in three subpopulations.
      2. Estimated number of individuals: ca. 6,000 plants.
      3. Density: Scattered, ca. 1-2 plants/sq. yd.
      4. Presence of dispersed seeds: Unknown.
      5. Evidence of reproduction: Small, non-reproductive individuals observed, and presumed to be juveniles. No seedlings observed.
      6. Evidence of population expansion or decline: None, but possibly stable or increasing.

   b. Lost Water Canyon.
      1. Area occupied by population: ca. 25 acres in four subpopulations.
      2. Estimated number of individuals: ca. 3,000 plants.
      3. Density: Unknown.
      4. Presence of dispersed seeds: Unknown.
      5. Evidence of reproduction: Small, non-reproductive individuals observed, and presumed to be juveniles. No seedlings observed.
      6. Evidence of population expansion or decline: None, but possibly stable or increasing.

   c. Mystery Cave.
      1. Area occupied by population: ca. 15 acres in three subpopulations.
      2. Estimated number of individuals: ca. 1,500 plants.
      3. Density: Unknown.
      4. Presence of dispersed seeds: Unknown.
      5. Evidence of reproduction: Small, non-reproductive individuals observed, and presumed to be juveniles. No seedlings observed.
      6. Evidence of population expansion or decline: None, but possibly stable or increasing.

C. Phenology.

1. Patterns: The first observations in Montana have been made in mid-June in the Beartooth Mountains. At this time, some of the Shoshonea plants were in flower, but most were already in fruit. In the Pryor Mountains in early July, most of the plants were in fruit, with seed dispersing, but a few plants growing in partial shade were still in flower. It is presumed that flowering on these exposed sites begins in May, and probably peaks during the latter part of that month or in early June. Fruit matures during June and early July, and dispersal probably begins in late June and continues through July and into early August. It is not known when Shoshonea becomes senescent, although it is suspected that the plants may be winter green, at least in part. The time of seed germination is unknown.

   Due to its unusual growth form and leaf morphology, Shoshonea pulvinata can be recognized in the field throughout the growing season.

2. Relation to climate and microclimate: Details are unknown.

D. Reproductive ecology.

1. Types of reproduction: Details of the breeding system are unknown. Reproduction appears to be entirely by seed; no evidence of asexual reproduction was observed.

2. Pollination.

   a. Mechanisms: Probably by insects. Faegri and van der Pijl (1971) state that members of the Apiaceae are adapted to pollination by a wide range of insects, including beetles, flies, and bees.

   b. Specific known pollinators: In several instances, flies of the Family Syrphidae were observed on the flowers of Shoshonea. Otherwise, specific pollinators are unknown.

   c. Other suspected pollinators: None known.

   d. Vulnerability of pollinators: Unknown.

3. Seed dispersal.

   a. General mechanisms: Shoshonea pulvinata does not appear to have any specialized mechanisms for long-distance dispersal. Although not directly observed, it is presumed that the mericarps fall from the inflorescence in the vicinity of the parent plant. Dispersal away from the parent plant may involve movement by wind, or by animal vectors such as ants or

rodents. The mericarps do have oil tubes (Evert and Constance 1982), and the oil in the fruit may serve as an attractant to animal dispersers (van der Pijl 1982).

b. Specific agents: None known.

c. Vulnerability of dispersal agents and mechanisms: Unknown.

d. Patterns of propagule dispersal: Unknown.

4. Seed biology.

a. Amount and variation of seed production: Details are unknown. Most plants that were observed produced some fruit, and most inflorescences examined had at least one maturing fruit.

b. Seed viability and longevity: Unknown.

c. Dormancy requirements: Unknown.

d. Germination requirements: Unknown.

e. Percent germination: Unknown.

5. Seedling ecology: Details are unknown. Many species of windswept alpine fellfields require the ameliorated microclimate, and accumulations of organic matter, provided by "nurse plants" (Griggs 1956). Shoshonea pulvinata may have similar requirements.

6. Survival and mortality: Details are unknown. Shoshonea will tolerate only partial shading, and occurs mainly in relatively open plant communities. These factors suggest that it is a stress tolerator species sensu Grime (1979), and is thus probably a poor competitor.

7. Overall assessment of taxon's reproductive success: The presence of small non-reproductive plants, which are presumed to be juveniles, in all of the Montana Shoshonea pulvinata populations indicates that the species is reproducing successfully. The fact that no seedlings were observed during the 1986 and 1987 field seasons may be a result of the general drought conditions which have prevailed during that time. Judging from the large size of many of the plants, Shoshonea is a long-lived perennial. The relatively long life of individual plants probably compensates for sporadic seedling recruitment. There is unoccupied, apparently suitable habitat in both the Pryor and Beartooth mountains in Montana, perhaps indicating that Shoshonea does not readily establish new populations. Nevertheless, it appears that established populations are stable at this time.

8. Population ecology of the taxon.

A. General summary: Shoshonea pulvinata occurs in sparse vegetation of open or occasionally partially shaded fellfield-like habitats. The species is probably intolerant of intense competition and full shade. In the Pryor Mountains in Montana, subpopulations occur in narrow belts along the windward rims of canyons. In the Beartooth Mountains, subpopulations occupy larger, windswept ridgetop areas. Although large grazing animals such as wild horses or mountain sheep may preferentially use these communities during the winter when they are more free of snow cover than adjacent areas, no evidence of grazing damage was observed.

B. Positive and neutral interactions: None known. Most species of herbaceous vascular plants have mycorrhizal associations with fungi in the Family Endogonaceae (Gerdemann 1968).

C. Negative interactions.

1. Herbivores, predators, pests parasites and diseases: None known. At the Grove Creek Pinnacles site in the Beartooth Mountains, at least two species of swallowtail butterflies (Family Papilionidae) were observed. Larvae of many butterflies in this family are specialized feeders on plants in the Apiaceae; however, no herbivore damage to Shoshonea plants was observed during the surveys.

2. Competition.

a. Intraspecific: In most cases, Shoshonea pulvinata plants are widely spaced. Although above-ground interference is probably not important, competition for nutrients and water may be occurring.

b. Interspecific: Shoshonea occurs only in areas with relatively sparse vegetation cover and appears to be intolerant to shading, indicating that it is probably a poor competitor. Based on its growth form and habitat preferences, Shoshonea would probably be considered a stress tolerator, sensu Grime (1982). These species are generally poor competitors. The observations indicate that the shade and litter created by a forest overstory may also have a negative effect on Shoshonea plants.

3. Hybridization.

1. Naturally occurring: None known.

2. Artificially induced: None known.

3. Potential in cultivation: Unknown.

E. Other factors of population ecology: None known.

9. Current land ownership and management responsibility.

A. General nature of ownership: United States Government and private.

B. Specific landowners (Montana):

1. USDA Forest Service
Custer National Forest
P.O. Box 2556
Billings, MT 59103

2. USDI Bureau of Land Management
Billings Resource Area Headquarters
P.O. Box 2020
Billings, MT 59101

3. USDI National Park Service
Big Horn Canyon National Recreation Area
P.O. Box 458
Fort Smith, MT 59035

4. Towe Farms Inc.
191 N. Frontage Rd.
Deer Lodge, MT 59722

5. Aetna Life & Casualty
Aetna Realty Investors, Inc.
YF 93, City Place
Hartford, CT 06156

C. Management responsibility: Same as ownership given above, except for Towe Farms land, which is managed by Waynard and Wylie Anderson, Belfry, MT.

D. Easements, conservation restrictions, etc.: A portion of the Lost Water Canyon site in the Pryor Mountains is in a parcel proposed for designation as a research natural area by the U.S. Forest Service. The Mystery Cave site is on the Pryor Mountain Wild Horse Range, and one of the subpopulations is in Big Horn Canyon National Recreation Area.

A private holding on the Grove Creek Pinnacles site in the Beartooth Mountains is owned by Aetna Life & Casualty (T8S, R20E, Section 23, NW¼NW¼, S½NW¼, SW¼, SW¼SE¼). Negotiations for potential transfer of this parcel to the Montana/Wyoming Field Office of The Nature Conservancy are in progress (J. Bird, The Nature Conservancy, pers. comm.).

10. Management practices and experience.

A. Habitat management.

1. Review of past management and land use experiences.

   a. Shoshonea pulvinata: At the Grove Creek Pinnacles site in the Beartooth Mountains, the surrounding land has been used for livestock grazing; however, the actual sites have received little or no grazing pressure. There are also mining claim markers on the site, but no mining activity has taken place. In the Pryor Mountains, the Lost Water Canyon site is on a livestock grazing allotment, and the Mystery Cave site is on the Pryor Mountain Wild Horse Range. However, field observations indicate that grazing has had little impact on the Shoshonea populations.

   b. Related taxa: None known.

   c. Other ecologically similar taxa: Not reviewed.

2. Performance under changed conditions: Not applicable.

3. Current management policies and actions: Current management is the same as outlined under past management. To our knowledge the federal agencies have no intention of changing current management schemes. It is not known how the proposed designation of the Lost Water Canyon area as a research natural area will affect management. The Towe Farms owners have expressed an interest in subdividing some of their land for residential development (J. Bird, The Nature Conservancy, personal communication).

4. Future land use: Present public land uses will probably continue. In addition, mining activity and residential development of private land may potentially occur in some areas.

B. Cultivation.

1. Controlled propagation techniques: None known.

2. Ease of transplanting: Not known.

3. Pertinent horticultural knowledge: Not reviewed.

4. Status and location of presently cultivated material: None known.

11. Evidence of threats to survival.

A. Present or threatened destruction, modification, or curtailment of habitat or range: Shoshonea pulvinata occupies habitats which are little threatened by human activities. Timber harvesting in adjacent forest communities could adversely affect Shoshonea sites, but the timber in most adjacent areas has a low commercial value. The presence of mining claim markers at the

Grove Creek Pinnacles site indicates that mining activity is a possibility, but the potential appears to be low.

B. Overutilization for commercial, sporting, scientific, or educational purposes: No threats known.

C. Disease, predation, or grazing: At the present time, populations of Shoshonea pulvinata do not appear to be threatened by livestock grazing. The sites are probably free of snow earlier in the year than surrounding areas, and may be favored by grazing animals in early spring. If grazing pressure from wild horses were to increase, Shoshonea populations might be adversely affected. In the Rocky Mountains, bighorn sheep use habitats similar to Shoshonea sites as winter range. If bighorn sheep were reintroduced in large numbers in the Pryor or Beartooth mountains, they might pose a threat to Shoshonea populations.

D. Inadequacy of existing regulatory mechanisms: None known.

E. Other natural or man-made factors: None known.

II. ASSESSMENT AND RECOMENDATIONS

12. General assessment of vigor, trends, and status: In Montana, Shoshonea pulvinata is presently known from three sites in Carbon County. An estimated 10,500-12,500 plants occur at these three sites. Based on limited observations, Shoshonea populations appear to be stable. Currently there are no serious threats to these populations. The status of populations in Wyoming is currently unknown.

13. Recommendations for listing or status change.

A. Recommendation to U.S. Fish and Wildlife Service: On the basis of current information summarized in this status report, it is recommended that Shoshonea pulvinata be retained in Category 2. Although there are no apparent threats to populations of Shoshonea pulvinata in Montana, the species has few populations and a very localized distribution. The complete distribution, abundance, and condition of Shoshonea populations in Wyoming, which contains the main range of the species, are presently unknown. Final status recommendations should be made upon completion of survey work in Wyoming.

B. Recommendations to other U.S. federal agencies: Shoshonea pulvinata has been placed on lists of sensitive plant species for Region One of the U.S. Forest Service, and for the Montana State Office of the U.S.D.I. Bureau of Land Management. Personnel charged with management of lands supporting populations of Shoshonea should be made aware of its presence and locations. The impacts of any change in management practices (i.e., timber harvesting, mining, increased stocking rates) on Shoshonea populations should be assessed before being implemented.

C. Other status recommendations.

1. Counties and local areas: No recommendations.

2. States: Shoshonea pulvinata is currently listed as S1 ("critically state endangered") in Montana, by the Montana Natural Heritage Program (Shelly 1988). No change in status is recommended.

3. Other nations: Not pertinent.

4. International: No recommendations.

14. Recommended critical habitat: Because the status of Shoshonea pulvinata has not been determined for the part of its range in Wyoming, critical habitat is not being recommended at this time.

15. Conservation/recovery recommendations.

A. General conservation recommendations.

1. Recommendations regarding present or anticipated activities: The effects of mining, logging, and increased grazing pressure in areas supporting Shoshonea populations should be assessed before any of these activities are implemented.

2. Areas recommended for protection: The Grove Creek Pinnacles site in the Beartooth Mounatins contains the largest known population of Shoshonea in Montana, and was nominated as a potential natural area at the 1986 Montana Natural Areas Conference (Peterson et al. 1987). The Lost Water Canyon area has been proposed for designation a U.S. Forest Service research natural area (Habeck 1988). The lands supporting Shoshonea populations should be included in the proposed reserves.

3. Habitat management recommendations: No recommendations are being made at this time.

4. Publicity sensitivity: Low.

5. Other recommendations: None.

B. Monitoring activities and research needs: Demographic monitoring studies (Lesica 1987, Palmer 1987) should be initiiated at one subpopulation at the Grove Creek Pinnacles site in the Beartooth Mountains, and for one subpopulation in the Pryor Mountains. Data from these transects can be used to assess and predict the performance of Shoshonea populations (Menges 1986). Future management recommendations can then be made based on a more thorough knowledge of the population biology of Shoshonea pulvinata. Detailed field surveys are needeed in Wyoming, to further assess the known populations and any threats to them, and to locate any additional new sites. Field surveys on the

Shoshone National Forest are planned in 1988 (Hollis Marriott, Wyoming Natural Heritage Program, pers. comm.).

16. Interested parties:

Office of Endangered Species
ATTN: Dr. James Miller
U.S. Fish and Wildlife Service
Region 6
P.O. Box 25486
Denver Federal Center
Denver, CO 80225

Endangered Species Field Office
ATTN: Carol Taylor
U.S. Fish and Wildlife Service
Federal Building, 301 S. Park
P.O. Box 10023
Helena, MT 59626

Office of Endangered Species
ATTN: Dr. John Fay
U.S. Fish and Wildlife Service
Washington D.C. 20240

U.S. Forest Service, Region One
ATTN: Angela Evenden
Federal Building
P.O. Box 7669
Missoula, MT 59807

The Nature Conservancy
ATTN: Dr. Larry Morse
1800 N. Kent Street
Arlington, VA 22209

Rocky Mountain Heritage Task Force
ATTN: Dr. Ben Brown
The Nature Conservancy
134 Union Blvd., Suite 125
Lakewood, CO 80228

The Nature Conservancy
ATTN: Dr. Joan Bird
Montana/Wyoming Field Office
P.O. Box 258
Helena, MT 59624

Hollis Marriott
Wyoming Natural Heritage Program
3165 University Station
Laramie, WY 82071

Dr. John Rumely
Department of Biology
Montana State University
Bozeman, MT 59717

Erwin Evert
1476 Tyrell
Park Ridge, IL 60086

James T. Peters
USDI National Park Service
Big Horn Canyon National Recreation Area
P.O. Box 458
Fort Smith, MT 59035

John Pierce
737 Locust
Missoula, MT 59802

Peter Lesica
P.O. Box 8944
Missoula, MT 59807

J. Stephen Shelly
Montana Natural Heritage Program
State Library Building
1515 E. 6th Ave.
Helena, MT 59620

III. INFORMATION SOURCES

17. Sources of Information.

A. Publications.

1. References cited in report: see Literature Cited (pp. 34-35).

2. Other publications/sources: None known.

B. Museum collections: Specimens from all known Montana populations are deposited at the University of Montana Herbarium in Missoula (MONTU). Duplicates are deposited at CA, NY, and RM. Specimens from all known Wyoming populations are deposited at the Rocky Mountain Herbarium (RM), University of Wyoming, Laramie. Specimens from MONTU and RM were examined in this study. The following list of known herbarium specimens is organized by occurrence number, for Montana and Wyoming:

Montana: 001 - P. Lesica (3417), MONTU
J.S. Shelly (1162), MONTU

002 - P. Lesica (4386, 4388, 4389), MONTU

003 - P. Lesica (4391, 4394), MONTU

Wyoming: 001 - E.F. Evert (1772), RM; (2113), RM, UC; (3118), RM

002 - R.W. Lichvar (5382), RM

003 - D.L. Martin (1432), RM

004 - E.F. Evert (3424), RM
R.L. Hartman et al. (13924), RM

005 - E.F. Evert (1761), RM; (1946), RM, UC; 2067, UC; (3279), RM, UC

006 - E.F. Evert (1577), RM; (1918), RM, UC; (2778), RM

007 - E.F. Evert (3334), RM
R.L. Hartman (13500), RM

008 - E.F. Evert (3394), RM
R.L. Hartman & K. Deuholm (11418), RM
R.L. Hartman et al. (11431), RM, UC

009 - B.E. Nelson (12506), RM

C. Fieldwork.

1. Surveys by the authors:

17-19 June 1985 (Lesica)
24-26 June 1986 (Shelly, Lesica)
8-13 July 1987 (Lesica)

Surveys were conducted in the Beartooth and Pryor mountains, Carbon and Stillwater counties; Natural Heritage field forms, photographs, and herbarium vouchers.

D. Knowledgeable individuals:

John Pierce
737 Locust
Missoula, MT 59802

E. Other information sources: Color slides and field forms are on file at the office of the Montana Natural Heritage Program, and the Montana/Wyoming Field Office of The Nature Conservancy (see section II.16. for addresses).

18. Summary of materials on file: All detailed field forms, maps and color slides are on file at the office of the Montana Natural Heritage Program. Herbarium vouchers for Montana populations are deposited at the University of Montana Herbarium (MONTU).

IV. AUTHORSHIP

19. Initial authorship:

Peter Lesica
P.O. Box 8944
Missoula, MT 59807

J. Stephen Shelly
Montana Natural Heritage Program
State Library Building
1515 E. 6th Avenue
Helena, MT 59620
Phone: 406-444-3009

20. Maintanance of status report: The Montana Natural Heritage Program will maintain current information and update the status report as needed. Should the taxon be listed as an endangered or threatened species by the U.S. Fish and Wildlife Service, the Service, through its Office of Endangered Species (Region 6), should maintain the primary file of information, encourage others to provide new information, and distribute new findings, as received, to the interested parties (section II.16.).

V. NEW INFORMATION

21. Record of revisions: Not currently applicable.

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van der Pijl, L. 1982. Principles of dispersal in higher plants. Springer-Verlag, New York. 215 pp.

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APPENDIX A: Letter from Crow Tribal Council.

CROW TRIBAL COUNCIL

P.O. Box 159
Crow Agency, MT 59022

RICHARD REAL BIRD, Chairman
JEROME HUGS, Vice Chairman
TRUMAN C. JEFFERSON, Secretary
CARLTON NOMEE, SR., Vice Secretary

Crow Country

August 26, 1987

Mr. J. Stephen Shelly
Botanist
Montana Natural Heritage Program
State of Montana
Montana State Library Building
1515 East 6th Avenue
Helena, Montana 59620

Dear Mr. Shelly:

In response to your letter dated, August 18, 1987, please be advised that a Crow Tribal Botanist will conduct all future plant surveys within the exterior boundaries of the Crow Reservation.

In the event that rare plant species, such as the Shoshonea Pulvinata are located, we will be pleased to inform you of the occurance.

Sincerely yours,

Richard Real Bird, Chairman
Crow Tribal Council

RRB:mjh
cc: President, Little Big Horn College
Botany Department

APPENDIX B: Element occurrence print-outs: Montana.

ELEMENT OCCURRENCE RECORD

EOCODE: PDAPI2G010.001
NAME: SHOSHONEA PULVINATA
COMNAME: SHOSHONEA
MARGNUM: 2 TENTEN: 2,2 IDENT: Y EORANK: A
EORANKCOMM: THREE LARGE, UNDISTURBED SUBPOPULATIONS.
SURVEYDATE: 1986-06-24 LASTOBS: 1986-06-24 FIRSTOBS: 1985 GRANK: G2G3
SRANK: S1 STATE: MT COUNTYNAME: MTCARB
QUADCODE: 4510912
QUADNAME: TOLMAN FLAT PRECISION: SC
LAT: 450629 LONG: 1091339 S: 450541 N: 450707 E: 1091324 W: 1091405
TOWNRANGE: 008S020E SECTION: 26 MERIDIAN: PR
TRSCOMM: N2NW4,E2SW4;23W2 PHYSPROV: MR WATERSHED: 10070006
DIRECTIONS: CA. 5 AIR MILES SSE. OF RED LODGE; HWY. 308 FROM BRIDGER TO BELFRY, THEN HWY. 397 S. 4.5 MI. TO GROVE CR. RD.; WEST 5 MI. TO RANCH, THEN LEFT, RT. AND ACROSS S. FORK GROVE CREEK.
GENDESC: GRAVELLY LIMESTONE SOILS ON WINDBLOWN RIDGETOPS, AMONGST SCATTERED PINUS FLEXILIS & PSEUDOTSUGA MENZIESII; WITH ERITRICHIUM HOWARDII, CYMOPTERUS HENDERSONII, KELSEYA.
ELEV: 7140 SIZE: 50
EODATA: EST. 6000-8000 PLANTS; THREE VERY LARGE, VIGOROUS SUBPOPULATIONS, WITH THE ELEMENT AS THE DOMINANT GROUND SPECIES IN MANY PLACES; SITES ARE ALMOST COMPLETELY UNDISTURBED, WITH NO WEEDS; EST. 3000-4000 PLANTS IN SOUTH SUBPOPULATION.
COMMENTS: RECENTLY DESCRIBED GENUS AND SPECIES (SYST. BOT. (1982) 7: 471); LESICA, P. (3417), 1985, SPECIMEN #102363 MONTU.
MACODE1: PRIVATEOWNMTUS CONTAINED1: N MACODE2: FBLRABILLIMTUS CONTAINED2: N
MACODE3: FBLDOMILEIMTUS CONTAINED3: N ADLMAS: N MORELAN: MOREPROT:
MOREMGMT: B SITECODE:
SITENAME: GROVE CREEK PINNACLES (MEETEETSE SPIRES)
OWNER: AETNA LIFE & CASUALTY
OWNERCOMM: AETNA REALTY INVESTORS, YF 93, CITY PLACE, HARTFORD, CT.
PROTCOMM:
MGMTCOMM:
MONITOR: MONITORNUM: -
BESTSOURCE: SHELLY, J.S. 1986. FIELD SURVEYS IN CARBON COUNTY OF 23-27 JUNE; WITH P. LESICA.
SOURCECODE: F86SHE04MTUS PNDSHE01MTUS PNDLES01MTUS S85LESUMMTUS A82 EVE01MTUS U85LES02MTUS S86SHEUMMTUS
DATASENS: N BOUNDARIES: Y PHOTOS: Y OWNERINFO: N
TRANSCRIBR: 86-01-23 JSS CDREV: Y MAPPER: 86-01-31 JSS QC: Y
UPDATE: 88-04-26 JSS

ELEMENT OCCURRENCE RECORD

EOCODE: PDAPI2G010.002
NAME: SHOSHONEA.PULVINATA
COMNAME: SHOSHONEA
MARGNUM: 9 TENTEN: 2,10 IDENT: Y EORANK: AB
EORANKCOMM: EXCELLENT CONDITION HABITAT; SOME POPULATIONS FAIRLY SMALL.
SURVEYDATE: 1987-07-10 LASTOBS: 1987-07-10 FIRSTOBS: 1984 GRANK: G2G3
SRANK: S1 STATE: MT COUNTYNAME: MTCARB
QUADCODE: 4510823 4510813
QUADNAME: EAST PRYOR MOUNTAIN, MYSTERY CAVE PRECISION: SC
LAT: 450800 LONG: 1082113 S: 450721 N: 450811 E: 1082035 W: 1082123
TOWNRANGE: 008S027E SECTION: 13 MERIDIAN: PR
TRSCOMM: SE4,24NE4;T8SR28E:+ PHYSPROV: MR WATERSHED: 10080010
DIRECTIONS: ALSO 18W2SW4,19NW4,NE4SW4. PRYOR MOUNTAINS, ALONG RIDGES EAST OF LOST WATER CANYON, 0.95-1.1 AIR MILES SW. TO SOUTH OF LITTLE ICE CAVE.
GENDESC: ON EDGES OR IN OPENINGS OF PINUS FLEXILIS-PSEUDOTSUGA MENZIESII FORESTS; WEST-FACING RIMS ABOVE CANYONS, IN STONEY LIMESTONE SOILS; WITH ASTRAGALUS ARETIOIDES (CONTINUED).
ELEV: 7800 SIZE: 25
EODATA: CA. 2900 PLANTS, IN 4 SUBPOPULATIONS (WEST-1500; NORTHEAST-800; CENTRAL-100; SOUTH-500); AREA IS LITTLE DISTURBED, AND PARTIALLY IN WILD HORSE RANGE; GENDESC (CONT.): ERITRICHIUM HOWARDII, HESPEROCHLOA KINGII, HAPLOPAPPUS ACAULIS.
COMMENTS: VOUCHERS-LESICA, P. (4386, 4388, 4389), 1987, MONTU; PIERCE, J., 1984, MONTU.
MACODE1: FFSRPLOST1MTUS CONTAINED1: N MACODE2: FBLHRPRYO1MTUS CONTAINED2: N
MACODE3: FFSNFCUST1MTUS CONTAINED3: Y ADLMAS: N MORELAN: MOREPROT:
MOREMGMT: B SITECODE:
SITENAME: LOST WATER CANYON
OWNER: CUSTER NATIONAL FOREST
OWNERCOMM:
PROTCOMM: PORTION OF SITE IS ON BOUNDARY OF A PROPOSED RNA.
MGMTCOMM:
MONITOR: MONITORNUM: -
BESTSOURCE: LESICA, P. 1987. FIELD SURVEYS IN CARBON COUNTY OF 8-13 JULY.
SOURCECODE: F87LES01MTUS PNDLES01MTUS S87LESUMMTUS PNDPIE01MTUS S84 PIEUMMTUS A82EVE01MTUS U85LES02MTUS A86LES03
DATASENS: N BOUNDARIES: Y PHOTOS: Y OWNERINFO: Y
TRANSCRIBR: 87-12-18 JSS CDREV: Y MAPPER: 87-12-18 JSS QC: Y
UPDATE: 88-04-26 JSS

ELEMENT OCCURRENCE RECORD

EOCODE: PDAPI2G010.003
NAME: SHOSHONEA PULVINATA
COMNAME: SHOSHONEA
MARGNUM: 19 TENTEN: 5,1 IDENT: Y EORANK: B
EORANKCOMM: REMOTE HABITAT IN GOOD CONDITION, MODERATE-SIZED POPULATION.
SURVEYDATE: 1987-07-13 LASTOBS: 1987-07-13 FIRSTOBS: 1987 GRANK: G2G3
SRANK: S1 STATE: MT COUNTYNAME: MTCARB
QUADCODE: 4510813
QUADNAME: MYSTERY CAVE PRECISION: SC
LAT: 450715 LONG: 1081901 S: 450650 N: 450722 E: 1081804 W: 1081910
TOWNRANGE: 008S028E SECTION: 20 MERIDIAN: PR
TRSCOMM: SE4,21SW4,28NW4 PHYSPROV: MR WATERSHED: 10080010
DIRECTIONS: PRYOR MOUNTAINS, ALONG RIDGES EAST OF BIG COULEE, 0.75-0.85 AIR MILES SSE TO WSW OF MYSTERY CAVE.

GENDESC: ON EDGES OF PINUS FLEXILIS-PSEDOTSUGA MENZIESII FORESTS; ON WIND-BLASTED RIMS OF GRAVELLY, LIMESTONE-DERIVED SOILS, GENTLE NW-FACING SLOPES, WITH ASTRAGALUS ARETIOIDES, (CONT.)
ELEV: 7480 SIZE: 15
EODATA: GENDESC (CONT.): ERITRICHIUM, ASTRAGALUS, ERIGERON.
EODATA: CA. 1500 PLANTS IN 3 SUBPOPULATIONS (WEST-1500 PLANTS; CENTRAL-300 PLANTS; EAST-200 PLANTS); SITE IS LITTLE THREATENED; EVIDENCE OF PAST LIVESTOCK GRAZING.
COMMENTS: VOUCHERS - LESICA, P. (4391, 4394), 1987, MONTU.

MACODE1: FNPNRBIGH1MTUS CONTAINED1: N MACODE2: FBLHRPRYO1MTUS CONTAINED2: Y
MACODE3: FBLRABILL1MTUS CONTAINED3: N ADLMAS: Y MORELAN: MOREPROT:
MOREMGMT: B SITECODE:
SITENAME: MYSTERY CAVE
OWNER: U.S. BLM, NPS
OWNERCOMM:
PROTCOMM: PARTIALLY WITHIN BIGHORN CANYON NATIONAL RECREATION AREA.
MGMTCOMM:
MONITOR: MONITORNUM:
BESTSOURCE: LESICA, P. 1987. FIELD SURVEYS IN CARBON COUNTY OF 8-13 JULY.
SOURCECODE: F87LES01MTUS PNDLES01MTUS S87LESUMMTUS A82EVE01MTUS

DATASENS: N BOUNDARIES: Y PHOTOS: Y OWNERINFO: Y
TRANSCRIBR: 87-12-17 JSS CDREV: Y MAPPER: 87-12-18 JSS QC: Y
UPDATE: 88-04-26 JSS