

Status Report on
Dubois Milkvetch
(Astragalus gilviflorus var. purpureus)
in Northwestern Wyoming

Prepared for the Bureau of Land Management
Wyoming State Office

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Table of Contents

	Page
I. Introduction	5
II. Methods	5
III. Species Information	5
A. Classification	5
B. Present legal or other formal status	6
C. Description	7
D. Geographical Distribution	9
E. Habitat	10
F. Population biology and demography	18
G. Population ecology	21
H. Land ownership	24
IV. Assessment and Management Recommendations	25
A. Potential threats to currently known populations	25
B. Management practices and response	27
C. Conservation recommendations	28
D. Status recommendations	28
V. Summary	29
VI. Literature Cited	29

Figures, Tables, and Appendices

Page

Figures

1. Line drawing of *Astragalus gilviflorus* var. *purpureus* 8

2. Photograph of *Astragalus gilviflorus* var. *purpureus* 11

3. Distribution of *Astragalus gilviflorus* var. *purpureus* 12

4. Habitat of *Astragalus gilviflorus* var. *purpureus* 17

5. Habitat of *Astragalus gilviflorus* var. *purpureus* 19

6. Topographic position of *Astragalus gilviflorus* var. *purpureus* 20

Tables

1. Location information for known populations of *Astragalus gilviflorus* var. *purpureus* in Wyoming 13

2. Demographic information for Wyoming populations of *Astragalus gilviflorus* var. *purpureus* in Wyoming 21

3. Land management status of known occurrences of *Astragalus gilviflorus* var. *purpureus* in Wyoming 26

Appendices

A. Element Occurrence Records and population maps 31

B. WYNND Special Status Plant Survey form 63

C. Survey Routes 65

I. INTRODUCTION

Astragalus gilviflorus var. *purpureus* (Dubois milkvetch) was first recognized as a distinct taxonomic entity by M. L. Roberts (1977), but was not officially described as a new taxon until Dorn published a brief account in the first edition of *Vascular Plants of Wyoming* (Dorn 1988, p 297). Due to its limited geographic range and small population size, this taxon was listed as a Category 2 candidate for listing under the Endangered Species Act by the US Fish and Wildlife Service (USFWS) in 1993. Under BLM Manual 6840, the BLM is directed to manage USFWS candidates on its lands in such a manner that these species 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 1996, the Bureau of Land Management Wyoming State Office contracted with the Wyoming Natural Diversity Database (WYNDD) on a cost-share basis to conduct field surveys and evaluate the status of this taxon on BLM lands in the northwestern Wind River Basin of Fremont County, Wyoming. The objective of this report is to summarize existing data on the biology, distribution, habitat, population size, and potential threats of *A. gilviflorus* var. *purpureus* to be used in determining its conservation status and potential management needs in Wyoming.

II. METHODS

Information on the habitat and distribution of *Astragalus gilviflorus* var. *purpureus* was obtained from secondary sources, including WYNDD files and computer databases, specimens from the Rocky Mountain Herbarium (RM), scientific 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 in early and mid-June 1996 (survey routes and collection sites are indicated in Appendix C). Data on the biology, habitat, population size, and management needs of this species were collected using WYNDD plant survey forms (Appendix B). Locations of occurrences were mapped on 7.5 minute USGS topographic maps. If populations were sufficiently large, voucher specimens were collected for deposit at the RM and the Rawlins District herbarium. Color photographs were taken of milkvetch plants and their habitat at each site. Information gathered in the field was entered into the computerized Element Occurrence database of WYNDD.

III. SPECIES INFORMATION

A. CLASSIFICATION

1. SCIENTIFIC NAME: *Astragalus gilviflorus* Sheld. var. *purpureus* Dorn (Dorn 1988). Type specimen: USA, Wyoming, Fremont

County, T42N R106W Sec 31 W ¼, rocky barren hills, 7000 ft., 26 June 1980, Dorn 3476 (RM).

2. SYNONYMS: Roberts (1977) proposed the name *Astragalus shoshonensis* for this taxon, but his description was never validly published.
3. COMMON NAMES: Dubois milkvetch.
4. FAMILY: Fabaceae or Leguminosae (pea family).
5. SIZE OF GENUS: Worldwide, the genus *Astragalus* contains over 1600 species, with about 375 known from North America (Barneby 1989). Dorn (1992) lists 59 species and an additional 20 varieties of *Astragalus* for Wyoming.
6. PHYLOGENETIC RELATIONSHIPS: The Dubois milkvetch is most closely related to *Astragalus gilviflorus* var. *gilviflorus*, differing primarily in flower color (Dorn 1988). Roberts (1977) considered the Dubois milkvetch to be derived from *A. gilviflorus*, but also noted a superficial resemblance to *A. barrii*, an endemic of the northern Great Plains.

B. PRESENT LEGAL OR OTHER FORMAL STATUS:

1. NATIONAL:

- a. LEGAL STATUS: *Astragalus gilviflorus* var. *purpureus* was formerly a Category 2 (C2) candidate for listing under the Endangered Species Act (US Fish and Wildlife Service 1993). The C2 list included species that might have warranted listing as Threatened or Endangered, but for which the USFWS lacked sufficient biological data to support a listing proposal. In February 1996, the USFWS revised its candidate policy and eliminated the C2 designation (US Fish and Wildlife Service 1996). As a result, *A. gilviflorus* var. *purpureus* currently has no legal status.
- b. HERITAGE RANK: *Astragalus gilviflorus* is ranked G5 in The Nature Conservancy's Natural Heritage network system. This rank indicates that the full species is "demonstrably secure" over its whole range. Variety *purpureus* is ranked T2, indicating that this taxon is "imperiled because of rarity" (with 6-20 extant occurrences) or because of other factors demonstrably making it vulnerable to extinction (Fertig 1997 a).

2. STATE:

a. LEGAL STATUS: None.

b. HERITAGE RANK: *A. gilviflorus* var. *purpureus* is ranked S2, indicating that it is imperiled because of rarity in the state of Wyoming (Fertig 1997 a).

C. DESCRIPTION

(Figures

among the
et al.

1. GENERAL NON-TECHNICAL DESCRIPTION: Dubois milkvetch is a loosely matted, perennial herb with a branching rootstalk (1-2). The leaves are silvery-pubescent, long-petioled, and divided into 3 oval leaflets 7-30 mm long. Pea-like flowers are borne in pairs among the densely packed basal rosette of leaves. The banner petal is blue or purple (occasionally pinkish), 12-28 mm long, and has a spoon-shaped blade that tapers evenly to a narrow base. Fruits are upright, elliptical pods that are often hidden among the leaf bases (Roberts 1977; Dorn 1988; Barneby 1989; Fertig 1994).

ciliate
pedicels to 1
mm

2. TECHNICAL DESCRIPTION: Caespitose herb from a much-branched caudex covered by a thatch of persistent petioles; herbage appearing silvery due to the lustrous, appressed, verrucose dolabriform vestiture, the hairs longer and somewhat spreading on the petioles; stipules ovate, corrugate, hyaline, ciliate, nearly glabrous; leaves 1-4 cm long, those emerging at anthesis shorter with smaller and broader leaflets, early leaflets ovate to obovate-cuneate and acute to obtuse, the later leaflets 6-15 mm long, 3-6 mm wide, narrowly lanceolate, acute, slightly keeled, the terminal leaflet exceeding the lateral in length, especially in the younger leaves; racemes essentially sessile, capitate, flowers 2; bracts hyaline, trilobate, obcordate in general outline with the central lobe aristate, the lateral lobes shorter, obtuse to nearly truncate, on the margins and lightly pubescent toward the base; pedicels 1-2 mm long; bracteoles linear-oblongate, glabrous; calyx 9-14.5 mm long, cylindric, the tube 7-11.5 mm long, becoming scarious and distended by the enlarging ovary; petals blue to purple, the banner with a white striate lozenge, the wings lighter toward the tips, the whole marcescent and yellowing in age; banner recurved 40-60°, obovate, cuneate to the claw, emarginate, 15-25 mm long, 5-7.2 mm wide, wings 18.7-22 mm long, the claws 9-13 mm long, 2-2.2 mm wide, spreading, flat; keel 16-19 mm long, the claws 9-12.5 mm long, the blades 5-6.5 mm long, obliquely elliptic, the apex bluntly triangular, incurved through $\pm 90^\circ$; anthers 0.5-0.7

mm

Figure 1. Line drawing of *Astragalus gilviflorus* var. *purpureus* from Fertig et al. 1994.
Illustration by W. Fertig.

slightly
cartilaginous
dull, 2-5

long, orange; style upcurved, slightly protruding at the apex of the keel; pod erect, nearly sessile, concealed by the persistent petioles and stipules and enclosed in the marcescent calyx, ovules 15-19, at maturity ovoid-ellipsoid, 6.8-11.5 mm long, 2.8-4 mm in diameter, obtuse at the base, contracted apically to a short cusp, compressed dorsally, the valves fleshy and becoming or sub-woody, densely strigose; seeds brown, smooth and maturing, 2-2.5 mm long (modified from Roberts 1977).

3. LOCAL FIELD CHARACTERISTICS: Dubois milkvetch can be recognized in the field by its matted growth form, silvery leaves with 3 leaflets, and bluish-purple pea-like flowers. Flower color and banner shape are needed to positively distinguish it from related species.

4. SIMILAR SPECIES: *Astragalus gilviflorus* var. *gilviflorus* has white or cream-colored flowers. *A. proimanthus*, *A. hyalinus*, and an undescribed species from Park County, Wyoming have yellowish or white fiddle-shaped banners. Other *Astragalus* species with 3 leaflets (including *A. barrii*) typically have smaller flowers and shorter calyx tubes (Dorn 1992; Fertig et al. 1994).

D. GEOGRAPHICAL DISTRIBUTION

Roberts

1. RANGE: *Astragalus gilviflorus* var. *purpureus* is endemic to the Dubois Badlands of the northwestern Wind River Basin and the adjacent foothills of the northeastern Wind River and southern Absaroka ranges in Fremont County, Wyoming (Figure 3). The entire known range of the taxon extends from White Pass (approximately 9 air miles northwest of Dubois) east 28 miles to Johnson Draw on the Wind River Indian Reservation and south approximately 15 miles to Torrey Rim and the Wind River. (1977) indicates that the range of the species extends about 40 miles southeast of Dubois, but no specimens have been found to confirm this.

2. EXTANT SITES: Dubois milkvetch is currently known from 11 extant occurrences, 9 of which have been discovered or relocated since 1990. These occurrences consist of 38 subpopulations and occupy a known area of at least 400 acres (with much more extensive areas of habitat probably available). One new occurrence (EO # 003) was discovered during field surveys in 1996 (Fertig 1997 b).

Records

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

3. SITES WHERE PRESENT STATUS NOT KNOWN: The populations from Johnson Draw on the Wind River Indian Reservation (EO # 004) and White Pass (EO # 012) have not been relocated since 1981 and 1984, respectively.
4. UNVERIFIED/UNDOCUMENTED REPORTS: In the “Representative Specimens” section of his thesis, Roberts (1977) cites nine of his own Fremont County collections of “*A. shoshonensis*”, but does not provide any specific location information. None of these specimens have been deposited at the RM (B.E. Nelson, RM manager, personal communication).
5. AREAS SURVEYED BUT SPECIES NOT LOCATED: Potential habitat was surveyed on BLM lands in the Alkali Creek and EA Mountain areas, but no populations of this species were found. Survey routes are shown in Appendix C.
6. AREAS OF UNSURVEYED POTENTIAL HABITAT: Additional unsurveyed potential habitat may exist in the badlands of the Chimney Rock Gulch area, ca 4 air miles west of Dubois and on the Wind River Indian Reservation in the Bain Draw, Sand Draw, and Crow Creek areas.

E. HABITAT

1. ASSOCIATED VEGETATION: *Astragalus gilviflorus* var. *purpureus* occurs primarily in sparsely vegetated cushion plant/bunchgrass communities on sandy-clay soils with abundant surface gravel (Figures 4-5). These communities may lack a shrub component, or contain widely scattered individuals of Wyoming big sagebrush, mountain big sagebrush, or black sagebrush. This species may also be found on semi-disturbed roadbanks with low, sparse vegetation (total cover averages less than 40%). Less common habitats include mountain big sagebrush/bluebunch wheatgrass communities with over 50% cover and lemon scurfpea/prickly-phlox/cushion plant communities on whitish

Figure 2 (page 11). *Astragalus gilviflorus* var. *purpureus* from the Dubois badlands, ca

13 road miles southeast of Dubois in Fremont County, Wyoming. Plants can be recognized by their purple flowers, leaves with 3 leaflets, and condensed, bun-like growth form. WYNDD photograph by Hollis Marriott, June 1990.

Fig 2

Figure 3. Wyoming distribution of *Astragalus gilviflorus* var. *purpureus*. Bottom:
Distribution in Fremont County, as reported by Roberts (1977).

Table 1. Location information for known populations of *Astragalus gilviflorus* var. *purpureus* in Wyoming.

<p>Occurrence # 001 County: Fremont. Legal Description: T42N R106W S30 (centerW2), S31 (W4); T42N R107W S26 (NW4), S27 (NE4), S35 (NW4NW4NW4). Latitude: 43° 34' 30" N (centrum). North: 43° 34' 48" N. South: 43° 33' 47" N. Longitude: 109° 37' 40" W. East: 109° 37' 39" W. West: 109° 41' 03" W. Elevation: 7000-7440 ft (2130-2270 m). USGS 7.5' Quad: Dubois. Location: Vicinity of Tappan Creek and Horse Creek, ca 2.5 miles north of Dubois.</p>	<p>Legal Description: T40N R106W S14 (SE4NW4), S15 (SW4SW4), S16 (SE4SE4), S21 (N2NE4), S22 (NW4NW4). Latitude: 43° 25' 42" N (centrum). North: 43° 26' 21" N. South: 43° 25' 40" N. Longitude: 109° 34' 20" W (centrum). East: 109° 32' 32" W. West: 109° 34' 25" W Elevation: 7480-7900 ft (2280-2410 m). USGS 7.5' Quad: Torrey Lake. Location: Torrey Rim above the southwest end of Trail Lake, ca 7 air miles south-southeast of Dubois and ca 0.2 miles north of the Trail Lake trailhead, ca 1.75 miles west of Trail Lake.</p>
<p>Occurrence # 002 County: Fremont. Legal Description: T42N R106W S21 (S2), S23 (SE4), S27 (W2SE4), S28 (NE4). Latitude: 43° 34' 15" N (centrum). North: 43° 35' 02" N. South: 43° 34' 05" N. Longitude: 109° 33' 36" W (centrum). East: 109° 32' 18" W. West: 109° 35' 00" W. Elevation: 7400-7600 ft (2255-2315 m). USGS 7.5' Quad: Mason Draw. Location: North and northeast slopes of Table Mountain along the south side of Little Alkali Creek and near the head of Mason Draw, ca 3.5 air miles north of US Highway 26/287 and ca 3.5-5 air miles northeast of Dubois.</p>	<p>Occurrence # 004 County: Fremont. Legal Description: T7N R4W S24 (SW4). Latitude: 43° 34' 05" N. Longitude: 109° 10' 48" W. Elevation: 8800 ft (2680 m). USGS 7.5' Quad: Johnson Draw. Location: Johnson Draw, ca 18 air miles north of Crowheart.</p>
<p>Occurrence # 003 County: Fremont.</p>	<p>Occurrence # 005 County: Fremont. Legal Description: T5N R6W S11 (SE4SW4), S14 (NW4NE4). Latitude: 43° 24' 50" N (centrum). North: 43° 25' 12" N. South: 43° 24' 50" N. Longitude: 109° 26' 10" W (centrum). East: 109° 26' 10" W. West: 109° 26' 41" W.</p>

Elevation: 6400 ft (1950 m).
USGS 7.5' Quad: Blue Holes.
Location: Ca 13 miles southeast of Dubois on southwest side of Highway 26 across from "Picture Turnout" on north and south sides of the confluence of Little Red Creek and the Wind River.

Occurrence # 006
County: Fremont.
Legal Description: T41N R106W S7 (SW4), S18 (NW4); T41N R107W S12 (SE4), S13 (NE4).
Latitude: 43° 31' 18" N (centrum).
North: 43° 31' 40" N.
South: 43° 31' 00" N.
Longitude: 109° 37' 47" W (centrum).
East: 109° 37' 10" W.
West: 109° 38' 20" W.
Elevation: 6950-7200 ft (2120-2195 m).
USGS 7.5' Quads: Dubois and Mason Draw.
Location: Badlands near the mouth of Lime Kiln Gulch on the south bank of the Wind River ca 0.5-1 miles south of Dubois.

Occurrence # 007
County: Fremont.
Legal Description: T41N R105W S6 (W2SW4 & SE4SW4), S7 (N2NE4 & NE4SE4NE4), S8 (S2NW4 & N4SW4NE4), S17 (SW4NE4), S18 (NE4SE4), S20 (NW4); T41N R106W S1 (NW4), S10 (E2SE4), S11 (W2NW4SW4, E4SE4SW4, SW4NW4, & NE4NW4), S14 (NE4NE4NW4), S24 (NW4).
Latitude: 43° 32' 10" N (centrum).
North: 43° 32' 46" N.
South: 43° 30' 05" N.
Longitude: 109° 30' 05" W (centrum).
East: 109° 28' 47" W.

West: 109° 33' 33" W.
Elevation: 6800-7600 ft. (2070-2315 m).
USGS 7.5' Quads: Bain Draw and Mason Draw.
Location: Badlands ridges on the south side of Table Mountain from the rim on the west side of Carson Draw east ca 4 miles to the foothills on the west side of the East Fork Road, ca 0.75 miles west of the East Fork of the Wind River.

Occurrence # 008
County: Fremont.
Legal Description: T42N R105W S16 (N4NE4SW4 & S4SW4NW4), S28 (E2NW4), S29 (NW4), S33 (SW4SE4).
Latitude: 43° 34' 34" N (centrum).
North: 43° 36' 10" N.
South: 43° 33' 13" N.
Longitude: 109° 28' 05" W (centrum).
East: 109° 28' 00" W.
West: 109° 29' 10" W.
Elevation: 6820-7400 ft (2080-2255 m)
USGS 7.5' Quad: Bain Draw.
Location: Vicinity of the confluence of the Wiggins Fork and East Fork of the Wind River, north ca 4 miles to the ridge on the west side of Bear Creek

Occurrence # 009
County: Fremont.
Legal Description: T41N R106W S5 (S2NW4 & NE4SE4), S8 (SW4).
Latitude: 43° 32' 53" N (centrum).
North: 43° 32' 59" N.
South: 43° 31' 40" N.
Longitude: 109° 36' 33" W (centrum).
East: 109° 35' 38" W.
West: 109° 36' 45" W.
Elevation: 7160-7280 ft (2180-2220 m).
USGS 7.5' Quad: Mason Draw.

Location: Ridge system on the east and west sides of the Mason Draw Road, ca 1.2 miles northeast of Dubois.

Occurrence # 010

County: Fremont.

Legal Description: T41N R105W S31 (NE4NW4); T41N R106W S15 (SE4SW4).

Latitude: 43° 28' 33" N (centrum).

North: 43° 30' 32" N.

South: 43° 28' 24" N.

Longitude: 109° 30' 30" W (centrum).

East: 109° 30' 12" W.

West: 109° 33' 56" W.

Elevation: 6640-7090 ft (2025-2160 m).

USGS 7.5' Quads: Mason Draw and Torrey Lake.

Location: South side of the Wind River and US Highway 26/287, ca 3.5-7 miles southeast of Dubois along the

Torrey Lake/Trail Lake Road ca 1.5-2 road miles south of the highway and on the ridge on the west side of Carson Ditch, ca 2 miles east of Torrey Lake.

Occurrence # 012

County: Fremont.

Legal Description: T42N R107W S6.

Latitude: 43° 38' 05" N.

Longitude: 109° 44' 43" W.

Elevation: 8100 ft (2470 m).

USGS 7.5' Quad: Ramshorn Peak.

Location: White Pass and vicinity, ca 6 air miles south of Ramshorn Peak and ca 9 air miles northwest of Dubois.

* Note: There is currently no EO # 011.

sandy slopes. *A. gilviflorus* var. *purpureus* is absent from alkaline habitats dominated by Gardner saltbush (*Atriplex gardneri*) and oblongleaf bahia (*Platyschkuhria integrifolia*) or slopes with tall, dense cover of sagebrush or grasses.

2. FREQUENTLY ASSOCIATED SPECIES:

Arenaria hookeri (Hooker's sandwort)

Artemisia nova (Black sagebrush)

Artemisia tridentata var. *vaseyana* (Mountain big sagebrush)

Artemisia tridentata var. *wyomingensis* (Wyoming big sagebrush)

Astragalus chamaeluece (Cicada milkvetch)

Astragalus miser var. *decumbens* (Weedy milkvetch)

Carex filifolia (Threadleaf sedge)

Elymus spicatus (Bluebunch wheatgrass)

Eriogonum brevicaulis (Shortstem buckwheat)

Haplopappus nuttallii (Gumweed aster)

Hymenoxys acaulis (Stemless hymenoxys)

Koeleria macrantha (Prairie junegrass)

Leptodactylon pungens (Prickly-phlox)

Lesquerella alpina (Alpine bladderpod)

Leucopoa kingii (Spike fescue)

Oryzopsis hymenoides (Indian ricegrass)
Oxytropis lagopus var. *lagopus* (Hare's-foot locoweed)
Oxytropis nana (Wyoming locoweed)
Oxytropis sericea var. *sericea* (Silvery locoweed)
Phlox muscoides (Moss phlox)
Potentilla ovina (Sheep cinquefoil)
Psoraleidium lanceolatum (Lemon scurfpea)
Senecio canus (Woolly groundsel)
Stipa comata (Needle-and-thread)

3. TOPOGRAPHY: *Astragalus gilviflorus* var. *purpureus* typically occurs on mid to upper slopes of 1-20° near the crest of badlands ridges or low knolls (Figure 6). Less commonly, populations can be found on gravelly outwash fans or at the toe of low slopes. This species appears to favor convex-shaped surfaces and is largely absent from deeply incised draws or slopes. Known occurrences range in elevation from 6400-8800 ft (1950-2680 m).
4. SOIL RELATIONSHIPS: Most of the populations of *Astragalus gilviflorus* var. *purpureus* in the Dubois badlands area occur on sparsely vegetated, pinkish-white or pale brown sandy clays with abundant surface gravel derived from the Tertiary Wind River or Indian Meadows formations (Love and Christiansen 1985).
 Usually, these populations are located on upper slopes above the multi-colored badlands outcrops. One small subpopulation along the East Fork Road apparently occurs on a localized outcrop of the Cretaceous age Cody Shale (EO # 007). Populations at the southern edge of the species range occur on reddish or brown substrates derived from the Triassic Chugwater and Dinwoody formations. At the base of Torrey Rim these outcrops may have a surface layer of limestone or granitic gravel (EO # 003). *Astragalus gilviflorus* var. *purpureus* has also been reported from limestone substrates (EO # 004) and gravelly moraines (EO # 010).
5. REGIONAL CLIMATE: Average annual precipitation in the Dubois area is 8.17 inches (207.5 mm), with peak levels from April-June. Mean annual temperature is 39.4° F (4.1°C), with mean maximum and minimum temperatures in January of 33.4° and 9.9° F (0.7° and

Figure 4 (page 17). Habitat of *Astragalus gilviflorus* var. *purpureus* on the ridgetops above Carson Draw in the Dubois badlands, Fremont County, Wyoming. Plants are located along the top of the ridge, above the multi-colored badlands slopes. WYNDD photograph by W. Fertig, 5 June 1996.

- 12.2° C) and mean maximum and minimum temperatures in July of 79.3° and 41.6° F (26.2° and 5.3° C) (Martner 1986).

6. LOCAL MICROCLIMATE: *Astragalus gilviflorus* var. *purpureus* typically occurs on light-colored, semi-barren substrates on the rims of steep slopes. These sites are exposed to high levels of solar radiation and wind, and are likely to be drier and have higher daytime surface temperatures than adjacent, more highly vegetated sites.

F. POPULATION BIOLOGY AND DEMOGRAPHY

1. PHENOLOGY: Flowering occurs primarily from late May to early July, while fruits are produced from mid-June to July. Based on field observations and herbarium specimens, flowering has been documented from May 28-July 10 and fruiting from June 20-July 18.
2. POPULATION SIZE AND CONDITION: *Astragalus gilviflorus* var. *purpureus* is known from 11 extant occurrences divided into at least 38 subpopulations. Approximately 50,000-68,000 plants were counted at 15 subpopulations in 6 of these occurrences in 1996 (Table 2). Based on the amount of additional, unsurveyed potential habitat, the total population is conservatively estimated at 100,000-150,000. Nearly 90% of the total population, however, is found in a single, extensive occurrence in the Dubois Badlands on the south side of Table Mountain and west of the East Fork Road (EO # 007).

With the exception of a few large and extensive populations of 1000-5000 plants, typical colonies of *Astragalus gilviflorus* var. *purpureus* consist of 40-100 plants in an area of 1-2 acres. Populations may be patchy to densely clustered, depending on the topography of the site and the presence of suitable substrates. Most populations consist of medium to large rosettes with few to no seedlings present. Seedling survival and establishment is probably low in most years due to harsh environmental conditions or low fruit production.

Figure 5 (page 19). Close-up of the habitat of *Astragalus gilviflorus* var. *purpureus*, ca 1.2 miles northeast of Dubois, Fremont County, Wyoming. Plants occur in cushion plant communities on outcrops of the Wind River or Indian Meadows formations. WYNDD

photograph by W. Fertig, 4 June 1996.

Figure 6. Topographic position of *Astragalus gilviflorus* var. *purpureus* on the landscape.
Illustration by W. Fertig.

Trend data are lacking for most occurrences of *Astragalus gilviflorus* var. *purpureus*. Hollis Marriott estimated the total population at "several thousand" plants at two large sites that she surveyed for The Nature Conservancy in 1990. Two additional populations surveyed in 1990, however, contained only about 30 plants each. These latter sites were revisited in 1996 and found to contain approximately the same number of individuals. Based on the present condition of the habitat in the Dubois area, this species is probably essentially stable at the present time, although some habitat may have been lost to residential or agricultural development in the past century.

3. REPRODUCTIVE BIOLOGY:

- a. TYPE OF REPRODUCTION: Dubois milkvetch reproduces primarily by seed. The species may also be able to spread to a limited degree by vegetative growth and branching of the caudex.
- b. POLLINATION BIOLOGY: Black ants and large bumblebees were observed pollinating the flowers of *Astragalus gilviflorus* var. *purpureus* in 1996.
- c. SEED DISPERSAL AND BIOLOGY: The fruits of *Astragalus gilviflorus* var. *purpureus* produce 2-5 mature seeds (Roberts 1977). The seeds probably rely on animals or gravity for dispersal. The clumped distribution pattern of many colonies may indicate that dispersal distances are short.

G. POPULATION ECOLOGY

1. GENERAL SUMMARY: *Astragalus gilviflorus* var. *purpureus* occurs primarily on convex-shaped upper slopes of pinkish or brown sandy-clay soils derived from the Wind River, Indian Meadows, Chugwater, and Dinwoody formations. Populations may also occur along roadcuts on suitable substrates, suggesting that the species is tolerant of some disturbance or capable of recolonizing disturbed sites. Individual populations are often small and localized, with plants clustered to widely spaced. Seedling establishment appears to be low, perhaps due to poor fruit production, or harsh conditions affecting seed germination or survival.
2. COMPETITION: Most populations of *Astragalus gilviflorus* var. *purpureus* are found in habitats characterized by short and sparse vegetative cover (usually under 50%). These sites probably

Table 2. Demographic information for known populations of *Astragalus gilviflorus* var. *purpureus* in Wyoming.

<p>Occurrence # 001 Area: 8-40 acres (4 subpopulations). Number and Age of Plants: 50-100 flowering and vegetative plants observed in Sec 30 colony by W. Fertig on 5 June 1996. Approximately 40 plants observed in Sec 27 colony and 1 plant observed in Sec 35 colony on 30 June 1994. Approximately 30 plants observed along roadside on 28 May 1990. Density: Rosettes observed to be clumped. Evidence of Reproduction: Plants observed in flower in June 1996. No seedlings observed. Evidence of Expansion/Contraction: Populations have been known from this site since 1980.</p> <p>Occurrence # 002 Area: 10 acres (3 subpopulations). Number and Age of Plants: Plants observed in flower in the Sec 21/28 colony on 25 June 1997. 500-800 flowering and vegetative plants observed by W. Fertig in Sec 27 colony on 4 June 1996. Observed in flower at Sec 28 colony on 8 June 1981. Density: Rosettes observed to be clumped or widely spaced. Evidence of Reproduction: Approximately 15% of all plants observed in flower in June 1996. No seedlings observed. Evidence of Expansion/Contraction: Populations have been known in this area since 1981.</p>	<p>Occurrence # 003 Area: 5 acres (2 main subpopulations). Number and Age of Plants: 2800-5000 flowering, fruiting, and vegetative plants observed 13-14 June 1996. Density: Plants widely scattered to locally common and dense. Evidence of Reproduction: Plants observed in flower and fruit. No seedlings observed. Evidence of Expansion/Contraction: Population discovered in 1996 (Fertig 1997 b).</p> <p>Occurrence # 004 Area: Not known. Number and Age of Plants: No census was taken when this population was last surveyed on 10 July 1981. Density: Not known. Evidence of Reproduction: Plants observed in flower in July 1981. Evidence of Expansion/Contraction: Not known.</p> <p>Occurrence # 005 Area: 4 acres (2 subpopulations). Number and Age of Plants: Ca 30 individuals observed in 1 small colony by Hollis Marriott in 1990. Plants observed, but not censused in 1987 and 1994. Density: Not reported. Evidence of Reproduction: Plants observed in flower on 2 June 1987. Evidence of Expansion/Contraction: Population has been known since 1987.</p>
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Occurrence # 006

Area: 250 acres.

Number and Age of Plants: "Several thousand" mostly vegetative or late-flowering plants observed by Hollis Marriott on 18 July 1990. Observed in flower by Marvin Roberts on 3 June 1976.

Density: Plants may be locally abundant on suitable habitat.

Evidence of Reproduction: Plants observed in late flower. No seedlings reported.

Evidence of Expansion/Contraction: Population has been known since 1976.

Occurrence # 007

Area: Ca 70 acres (14 subpopulations).

Number and Age of Plants: 40,000-50,000 flowering and vegetative plants observed in Sec 10, 11, & 14 colonies (5 subpopulations) on 5 June 1996. Entire population estimated at ca 100,000. 75-100 additional plants observed in 2 small subpopulations in Sec 17. 5000-10,000 flowering and vegetative plants observed in Sec 6-8 colonies (2 large subpopulations) on 4 June 1996. "Several thousand" plants observed in Sec 18 colony by Hollis Marriott on 18 July 1990. Observed in flower and early fruit in Sec 1 colony on 26 June 1984. Observed in flower and early fruit in Sec 20 colony by R. Hartman on 23 June 1983.

Density: Observed to be densely clustered to widely spaced.

Evidence of Reproduction: Plants observed in flower and early fruit.

No seedlings have been reported from the site.

Evidence of Expansion/Contraction:

Populations have been documented at this site since 1983.

Occurrence # 008

Area: 16 + acres (4 subpopulations).

Number and Age of Plants: Ca 50 flowering and vegetative plants observed in Sec 16 colony by W. Fertig on 4 June 1996. Several thousand plants reported by Hollis Marriott in Sec 29 colony on 18 July 1990.

Density: Widely scattered to clumped.

Evidence of Reproduction: Plants observed in flower.

Evidence of Expansion/Contraction: Population has been known since 1990.

Occurrence # 009

Area: 10-15+ acres (3 subpopulations).

Number and Age of Plants: 500-1000 flowering and vegetative plants observed in Sec 5 NW4 colony by W. Fertig on 4 June 1996. Ca 200 plants observed in Sec 5 SW4 colony by Lynn Kinter on 15 June 1996.

Density: Locally common on some slopes, but rare to absent on others.

Evidence of Reproduction: Ca 25% of all plants observed in flower in 1996.

Evidence of Expansion/Contraction: Population has been known since 1980.

Occurrence # 010

Area: 5 acres (2 subpopulations).

Number and Age of Plants:

Approximately 250 flowering or vegetative plants observed at two sites by Lynn Kinter in May and June 1994.

Density: Not reported.

Evidence of Reproduction: Plants observed in flower. No seedlings

reported.
Evidence of Expansion/Contraction:
Population has only been known
since
1994.
Occurrence # 012
Area: Not known.
Number and Age of Plants: No census

was taken when this population was
last observed on 28 June 1984.
Density: Not known.
Evidence of Reproduction: Observed in
flower in June 1984.
Evidence of Expansion/Contraction:
Not
known.

represent a "climax" condition maintained by edaphic properties, harsh environmental factors, and occasional disturbance. The matted, perennial growth habit and apparently low reproductive potential of *A. gilviflorus* var. *purpureus* appears to be an adaptation to survive under these extreme conditions. Where environments are less severe, this species may not be able to compete as well with other plants. Occasional populations also occur in semi-disturbed roadside areas with relatively sparse cover of exotic weedy species. *A. gilviflorus* var. *purpureus* may be able to persist at these sites or is able to behave as a pioneer species. Trend data are not available to determine the long-term survival of plants at disturbed sites.

3. HERBIVORY: No evidence of herbivory on leaves, stems, or flowers was observed during field surveys in 1996. The low, matted growth form and presence of distasteful chemical compounds in the foliage probably protects this species from grazing by livestock and wildlife. Low fruit production, however, may possibly

be

related to herbivory by insects or rodents.

4. HYBRIDIZATION: There is no strong evidence of hybridization between *Astragalus gilviflorus* var. *purpureus* and other related species in the field. Occasional plants can be found with light pink

and

flowers, but these may be the result of natural variation or age rather than hybridization. Marriott suggested that some populations in the Dubois area may contain both var. *purpureus* var. *gilviflorus*, but her observations were based on vegetative plants that were past flowering. Roberts (1977) reports that the nearest population of var. *gilviflorus* occurs near Thermopolis, Wyoming, nearly 50 miles east of the closest *purpureus* site.

H. LAND OWNERSHIP (Table 3)

1. BLM: All or part of seven occurrences of *Astragalus gilviflorus* var. *purpureus* are found on lands managed by the Lander Resource Area in the BLM Rawlins District. Two extensive subpopulations of EO # 007 are found within the Dubois Badlands Area of Critical Environmental Concern (ACEC) (USDI Bureau of Land Management 1987). These same subpopulations are also found within the Dubois Badlands Wilderness Study Area (USDI Bureau of Land Management 1988).
2. US FOREST SERVICE: A single small population (EO # 003) was discovered on the Shoshone National Forest (Wind River Ranger District) at the base of Torrey Rim during 1996 surveys (Fertig 1997 b).
3. WIND RIVER INDIAN RESERVATION: Two small populations are currently known from Reservation lands in the vicinity of Dubois (EOs 004 and 005).
4. STATE: Portions of three small to medium-sized occurrences are on wildlife habitat management units operated by the Wyoming Game and Fish Department (East Fork and Whiskey Basin/Little Red Creek). One additional subpopulation occurs on State trust lands.
5. PRIVATE: Parts of five occurrences are found on private lands in the Dubois area. The largest of these has a conservation easement with the Jackson Hole Land Trust and The Nature Conservancy. Several private land sites are along the edge of public roads.

II. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

A. POTENTIAL THREATS TO CURRENTLY KNOWN POPULATIONS: A small geographic range makes this taxon vulnerable to large scale natural and human induced disturbances. The following potential threats were observed during field surveys in 1996 or have been reported in the literature:

1. RECREATION: Off-road vehicle (ORV) use is probably the most significant threat to populations of *Astragalus gilviflorus* var. *purpureus* on private and public lands in the immediate vicinity of Dubois. ORVs may impact plants directly by dislodging their roots, or indirectly through increased soil erosion or compaction. The amount of plant mortality in an area, however, is probably related to the intensity of ORV use. Plants are capable of colonizing semi-disturbed roadbanks that receive occasional, but

not constant, ORV use (such as along the east side of Table Mountain), but are unable to become established on regularly bladed roads or ORV trails that receive continual use. The BLM currently allows ORVs on existing roads and trails in the Dubois area, except in the Dubois Badlands

Table 3. Land management status of known occurrences of *Astragalus gilviflorus* var. *purpureus* in Wyoming

<p>1. Bureau of Land Management Rawlins District (Lander Resource Area)</p> <p>EO # 001 (in part) EO # 002 (in part) EO # 006 (in part) EO # 007 (in part; partly within the Dubois Badlands ACEC) EO # 008 (in part) EO # 009 (in part) EO # 012</p> <p>2. US Forest Service (Shoshone National Forest/Wind River Ranger District)</p> <p>EO # 003 (in part)</p> <p>3. Wind River Indian Reservation</p> <p>EO # 004 EO # 005</p> <p>4. State of Wyoming/Wyoming Game and Fish Department</p>	<p>A. East Fork Wildlife Habitat Management Unit</p> <p>EO # 002 (in part) EO # 007 (in part)</p> <p>B. Whiskey Basin and Little Red Creek Wildlife Habitat Management Unit</p> <p>EO # 003 (in part)</p> <p>C. State Trust Lands</p> <p>EO # 002 (in part)</p> <p>5. Private</p> <p>EO # 001 (in part) EO # 006 (in part; TNC and Jackson Hole Land Trust Conservation Easements) EO # 008 (in part) EO # 009 (in part) EO # 010 (in vicinity of TNC Conservation Easement)</p>
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ACEC (USDI Bureau of Land Management 1987). Abuse of these regulations may jeopardize the survival of *A. gilviflorus* var. *purpureus* at some sites in the ACEC. Other recreational uses, such as hiking, trapping, and big-game hunting, do not appear to adversely impact populations of this species.

2. GRAZING: Livestock grazing is one of the major land uses on public and private lands throughout the range of this species. Field observations strongly indicate that *Astragalus gilviflorus* var. *purpureus* is not utilized as forage by livestock or by native grazers.

Most populations of this species occur on marginal rangeland sites with sparse forage and no water. These microsites appear to receive relatively little use by grazing animals. Trampling could be a problem if animals are herded through occupied habitat or induced to use these habitats through salt blocks or water tanks.

3. MINERAL DEVELOPMENT: Most of the BLM lands in the range of *Astragalus gilviflorus* var. *purpureus* are open to oil and gas leasing and the development of locatable minerals. Exceptions occur in the East Fork, Dubois Badlands, and Whiskey Mountain management units where selected areas have been closed to leasing or no-surface occupancy stipulations have been put in place to protect habitat for wildlife (USDI Bureau of Land Management 1987). Mineral exploration appears to be low at the present time. Renewed interest in uranium mining in deposits of the Wind River Formation could impact populations of this species in the future.

4. OTHER: Residential growth in the Dubois area could have an impact on populations of *Astragalus gilviflorus* var. *purpureus*. Some potential habitat for this species may occur on private lands that are likely to be developed. Increased urbanization could also result in the spread of exotic weedy species and in increased impacts from recreation. The Nature Conservancy and Jackson Hole Land Trust have secured conservation easements on some known and potential *A. gilviflorus* var. *purpureus* sites in the Dubois area.

- B. MANAGEMENT PRACTICES AND RESPONSE: No experimental data exist on the response of this taxon to most management actions. Observations in 1996 suggest that *Astragalus gilviflorus* var. *purpureus* is not adversely impacted by current levels of grazing, but may be vulnerable to disturbance by off-road vehicles.

C. CONSERVATION RECOMMENDATIONS:

1. RECOMMENDATIONS REGARDING PRESENT OR ANTICIPATED ACTIVITIES: Establishment of additional roads and ORV trails (both planned and unplanned) should be discouraged in *Astragalus gilviflorus* var. *purpureus* habitat to reduce trampling mortality and soil loss. Developments associated with mineral exploration should be kept to a minimum in plant habitats that have fragile soils. Salt blocks, water tanks, and trails should not be placed in occupied habitat in order to minimize trampling by livestock.

and
units.
habitat

2. AREAS RECOMMENDED FOR PROTECTION: The two largest known populations of *Astragalus gilviflorus* var. *purpureus* are currently protected within the Dubois Badlands ACEC and conservation easements established by The Nature Conservancy Jackson Hole Land Trust. Other, smaller occurrences are found within the Wyoming Game and Fish Department's East Fork and Whiskey Basin/Little Red Creek wildlife habitat management units. No other populations currently receive formal protection. Establishment of the Dubois Badlands Wilderness would provide more rigorous protection for the colonies found within the Dubois Badlands ACEC. Such a designation, however, has not been recommended in the preferred alternative for wilderness management in the Lander Resource Management Plan (USDI Bureau of Land Management 1988). The management needs of this species need to receive more attention in areas where its habitat is already protected from development.

D. STATUS RECOMMENDATIONS: Surveys in 1990 and 1996 have found *Astragalus gilviflorus* var. *purpureus* to be locally abundant and not in imminent danger of extinction within its limited geographic range in the northwestern Wind River Basin. Listing of this species under the Endangered Species Act does not appear to be warranted at the present time. Due to current and anticipated growth in the Dubois area, however, this species may be vulnerable to habitat loss, recreational impacts, and potential mineral development in the near future. The BLM Wyoming State Office should list *A. gilviflorus* var. *purpureus* as a state sensitive species and develop appropriate management strategies to ensure that actions by the agency do not contribute to future endangerment of the species and the subsequent need for listing under the Endangered Species Act.

V. SUMMARY: *Astragalus gilviflorus* var. *purpureus* is endemic to the northwestern Wind River Basin and adjacent foothills of the Absaroka and Wind River ranges near Dubois, Wyoming. It was a candidate for listing under the Endangered Species Act until the candidate program was revised in 1996. Surveys since 1990 have shown that this species may number between 100,000 to 150,000 individuals in the Dubois area, with much additional potential unsurveyed habitat on BLM, private, and Wind River Indian Reservation lands. *A. gilviflorus* var. *purpureus* occurs primarily on mid to upper slopes of badland ridges and low knolls on sparsely vegetated pinkish to brown sandy clay soils derived from the Wind River, Indian Meadows, Chugwater, and Dinwoody formations. Habitat degradation or trampling by off-road vehicles is probably the major threat to this species, although impacts from mineral development and residential expansion may also be important. Several sites, (including the two largest known populations), are protected to some degree in the BLM's Dubois Badlands ACEC, private conservation easements, and Wyoming Game and Fish Department wildlife habitat management units. Although secure at the present time, future growth in the Dubois area may threaten the long-term survival of this species. *A. gilviflorus* var. *purpureus* should be managed as a Sensitive species by the BLM to ensure that it does not trend toward further endangerment.

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Appendix A.

Element Occurrence Records and Population Maps