STATUS REPORT ON

Lesquerella fremontii

IN CENTRAL WYOMING

Prepared for the Bureau of Land Management
Wyoming State Office and Rawlins District

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24 February 1995

COOPERATIVE AGREEMENT # K910-A4-0011
TASK ORDER # 003

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I. INTRODUCTION

Lesquerella fremontii (Fremont bladderpod) was first collected in the South Pass area of southwestern Fremont County, Wyoming in 1947. The species went unrecognized for 26 years until it was described as a new taxon by Rollins and Shaw (1973). Until 1977, L. fremontii was known only from the type collection and was proposed for listing as Endangered (Ayensu and DeFilipps 1978). Surveys from 1977-1985 resulted in the discovery of several populations in the southeastern Wind River Range and Beaver Rim area, prompting the US Fish and Wildlife Service (USFWS) to drop the species to Category 3C in 1985 (US Fish and Wildlife Service 1985).

Due to its limited distribution, Lesquerella fremontii is designated by US Forest Service Region 2 as a Sensitive species (Kratz 1994) and has been recommended for listing as Sensitive by the Bureau of Land Management (BLM) Wyoming State Office (W. Fertig letter to Ray Brubaker, former State Director, BLM, dated 26 April 1994). Under BLM Manual 6840, the BLM is directed to manage Sensitive species in such a manner that these species and their habitats are conserved and to ensure that agency actions do not contribute to the need to list these species as Threatened or Endangered (Willoughby et al. 1992).

In 1994, the Rawlins District and Wyoming State Office of the BLM contracted on a cost-share basis with The Nature Conservancy's Wyoming Natural Diversity Database (WYNDD) to conduct field surveys for Lesquerella fremontii on public lands in central Wyoming. The objectives of this project were to collect information on the biology, distribution, habitat use, population size, and potential threats to this species to be used in guiding management decisions. In addition, a permanent monitoring plot was established and baseline demographic and population trend data were collected.

II. METHODS

Information on habitat and distribution of Lesquerella fremontii was obtained from secondary sources, including WYNDD files and computer databases, collections of the Rocky Mountain Herbarium (RM), the literature, and knowledgeable individuals. USGS topographic maps, geologic maps (Love and Christiansen 1985), and BLM land status maps were used to identify areas of potential habitat for ground survey.

Field surveys were conducted by the author from mid-June to mid July 1994 (survey routes and collection sites are indicated in Appendix B). Data on biology, habitat, population size, and

management needs were collected using WYNDD plant survey forms (Appendix C). Locations of occurrences were mapped on 7.5' USGS topographic maps. If populations were sufficiently large, voucher specimens were collected for deposit at the RM. Information gathered in the field was entered into the computerized Element Occurrence database of WYNDD.

A permanent monitoring transect was established on Limestone Mountain in 1994, following the protocol of Lesica (1987). The transect consisted of a single belt 1 m x 30 m long, subdivided into 30 1 m x 1 m cells. Within each cell, individual plants were mapped and assigned to one of three age classes: reproductive (in flower), fruiting (with fruit of the current year), and vegetative (completely lacking flowers and fruits). The number of flowering and fruiting stems per plant was also tallied. This technique generated quantitative data on population size, density, age distribution, and reproductive potential. Baseline data from this transect are included in Appendix D.

III. SPECIES INFORMATION

A. CLASSIFICATION

1. SCIENTIFIC NAME: Lesquerella fremontii Rollins and Shaw (Roll

2. SYNONYMS: None.

3. COMMON NAME: Fremont bladderpod.

4. FAMILY: Brassicaceae (Mustard family).

5. SIZE OF GENUS: Rollins (1993) recognizes 95 species in the genus Lesquerella, all native to North and South America. Ten species and three varieties occur in Wyoming (Dorn 1992).

6. PHYLOGENETIC RELATIONSHIPS: Rollins and Shaw (1973) considered Lesquerella fremontii to be most closely related to L. macrocarpa, another Wyoming endemic. Both species are placed in the L. prostrata-L. occidentalis group based on their inflated fruits.

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. NATIONAL

a. LEGAL STATUS: Listed as a Category 3 (3C)

species by the USFWS (US Fish and Wildlife Service 1985). Category 3 includes taxa that have either proven more abundant or widespread than previously believed or which are not subject to any identifiable threat. Lesquerella fremontii was downlisted to 3C on the basis of lack of threats in 1985. The species is listed as Sensitive by US Forest Service Region 2 (Kratz 1994).

b. HERITAGE RANK: Ranked G2 in The Nature Conservancy's Natural Heritage Network system. As a species, Lesquerella fremontii is considered imperiled because of rarity throughout its range (less than 20 extant occurrences are known).

2. STATE

a. LEGAL STATUS: None.

b. HERITAGE RANK: WYNDD ranks this species as S2, indicating that it is imperiled because of rarity in the state of Wyoming (Fertig 1994 b).

C. DESCRIPTION

1. GENERAL NON-TECHNICAL DESCRIPTION: Lesquerella fremontii is a pubescent perennial herb with decumbent stems 2-6 inches (5-15 cm) long (Figures 1-2). The basal leaves are 5/8-1 1/2 inches (1.5-4 cm) long and elliptic to diamond-shaped, while the stem leaves are shorter and narrower. The four-petaled flowers are 1/4-3/8 inches (6-8 mm) long, yellow, and have styles about 1/16 inches (1.5-2 mm) long. Fruits are elliptic, 3/16-5/16 inches (4-7 mm) long, and inflated or slightly flattened. At maturity, the fruits are pubescent on both the outer and inner surfaces and are borne on recurved stalks (Rollins and Shaw 1973; Clark and Dorn 1979; Fertig 1994 a; Fertig et al. 1994).

2. TECHNICAL DESCRIPTION: Perennial, densely pubescent. Trichomes subsessile, roughly granular, 5-7 rayed, rays distinct to slightly fused at base, usually forked. Caudex simple. Fruiting stems few to several, 0.5-1.5 dm long, prostrate, slender, usually simple, arising below a terminal cluster of erect leaves. Basal leaves with a

slender petiole, 1.5–4 (–5) cm long, blades elliptical to rhombic, entire or rarely remotely dentate. Cauline leaves narrowly obovate to oblanceolate, 5–15 mm long. Inflorescences short but rather loose. Petals yellow, unguiculate (clawed), 6–8 mm long. Infructescences usually

Figure 1. Line drawing of Lesquerella fremontii from Fertig et al. 1994, in ed. Illustration by Isobel Nichols.

secund. Fruiting pedicels recurved, 5-8 mm long. Siliques 3-6 mm long, pendent, sessile, globose or subglobose to slightly obcompressed, valves pubescent on exterior and interior, usually beaked at apex. Styles 1-2 mm long, pubescent. Ovules 4-6 per locule. Seeds slightly compressed, nearly orbicular, wingless (adapted from Rollins and Shaw 1973 and Rollins 1993).

3. LOCAL FIELD CHARACTERS: Lesquerella fremontii can be recognized by its low stature, basal cluster of pubescent diamond-shaped leaves, yellow four-petaled flowers, and slightly inflated fruits on recurved stalks. The fruit walls of L. fremontii are pubescent on both the inner and outer surfaces.

4. SIMILAR SPECIES: Lesquerella macrocarpa has inflated, globe-shaped fruits with walls glabrous on the inner surface and a more prostrate growth form. L. carinata and L. paysonii have strongly flattened fruits. Vegetative rosettes of L. fremontii resemble those of Townsendia spathulata but are smaller (Fertig et al. 1994).

D. SIGNIFICANCE: Over 20 species in the genus Lesquerella have been studied for possible cultivation as an oil-seed crop in the United States. Oils in the seeds and fruit of L. fendleri (a native of arid regions of the southwestern United States) have been found to be rich in hydroxy fatty acids. These acids are similar in quality to those currently available only from imported castor oil. These oils can be used in the production of resins, waxes, plastics, lubricants, soaps, and cosmetics. Residual meal from the seeds also makes a protein-rich livestock feed supplement (Senft 1992). L. fremontii may also contain commercial-grade oils and could provide useful genetic material for developing improved crop strains.

E. GEOGRAPHICAL DISTRIBUTION

1. RANGE: Lesquerella fremontii is endemic to the foothills of the southeastern Wind River Range and the Beaver Rim divide in western Fremont County, Wyoming (Figure 3). The entire known range of the species falls within an area 30.5 miles long by 14 miles wide. Little potential habitat, however, exists in the western Wind River

Basin between the Wind River Range and Beaver Rim.

Figure 2. Lesquerella fremontii from the vicinity of the radio tower on the summit of Limestone Mountain in the southeastern Wind River Range, Fremont County, Wyoming. Plants are shown in flower in early June. Photograph by Charmaine Refsdal.

Figure 3. Wyoming distribution of Lesquerella fremontii

2. EXTANT SITES: Lesquerella fremontii is currently known from five extant locations. Three of these occurrences are in the southeastern Wind River Range in the vicinity of Limestone Mountain and Sinks Canyon. Prior to 1994, eight separate populations were recognized in this area. Intensive surveys have shown that six of these populations were essentially confluent and could be lumped into one extensive occurrence. The other known locations of L. fremontii are found along Beaver Rim, approximately 20 miles east of the Wind River Range. Neither of the Beaver Rim populations could be relocated during drought conditions in 1994.

Exact locations of these populations are listed in Table 1. More detailed information is provided in the Element Occurrence Records and maps in Appendix A.

3. HISTORICAL SITES: The type locality of Lesquerella fremontii has not been relocated since its discovery by Ripley and Barneby in June 1947. Originally, the type location was reported as "5 miles east of Atlantic City" on a "calcareous gravel ridge, 8,200 ft.". The habitat and elevation at this location, however, does not match the description on the specimen label. Barneby later corrected the location data on the specimen as "3 miles north of Atlantic City at 8,200 ft" (Lichvar and Dorn 1980). This would place the type locality in the vicinity of the Columbia-Geneva Mine, southwest of Limestone Mountain.

4. POPULATIONS KNOWN OR ASSUMED EXTIRPATED: A small population along Wyoming State Highway 28 on the south slopes of Limestone Mountain (now considered to be a subpopulation of the Limestone Mountain population) is suspected to have been extirpated following paving and expansion of the road in the 1980s. L. fremontii plants were last observed at this site in June, 1979 and could not be relocated during visits in 1992 and 1994. No suitable habitat remains in the immediate vicinity of the roadcut.

5. UNVERIFIED/UNDOCUMENTED REPORTS: The earliest documented specimen of Lesquerella fremontii was collected by C. J. Bayer from "Washakie National Forest" (now the Shoshone National Forest) in May,

Table 1. Location information for known populations of *Lesquerella fremontii* in central Wyoming [1].

1. Southeastern Wind River Range

Occurrence # 001
County: Fremont.
Legal Description: T30N R98W S31 SE4.
Latitude: 42° 31' 51" N.
Longitude: 108° 34' 58" W.
Elevation: 7600 ft (2320 m).
USGS 7.5' Quad: Gravel Spring.
Location: North side of Beaver Creek, about 4.5 miles east of Miner's Delight, approximately 25 air miles south-southeast of Lander.

Occurrence # 002
County: Fremont.
Legal Description: T30N R99W S6 (E2 of E2), S7 (NW4 of NE4 of NE4, SW4 of NE4, & SE4 of SW4), 8 (S2), S16 (SE4 of SW4), 18 (NE4 & NW4 of NW4), S19 (NE4 of NE4 - possibly extirpated), S20 (E2), S21 (SW4); T30N R100W S13 (NE4); T31N R99W S19 (NW4 of SE4 & SW4 of NW4), S30 (E2 of NW4), S31 (E2 of SE4); T31N R100W S13 (NE4 of NE4), S24 (E2 of E2, SE4 of SE4 of SW4, & SW4 of SW4 of SE4), S25 (SW4 of SW4, NE4 of NW4, & NW4 of NE4), S26 (SE4), S35 (NE4), S36 (NE4 of NW4).
Latitude: 42° 36' 00" N (centrum).
Longitude: 108° 42' 33" W (centrum).
Elevation: 7100-9000 ft (2165-2745 m).
USGS 7.5' Quad: Miner's Delight.
Location: Limestone Mountain from the north side of Beaver Creek (south of Wyoming Highway 28) north along the main summit ridge and Cherry Creek ridge to the north rim of Little Popo Agie Canyon and on the south and east slopes of Young Mountain.

Occurrence # 003
County: Fremont.
Legal Description: T32N R101W S13 (SE4).
Latitude: 42° 44' 29" N.
Longitude: 108° 50' 27" W.
Elevation: 8500-8700 ft (2590-2650 m).
USGS 7.5' Quad: Fossil Hill.
Location: Sinks Canyon, on top of limestone bluff about 0.5 miles west-northwest of Sinks Canyon Campground.

[1] Gaps in occurrence numbers are due to the combination of several records with occurrence # 002. Ambiguous occurrence records are not included.

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2. Beaver Rim area

Occurrence # 009
County: Fremont.
Legal Description: T30N R96W S2 (SW4).
Latitude: 42° 35' 58" N.
Longitude: 108° 16' 57" W.
Elevation: 6800 ft (2075 m).
USGS 7.5' Quad: Red Canyon.
Location: Top of Beaver Rim, about 0.5 miles north-northeast of crossing of US Highway 287 (in vicinity of first curve in abandoned highway).

Occurrence # 012
County: Fremont.
Legal Description: T29N R97W S20.
Latitude: 42° 28' 37" N.
Longitude: 108° 27' 15" W.
Elevation: 7200-7300 ft (2195-2225 m).
USGS 7.5' Quad: Lewiston Lakes.
Location: South end of Beaver Rim in vicinity of Silver Creek, north of McLean Meadows, about 14 air miles southwest of Sweetwater Station.

1911. No additional label information is available and the location of the collection site is unknown (RM records). A second herbarium specimen collected by R. W. Deland from "Lander, Wyoming" in May, 1936 also lacks specific location data (RM records).

A 1980 collection by R. W. Lichvar has ambiguous label data and cannot be positively relocated. The specimen label cites the location as "ca 5 miles west of Limestone Mountain", but the accompanying legal description gives the location as being over 100 miles to the west, well out of the known range of the species. It is possible that this record is from the Freak Mountains or Baxter Mountain in Shoshone National Forest.
Additional survey is needed to confirm this location.

Two 1981 collections from Reed Rollins also lack precise location information. Both are from the southeast Wind River Mountains "near Wyoming State Highway 28, 24 miles southwest of Lander" (RM records). Based on road miles, these collections are probably in the vicinity of Limestone Mountain.

6. AREAS SURVEYED BUT SPECIES NOT LOCATED: Surveys in 1994 focus
Wyoming. Unsuccessful searches were conducted along the western slope of Beaver Rim and on Table Mountain south of Lander. Surveys of low elevation ridges and slopes on the east flank of the Wind Rivers were also unsuccessful. Previous floristic surveys in the foothills of the southwestern Wind River Range have failed to document Lesquerella fremontii or suitable habitat (Fertig 1992). Survey routes are shown in Appendix B.

F. HABITAT

1. ASSOCIATED VEGETATION: Lesquerella fremontii typically occurs in sparse montane meadows or shallow depressions on slopes and ridges with scattered limber pine (Pinus flexilis) (Figure 4). Soils are usually relatively deep and covered by a thin surface layer of limestone gravel. Plant cover is generally low, consisting mostly of small forbs, cushion plants, bunchgrasses, and three-tip sagebrush (Artemisia tripartita). Occasionally, L. fremontii can be found in narrow, soil-filled

cracks in calcareous boulders or bedrock. The species does not occur in moist valley bottoms and riparian areas or on lower mountain slopes on non-calcareous substrates.

2. FREQUENTLY ASSOCIATED SPECIES:

Arenaria congesta (Ballhead sandwort)
Artemisia tripartita (Three-tip sagebrush)
var. rupicola
Astragalus miser (Weedy milkvetch)
Balsamorhiza incana (Hoary balsamroot)
Carex filifolia (Thread-leaf sedge)
Castilleja flava (Yellow paintbrush)
Draba oligosperma (Few-seed draba)
Elymus spicatus (Bluebunch wheatgrass)
Erigeron compositus (Cut-leaved daisy)
Eriogonum flavum (Yellow wild-buckwheat)
Eriogonum umbellatum (Sulfur wild-buckwheat)
Festuca idahoensis (Idaho fescue)
Haplopappus acaulis (Stemless goldenweed)
Hymenoxys acaulis (Stemless hymenoxys)
Hymenoxys richardsonii (Richardson's hymenoxys)
Koeleria macrantha (Junegrass)
Lomatium triternatum (Nine-leaf biscuit-root)
Lupinus argenteus (Silvery lupine)
Oxytropis sericea (White locoweed)
Penstemon laricifolius (Larch-leaved beardtongue)
Phlox hoodii (Hood's phlox)
Phlox multiflora (Many-flowered phlox)
Pinus flexilis (Limber pine)
Poa secunda (Sandberg bluegrass)
Potentilla concinna (Early cinquefoil)
Potentilla ovina (Sheep cinquefoil)
Purshia tridentata (Bitter-brush)
Sedum lanceolatum (Lance-leaved stonecrop)
Senecio integerrimus (Western groundsel)
Townsendia spathulata (Spoon-leaved Easter-daisy)

3. TOPOGRAPHY: Lesquerella fremontii typically occurs on gentle to steep west or south-facing slopes (although it may also occur on north and east-facing slopes). Less frequently, it can be found in shallow depressions or saddles between ridgecrests (Figure 5). Known occurrences range in elevation from 6800-9000 feet (2075-2745 m).

4. SOIL RELATIONSHIPS: Known occurrences of Lesquerella fremontii are found on soils derived from

calcareous or other sedimentary substrates.

Figure 4. Habitat of Lesquerella fremontii on the summit of Limestone Mountain in the southeastern Wind River Range, Fremont County, Wyoming. Plants are restricted to sparsely vegetated depressions surrounded by mountain big sagebrush (in center of photograph). Soils in these sites are relatively deep, but are covered by a thin surface layer of fine limestone gravels. WYNDD photograph by W. Fertig.

Figure 5. Position of Lesquerella fremontii on the landscape. Illustration by W. Fertig.

Most populations are found on deep, relatively mesic soils covered with a thin layer of limestone or shale gravel. One population has also been reported from sandstone formations.

5. REGIONAL CLIMATE: Average annual precipitation in the southeastern Wind River Range is 16-20 inches (406-508 mm), with peak levels in January and May. Mean annual temperature is 35° F (1.6° C), with mean maximum and minimum temperatures in January of 26° and 0° F (- 3.3° and - 18° C) and mean maximum and minimum temperatures in July of 79° and 41° F (26° and 5° C) (Martner 1986). Monthly temperatures are higher on average and precipitation lower in Lesquerella fremontii habitat along Beaver Rim.

6. LOCAL MICROCLIMATE: Lesquerella fremontii often occurs on south or west-facing upper slopes, facing the prevailing wind. Evaporation from solar radiation and wind may make these microsites drier than regional precipitation data would indicate. The gravelly nature of the soils inhabited by L. fremontii however, may allow for deeper water infiltration during runoff and mitigate the drying effects of sun and wind.

G. POPULATION BIOLOGY AND DEMOGRAPHY

1. PHENOLOGY: Flowering occurs from late May through late June,

2. POPULATION SIZE AND CONDITION: There are currently five known years. The largest population (on Limestone and Young mountains) consists of 27 discrete subpopulations spread along a continuous ridge system about 8 miles long. The total area of known occupied habitat within this occurrence is approximately 211 acres.

The abundance of individual subpopulations on Limestone and Young mountains was found to vary from 3 to over 5,000 plants in 1994. Most subpopulations were found to be locally abundant, although usually restricted to relatively small and scattered areas of suitable habitat. Previous observations (mostly from labels on herbarium specimens) have suggested that populations are often very small and sparsely populated. These observations may be an artifact of the difficulty in distinguishing this drab, low-growing species in the field when

it is not in flower.

Based on qualitative observations in the field, the Limestone-Young mountain population is estimated to contain 40,000-45,000 plants. Demographic monitoring data from 1994 indicate a density of 9.5 plants per square meter at one high-quality site on Limestone Mountain. Although this site may not be typical of densities found elsewhere, it suggests that the total size of this population may be much higher (perhaps even exceeding 100,000 individuals). No census data are available from other known occurrences.

Demographic data collected in 1994 are summarized in Table 2.

3. REPRODUCTIVE BIOLOGY

a. TYPE OF REPRODUCTION: Lesquerella fremontii is a perennial that reproduces exclusively by seed.

b. POLLINATION BIOLOGY: The pollinator of Lesquerella fremontii is unknown. The plant's yellow flowers are likely to attract flies or other small insect pollinators.

c. SEED DISPERSAL AND BIOLOGY: The seeds of Lesquerella fremontii are somewhat flattened but lack wings or other structures to facilitate dispersal (Rollins 1993). In 1994, numerous plants were observed with dehiscent branches bearing 5-6 mature fruits. It is possible that the entire branch serves as the dispersal agent. This type of dispersal could account for the clumped, non-random distribution pattern exhibited by flowering and fruiting plants.

Germination requirements of the seeds are unknown. The occurrence of mature plants in the lee of rocks or at the edge of clumps of vegetation suggests that some type of cover or shade is necessary for seedling establishment.

Table 2. Demographic information for known populations of *Lesquerella fremontii* in central Wyoming.

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1. Southeastern Wind River Range

Occurrence # 001 (North side of Beaver Creek).
Area: Unknown.
Number and age of plants: Unknown.
Density: Unknown.
Presence of dispersed seed: Unknown.
Evidence of reproduction: Observed in flower and fruit in June 1977.
Evidence of expansion/contraction: No baseline population trend data are available. This occurrence has not been relocated since 1977.

Occurrence # 002 (Limestone and Young mountains).
Area: 211 acres.
Number and age of plants: Population estimated at 40,000-45,000 during ocular surveys in 1994. Total population size may be much higher based on densities observed in intensively sampled demographic plots.
Density: 9.5 plants per square meter were observed in a single demographic monitoring plot on Limestone Mountain. Individual plants occurred in a non-random, clumped distribution pattern (Appendix D).
Presence of dispersed seed: Individual fruits, seeds, and dehisced fruit-bearing branches were commonly observed on the ground during 1994 surveys.
Evidence of reproduction: Plants have been observed in flower and fruit at this site since 1977. 12.9 flowering and fruiting stems per square meter were observed in demographic plots in 1994.
Evidence of expansion/contraction: Although baseline trend data are lacking, past reports suggest that the population at this site is stable.

Occurrence # 003 (Sinks Canyon).
Area: ca 2 acres.
Number and age of plants: Reported as "infrequent" in 1980.
Density: Unknown.
Presence of dispersed seed: Unknown.
Evidence of reproduction: Plants observed in flower and fruit at this site in 1978 and in fruit in 1980.
Evidence of expansion/contraction: No population trend data are available.

2. Beaver Rim

Occurrence # 003 (Top of Beaver Rim, near old highway crossing).
Area: Unknown.
Number and age of plants: Unknown.
Density: Unknown.
Presence of dispersed seed: Unknown.
Evidence of reproduction: Unknown.
Evidence of expansion/contraction: This population could not be relocated during a thorough survey of the area in July 1994. Only a small area of suitable habitat appeared to be present. The population was last observed in 1978.

Occurrence # 012 (South end of Beaver Rim).
Area: Unknown.
Number and age of plants: Unknown.
Density: Unknown.
Presence of dispersed seed: Unknown.
Evidence of reproduction: Plants collected in fruit at this site in late May 1985.
Evidence of expansion/contraction: No baseline trend data exist for this population. This occurrence has not been relocated since 1985.

H. POPULATION ECOLOGY

1. GENERAL SUMMARY: Lesquerella fremontii occurs in sparsely vegetated montane meadows or low depressions on relatively deep, calcareous soils with a thin surface layer of limestone or shale gravel. Populations are often locally abundant within scattered pockets of suitable habitat. Due to the perennial nature of the plant, populations are probably stable from year to year.

2. COMPETITION: Most subpopulations of Lesquerella fremontii occur in open sites with low vegetative cover (typically 40-50%). Scattered plants can occasionally be found in semi-shade of limber pine, mountain big sagebrush or three-tip sagebrush. In general, L. fremontii does not appear to thrive under heavy shade of taller graminoids or forbs.

3. HERBIVORY: Leaves, stems, and inflorescences of Lesquerella fremontii showed no evidence of herbivory by livestock, native grazers, or insects in 1994. Fruits and seeds may be preyed upon by insects and rodents.

4. HYBRIDIZATION: There is no evidence to suggest that Lesquerella fremontii hybridizes with other members of its genus.

I. LAND OWNERSHIP (Table 3).

1. BLM: Both of the Beaver Rim populations and 12 of the 27 kno Resource Area). The Beaver Creek population (Occurrence # 001) may extend onto BLM lands from adjacent private lands.

2. US FOREST SERVICE: The Sinks Canyon occurrence and 12 of the Forest.

3. STATE OF WYOMING: One subpopulation of the Limestone Mountain population is found on state lands (T30N R99W S16). An additional subpopulation was formerly found along the state right-of-way along Wyoming Highway 28, but has apparently been extirpated by road expansion.

Table 3. Land ownership of populations and subpopulations of Lesquerella fremontii in Wyoming.

1. BLM Rawlins District (Lander Resource Area)

Occurrence # 002 (Limestone-Young mountains)
T30N R99W S8 (S2) [Red Canyon ACEC], S20 (E2), S21 (SW4).
T31N R99W S19 (SW4 of NW4), S30 (E2 of NW4), S31 (E2 of SE4) [all in Red Canyon ACEC].

Occurrence # 009 (Top of Beaver Rim)
T30N R96W S2 (SW4) [Beaver Rim ACEC].

Occurrence # 012 (South end of Beaver Rim)
T29N R97W S20.

2. Shoshone National Forest (Washakie Ranger District)

Occurrence # 002 (Limestone-Young mountains)
T30N R99W S6 (E2 of E2), S7 (NW4 of NE4 of NE4, SW4 of NE4, & SE4 of SW4), S18 (NE4 & NW4 of NW4).
T30N R100W S13 (NE4).
T31N R100W S13 (NE4 of NE4), S24 (E2 of E2, SE4 of SE4 of SW4, & SW4 of SW4 of SE4), S25 (SW4 of SW4, NE4 of NW4, & NW4 of NE4), S26 (SE4), S35 (NE4), S36 (NE4 of NW4).

Occurrence # 003 (Sinks Canyon)
T32N R101W S13 (SE4).

3. State of Wyoming

Occurrence # 002 (Limestone-Young mountains)
T30N R99W S16 (SE4 of SW4), S19 (NE4 of NE4) [state highway right-of-way].

4. Private

Occurrence # 001 (North Beaver Creek)
T30N R98W S31 (SE4) [may extend onto adjacent BLM lands].

Occurrence # 002 (Limestone-Young mountains)
T31N R99W S19 (NW4 of SE4) [TNC Red Canyon Ranch].

4. PRIVATE: The Beaver Creek population occurs on privately owned lands east of Limestone Mountain. One small subpopulation of the Limestone Mountain population is found on private lands on The Nature Conservancy's Red Canyon Preserve.

IV. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

A. POTENTIAL THREATS TO CURRENTLY KNOWN POPULATIONS: The restricted were identified during field surveys in 1994:

1. MINERAL DEVELOPMENT: Development associated with oil and gas exploration and development is a potential threat in the Beaver Rim area. In particular, the fragile soils and erodible slopes inhabited by L. fremontii are vulnerable to damage from road construction and trampling by vehicles testing seismic lines. Oil and gas activity is currently low elsewhere in the known range of the species.

An inactive limestone quarry is found on Shoshone National Forest lands below the summit of Limestone Mountain. The close association between L. fremontii and calcareous sites makes it especially vulnerable to surface disturbances resulting from quarrying activity and subsidiary development.

2. GRAZING: Cattle grazing occurs in the vicinity of the Beaver habitat appears to be relatively minor due to the low amount of available forage, rugged terrain, and lack of water. Because of the early flowering and fruiting period of L. fremontii, late summer grazing probably does not adversely affect fruit production or dispersal. Trampling by livestock is a potential threat at high stocking levels.

3. RECREATION: Trampling by off-road vehicles may result in direct mortality of plants and lead to soil compaction and erosion. No L. fremontii plants were observed in roadbeds or along the edge of heavily-used two-tracks on the summit of Limestone Mountain.

B. MANAGEMENT PRACTICES AND RESPONSE: No experimental data exist on the response of this species to management actions, such as prescribed burning or herbicide treatment. Observations in 1994 suggest that Lesquerella fremontii is not seriously impacted by

livestock grazing, although it could be negatively affected by trampling. The absence of plants in existing roadbeds in suitable habitat suggests that road construction and trampling by vehicles are negative impacts.

C. CONSERVATION RECOMMENDATIONS

1. RECOMMENDATIONS REGARDING PRESENT OR ANTICIPATED ACTIVITIES: Well pads, roads, and other structures associated with oil, gas, and hard-rock mineral development should be located off-site of occupied Lesquerella fremontii habitat. Salt blocks and water tanks should not be placed in L. fremontii habitat in order to minimize trampling by livestock. Additional roads and two-tracks should not be established or should be re-routed around occupied habitat.

2. NOTIFICATION OF BLM PERSONNEL OF LOCATIONS ON BLM LANDS: To prevent inadvertent impacts to known populations, all appropriate BLM personnel involved in planning and on-the-ground land management activities should be provided with location data for Lesquerella fremontii. It is especially important that agency minerals, engineering, and range staff know precise locations so that disturbances can be avoided.

3. AREAS RECOMMENDED FOR PROTECTION: The population of Lesquerella fremontii reported from the top of Beaver Rim (Occurrence # 009) is found within the Beaver Rim Area of Critical Environmental Concern (ACEC) (Jones 1989). The Lander Resource Area Resource Management Plan (USDI Bureau of Land Management 1987) allows oil and gas development in this area with no surface occupancy stipulations.

Six subpopulations of the Limestone Mountain population are within the BLM Red Canyon Management Unit ACEC. The management plan for this area is intended to protect wildlife and scenic values through seasonal controls on vehicle use and no-surface occupancy stipulations and other restrictions on mineral development (USDI Bureau of Land Management 1987). Subpopulations on adjoining National Forest lands are not currently protected within a special management area.

A small segment of the Limestone Mountain population occurs within The Nature Conservancy's Red Canyon Preserve. The preserve also controls grazing allotments over much of the adjacent National Forest and BLM land. Cattle grazing is being adopted as a management tool by the Conservancy. Long-term monitoring is recommended to gauge the response of L. fremontii to this management program.

D. STATUS RECOMMENDATIONS: Lesquerella fremontii should continue t observations that this species is insufficiently threatened at the present time to warrant listing as Threatened or Endangered. The species' small range however, makes it potentially vulnerable to decline if inappropriate management actions lead to habitat degradation or loss. Continued recognition of L. fremontii as a Forest Service Sensitive species will afford the plant sufficient management attention to prevent it from inadvertently trending towards extinction and subsequent need for listing as Threatened or Endangered in the future. The BLM Wyoming State Office should also list L. fremontii as a state Sensitive species and develop appropriate management strategies to maintain populations at current, stable levels.

Follow-up demographic trend monitoring should be conducted annually in order to add to the baseline data collected in 1994. Additional monitoring transects should also be established at the Limestone Mountain site and in the Beaver Rim area. Population trend data should be collected at these sites in 1-3 year intervals to determine if populations are stable, increasing, or decreasing. Additional surveys of potential habitat in the Beaver Rim area should be conducted in non-drought years to determine if these populations are still extant.

E. SUMMARY: Lesquerella fremontii is a state endemic restricted listed as a 3C candidate by the USFWS and as Sensitive by US Forest Service Region 2. From 1977-1993 the species was reported from nearly one dozen locations in Wyoming. Surveys in 1994, however, revealed that many of these populations were confluent with another. Five reproductively and geographically isolated populations are now recognized, two of which could not be relocated during drought conditions in 1994. The largest population, comprising 27 closely aggregated

subpopulations on Limestone and Young mountains, was found to contain an estimated 40,000-45,000 plants. Population size of separate subpoulations ranged from 3 to approximately 5,000 plants. Demographic plot data revealed a higher density than that observed by casual observation, suggesting that ocular population estimates may be too conservative. Based on an observed density of 9.5 plants per square meter at one monitoring site, the total population on Limestone Mountain may be closer to 100,000 plants. Census data are not available from the other populations. Although often locally abundant, plants were usually restricted to relatively small and scattered pockets of suitable habitat. L. fremontii typically occurs on open, west or south-facing mountain slopes and shallow depressions with deep, calcareous soils covered by a thin layer of limestone or shale gravel. Vegetation at these sites usually consists of low forbs, bunchgrasses, three-tip sagebrush, and an occasional limber pine. L. fremontii was observed to be minimally impacted by current grazing activities, but potentially affected by mineral exploration and development and trampling from off-road vehicles. Two populations are currently protected on BLM lands in the Beaver Rim and Red Canyon Management Unit ACECs. No populations are formally protected in Shoshone National Forest. The Nature Conservancy's Red Canyon Preserve includes a small portion of L. fremontii habitat on Limestone Mountain. Follow-up surveys and censuses are recommended to gather additional demographic data on this species and to determine if some satellite populations are still extant. Due to its restricted range and potential vulnerability to habitat loss, L. fremontii should continue to be managed as a Sensitive species by the US Forest Service and should be listed as Sensitive by the BLM Wyoming State Office.

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Appendix A.

Element Occurrence Records

and

Population Maps

for *Lesquerella fremontii*

Appendix B.

1994 Survey Routes

Appendix C.

Special Plant Survey Form

WYNDD

Appendix D.

Monitoring Data, 1994

Lesquerella fremontii (Fremont bladderpod)
Transect # 001
Demographic Monitoring Data

Date: 8 July 1994 Surveyors: Walter Fertig and Jerry Bigelow

Transect Location:

County: Fremont.
Occurrence: EO # 002.
Legal Description: T31N R99W S31 SE4SE4.
Orientation: 219° magnetic North.
USGS Quad: Miner's Delight.
Directions: From Lander, follow Wyoming State Highway 28 approximately 23 road miles to the Limestone Mountain Road. Proceed about 1.5 miles on this gravel road to the turnoff for the radio tower. Turn right onto this road and continue to the towers on the summit. This road continues as a 4WD or jeep trail northward from the radio towers and may not be passable to all vehicles or in inclement weather. Follow this road for approximately 2 miles along the crest of Limestone Mountain. After passing out of Shoshone National Forest onto BLM lands, take the first two-track trail entering from the left (west). Continue a short distance on this track to the top of the saddle. The transect is located on the south side of the saddle at its highest point. Endpoints of the transect are marked by orange-tipped re-bar. From the origin of the transect (nearest the road) proceed southwest to the endpoint.

Sampling Method: A 30 x 1 meter belt transect was established with starting points indicated by orange re-bar and a low rock pile. The meter tape formed the baseline and meter sticks framed each 1 x 1 meter subdivision. 30 contiguous plots were read following the left side of the tape, beginning from the origin. Locations of individual rosettes were mapped and given X, Y coordinates and the number of flowering and fruiting stems per plant was recorded. One of three age classes was assigned to each plant: R (reproductive, in flower or bud), F (fruiting in current season), and V (vegetative). The number of flowering and fruiting stems per plot was also recorded.

Habitat: Mountain meadow and open limber pine savanna in saddle between adjacent ridges. Soil deep, relatively mesic, and covered with surface layer of limestone-sandstone gravel. Associated species include Elymus spicatus, Hymenoxys

acaulis, Antennaria umbrinella, Arenaria hookeri, Balsamorhiza incana, Sedum lanceolatum, and Selaginella densa.

Summary of Results: Since monitoring was only initiated in 1994, no information on population trends is available at this time. The accompanying data sheets summarize baseline data collected this year. Because of drought conditions in 1994, production may have been adversely affected.

Discussion and Recommendations: Follow-up monitoring should be conducted at this site every 1-3 years. Monitoring yearly would provide valuable data on reproductive success, seedling establishment, and longevity of individual plants. Periodic monitoring (every 2-3 years) would provide population trend data for this site only, but could provide inferences to overall trends of the species. Additional monitoring sites should be located in the future to create a larger data set and more accurately indicate population size and trends.

Figure 6. Location of monitoring plot.

Lesquerella fremontii
Transect # 001
Census Data

Date: 8 July 1994
Surveyors: Walter Fertig and Jerry Bigelow

Subdiv #	Total #	# R	# F	# V	# Fl/Fr stems	Notes
1	12	0	12	0	19	
2	4	0	4	0	5	
3	12	0	12	0	16	
4	5	0	5	0	5	
5	0	0	0	0	0	
6	3	0	3	0	5	
7	7	0	7	0	12	
8	2	0	2	0	4	
9	8	0	7	1	8	
10	21	0	17	4	21	
11	16	0	15	1	19	
12	15	0	15	0	25	
13	26	0	23	3	38	
14	11	0	11	0	23	
15	3	0	2	1	2	
16	2	0	2	0	3	
17	12	0	12	0	18	
18	6	0	6	0	8	
19	15	0	14	1	21	
20	19	0	17	2	24	
21	21	0	21	0	28	
22	19	0	18	1	23	
23	24	0	24	0	33	
24	14	0	14	0	16	
25	4	0	4	0	4	
26	0	0	0	0	0	
27	0	0	0	0	0	
28	0	0	0	0	0	
29	5	0	5	0	6	
30	0	0	0	0	0	
Total	286	0	272	14	386	

Number of plants per square meter: 9.53

Number of flowering/fruiting stems per square meter: 12.9

Codes: R = Reproductive (plants with mature flowers or buds), F = Fruiting (plants with fruiting heads of the current season), V = Vegetative (plants lacking flowering or fruiting heads or buds).

Lesquerella fremontii
Transect # 001

X, Y Coordinates of plants, growth form class, and number of flowering/fruiting stems for each plant per plot.

Date: 8 July 1994
Surveyors: Walter Fertig and Jerry Bigelow

Plot 1: (0.0, 3.0) F-1; (0.0, 3.4) F-2; (0.5, 4.0) F-2; (1.1, 1.1) F-2; (1.4, 0.4) F-1; (1.6, 3.0) F-1;
(2.1, 8.1) F-2; (2.5, 2.9) F-1; (4.5, 2.8) F-1; (5.3, 8.8) F-1; (6.6, 9.1) F-2; (7.1, 4.4) F-1.

Plot 2: ((4.9, 2.5) F-2; (6.1, 1.7) F-1; (6.7, 1.4) F-1; (9.0, 0.6) F-1.

Plot 3: (1.6, 5.2) F-1; (1.7, 9.6) F-1; (2.4, 6.3) F-2; (2.4, 8.1) F-2; (2.7, 7.2) F-1; (3.8, 5.3) F-1;
(4.2, 4.0) F-1; (4.3, 5.3) F-2; (6.0, 2.6) F-1; (8.0, 6.8) F-2; (8.9, 0.9) F-1; (9.0, 9.4) F-1.

Plot 4: (1.3, 3.3) F-1; (1.9, 3.7) F-1; (2.0, 6.1) F-1; (2.4, 3.5) F-1; (2.7, 6.3) F-1.

Plot 5: None.

Plot 6: (1.4, 8.1) F-2; (7.0, 7.0) F-2; (8.1, 4.8) F-1.

Plot 7: (1.5, 7.8) F-2; (2.2, 5.2) F-2; (3.3, 5.6) F-3; (3.8, 4.6) F-1; (5.2, 2.8) F-2; (9.7, 5.6) F-1;
(9.7, 8.5) F-1.

Plot 8: (6.9. 1.0) F-3; (9.0, 7.6) F-1.

Plot 9: (0.9, 6.5) F-1; (0.9, 6.7) F-1; (2.4, 8.1) F-1; (2.9, 6.8) V-0; (3.3, 4.4) F-1; (4.6, 4.9) F-2;
(8.0, 7.3) F-1; (9.9, 9.9) F-1.

Plot 10: (2.1, 3.4) F-1; (2.8, 6.7) V-0; (3.0, 9.1) F-2; (3.6, 3.8) F-2; (4.5, 7.2) V-0; (4.5, 7.5) F-1;
(5.0, 3.5) F-1; (5.8, 3.8) F-1; (5.8, 9.5) F-1; (6.8, 4.2) F-1; (6.9, 5.6) F-1; (7.5, 3.8) F-1;
(7.5, 5.4) V-0; (8.0, 5.6) F-1; (8.1, 3.9) F-1; (8.1, 8.2) F-1; (8.5, 3.7) F-1; (8.5, 6.8) V-0;
(9.0, 6.8) F-2; (9.2, 7.1) F-2; (9.3, 3.4) F-1.

Plot 11: (0.7, 2.6) F-1; (2.0, 7.9) F-1; (2.3, 5.3) F-1; (3.0, 4.3) F-1; (3.3, 2.5) F-2; (3.7, 4.0) F-2;
(3.9, 5.6) F-1; (3.9, 5.8) V-0; (4.0, 9.9) F-1; (4.8, 5.3) F-2; (5.7, 4.5)

F-1; (6.2, 8.1) F-2; (6.8, 9.7) F-1; (7.1, 8.1) F-1; (8.6, 5.8) F-1; (9.9, 5.8) F-1.

Plot 12: (4.5, 6.5) F-2; (5.1, 4.0) F-2; (5.2, 6.1) F-2; (5.2, 6.4) F-1; (5.3, 7.8) F-3; (6.5, 1.0) F-1;
(6.5, 5.7) F-1; (7.4, 6.3) F-2; (7.8, 6.3) F-2; (7.9, 7.1) F-1; (8.0, 7.3) F-1; (8.0, 9.4) F-2; (8.5, 5.6) F-1; (9.9, 4.0) F-2; (9.9, 8.1) F-2.

Plot 13: (0.7, 3.3) F-1; (0.8, 4.5) V-0; (0.8, 5.7) F-2; (0.8, 6.3) F-1; (0.8, 7.6) F-1; (0.9, 4.2) F-3;
(0.9, 6.3) V-0; (1.0, 7.1) F-2; (1.2, 8.3) F-2; (1.3, 6.1) F-2; (1.3, 6.8) V-0; (1.3, 8.1) F-1; (1.7, 6.8) F-1; (2.0, 4.0) F-1; (2.5, 8.6) F-3; (3.0, 9.2) F-2; (3.7, 7.8) F-1; (4.1, 9.7) F-2; (4.5, 9.7) F-2; (4.7, 8.4) F-2; (4.8, 8.7) F-1; (5.7, 9.1) F-1; (5.9, 8.1) F-1; (6.3, 9.1) F-3; (6.4, 6.2) F-2; (9.4, 6.1) F-1.

Plot 14: (0.4, 4.3) F-2; (0.5, 5.6) F-3; (0.5, 6.4) F-3; (0.9, 5.7) F-5; (1.4, 5.4) F-3; (1.5, 1.4) F-1;
(1.6, 5.7) F-1; (5.7, 4.6) F-1; (5.8, 9.4) F-1; (7.6, 0.6) F-1; (8.7, 0.7) F-2.

Plot 15: (3.8, 1.6) F-1; (5.8, 4.7) V-0; (9.4, 3.1) F-1.

Plot 16: (1.2, 7.1) F-2; (9.1, 6.1) F-1.

Plot 17: (2.0, 9.1) F-1; (3.9, 1.2) F-1; (4.5, 1.2) F-2; (4.7, 1.1) F-2; (4.9, 6.2) F-2; (5.1, 8.9) F-1;
(6.1, 0.5) F-1; (7.4, 0.5) F-2; (7.5, 7.5) F-3; (7.9, 1.8) F-1; (8.3, 2.0) F-1; (9.0, 0.2) F-1.

Plot 18: (3.3, 5.3) F-1; (5.9, 7.3) F-1; (5.9, 8.6) F-2; (6.9, 0.4) F-1; (6.9, 8.9) F-1; (9.8, 9.5) F-2.

Plot 19: (0.1, 1.2) V-0; (0.4, 6.3) F-1; (0.8, 3.3) F-2; (1.0, 6.8) F-1; (1.3, 1.8) F-2; (1.5, 2.1) F-1;
(1.8, 3.4) F-1; (3.3, 4.4) F-2; (5.8, 4.3) F-2; (6.3, 7.1) F-1; (6.7, 5.1) F-1; (8.1, 3.9) F-2; (8.1, 9.7) F-1; (8.7, 8.9) F-1; (9.3, 3.5) F-3.

Plot 20: (0.2, 6.9) V-0; (0.7, 3.3) F-1; (1.1, 3.3) F-1; (1.2, 6.8) F-2; (1.5, 0.3) F-1; (2.6, 8.0) F-2;
(3.1, 1.6) F-2; (3.6, 1.1) F-1; (5.2, 2.1) F-1; (5.7, 3.4) F-1; (6.7, 1.3) F-1; (7.9, 2.3) F-3; (8.1, 4.9) F-1; (8.3, 2.0) F-1; (8.7, 0.0) F-3; (9.0, 6.8) V-0; (9.5, 6.6) F-1; (9.5, 7.6) F-1; (9.7, 0.3) F-1.

Plot 21: (1.1, 7.8) F-2; (1.1, 8.3) F-2; (2.3, 8.2) F-2; (2.9, 9.2) F-1; (3.0, 8.1) F-1; (3.1, 9.4) F-1;
(4.8, 8.2) F-1; (5.0, 8.7) F-1; (5.1, 8.6) F-1; (5.5, 1.0) F-1; (5.5, 5.7) F-1; (6.0, 5.3) F-1; (6.3, 4.3) F-1; (7.9, 2.4) F-1; (8.2, 8.1) F-2; (8.3,

7.8) F-1; (8.7, 0.5) F-2; (8.8, 2.4) F-1; (8.9, 2.8) F-1; (9.0, 7.6) F-1; (9.7, 1.2) F-3.

Plot 22: (1.1, 0.6) V-0; (1.3, 2.4) F-1; (2.6, 4.7) F-3; (2.6, 7.3) F-3; (4.0, 2.8) F-1; (4.0, 3.0) F-1; (4.5, 5.8) F-1; (4.7, 3.0) F-1; (4.8, 3.3) F-1; (5.0, 0.8) F-1; (5.0, 5.1) F-1; (5.2, 9.6) F-1; (5.5, 9.5) F-1; (5.5, 9.7) F-1; (5.9, 1.1) F-1; (5.9, 8.1) F-1; (6.5, 0.2) F-1; (8.3, 7.9) F-2; (8.5, 7.3) F-1.

Plot 23: (1.5, 7.1) F-2; (2.0, 0.2) F-1; (2.2, 6.8) F-1; (2.2, 9.8) F-1; (2.3, 6.5) F-3; (2.5, 9.9) F-1; (2.8, 0.6) F-1; (3.0, 2.7) F-2; (3.0, 5.7) F-1; (3.1, 2.5) F-2; (3.5, 6.3) F-1; (4.2, 0.7) F-3; (4.8, 9.0) F-1; (5.2, 9.1) F-1; (6.4, 0.6) F-1; (7.0, 4.6) F-1; (7.2, 7.5) F-1; (7.3, 7.4) F-1; (8.0, 7.6) F-1; (8.1, 8.1) F-1; (8.2, 0.2) F-1; (8.7, 4.3) F-2; (9.8, 8.2) F-2; (9.9, 5.3) F-1.

Plot 24: (0.5, 5.8) F-1; (0.7, 5.2) F-1; (1.0, 4.0); F-1; (2.5, 0.5) F-2; (2.7, 2.4) F-1; (4.7, 6.6) F-1; (5.0, 1.2) F-1; (5.0, 6.3) F-1; (6.4, 0.4) F-1; (6.4, 7.3) F-1; (7.6, 6.3) F-1; (7.8, 4.2) F-1; (8.3, 5.6) F-1; (9.4, 0.6) F-2.

Plot 25: (1.6, 2.3) F-1; (5.2, 1.5) F-1; (5.3, 1.0) F-1; (9.6, 1.8) F-1.

Plot 26: None.

Plot 27: None.

Plot 28: None.

Plot 29: (1.7, 9.1) F-2; (3.9, 8.6) F-1; (4.6, 8.1) F-1; (5.2, 9.1) F-1; (5.3, 8.1) F-1.

Plot 30: None.

Appendix E.

Slides