Status of
Hyattville Milkvetch
(*Astragalus jejunus var. articulatus*)
in Wyoming

Prepared for the Bureau of Land Management
Wyoming State Office

By

Walter Fertig and Laura Welp

Wyoming Natural Diversity Database
University of Wyoming
PO Box 3381
Laramie, WY 82071

9 March 2001

Agreement # K910-A4-0011, Task Order No. TO-09

ABSTRACT

Hyattville milkvetch (*Astragalus jejunus* var. *articulatus*) is a narrow endemic restricted to the west slope of the Bighorn Range and the eastern rim of the Bighorn Basin in Big Horn County, Wyoming. This species is found primarily in sparsely vegetated cushion plant/bunchgrass/low shrub communities within a matrix of Wyoming big sagebrush/Utah juniper grasslands on gentle slopes and ridgecrests of dry, reddish clay soils with a surface of whitish sandstone fragments derived from the Goose Egg and Chugwater formations. Since first being discovered in 1979, Hyattville milkvetch has been documented from 12 small to medium-sized colonies in 2 main populations within a 5 mile area covering approximately 35 acres. Surveys by Robert Dorn in 1989 estimated the total population at 6750 individuals. Follow-up surveys in 1998-2000 documented a comparable number of plants (5100-6500), but no new populations. The two main populations are probably stable at present, although they may be subject to annual or short-term fluctuations based on climatic conditions. Monitoring studies initiated in 1999 documented population densities of 1.4-3.8 plants per square meter. Under present management, threats are relatively low, but include mortality or soil compaction and erosion from off-road vehicle recreation and road maintenance, habitat degradation from invasion of Utah juniper due to fire suppression, and gypsum mining. *A. jejunus* var. *articulatus* was formerly a Category 2 candidate for potential listing under the Endangered Species Act, and was proposed for listing as Sensitive by the BLM Wyoming State Office in 2000. Continued monitoring is needed to better assess population trends and response to threats.

ACKNOWLEDGEMENTS

We would like to thank the following individuals for their help with this project: Karen Hepp of the BLM Worland Field Office assisted with field surveys and provided logistic support in 1999, Ann Humphrey of The Nature Conservancy helped with field work in 1999, and Jeff Carroll of the BLM Wyoming state office provided funding.

Table of Contents

Figures, Tables, and Appendices

INTRODUCTION

Hyattville milkvetch (*Astragalus jejunus* var. *articulatus*) was first discovered by Dr. Ron Hartman and Ann Odasz on 21 June 1979, near Hyattville, Wyoming. By coincidence, the plant was discovered independently by Dr. Robert Dorn in the same general area on the very next day (Fertig 1997). Dorn recognized the similarity of these plants to *Astragalus jejunus*, a regional endemic of the basins of southwest Wyoming and adjacent Utah and Idaho, but also observed several key differences in leaf and floral morphology. After several years of study, Dorn described the Hyattville plants as a new variety of *A. jejunus* in the first edition of his *Vascular Plants of Wyoming* (Dorn 1988).

Due to its apparent rarity, *Astragalus jejunus* var. *articulatus* was designated a Category 2 candidate for listing under the Endangered Species Act in 1985 (as *A. jejunus* ssp. novum/ined.). Although no longer a candidate, this taxon remains under consideration for possible listing as Sensitive by the Bureau of Land Management (BLM) Wyoming State Office. In 1999, the BLM contracted with the University of Wyoming and the Wyoming Natural Diversity Database (WYNDD) to conduct field surveys for Hyattville milkvetch on public lands in north-central Wyoming. The results of this study, as well as information on the biology, distribution, habitat, population size, potential threats, and conservation status of *A. jejunus* var. *articulatus* are discussed in the following report.

METHODS

Information on the habitat and distribution of *Astragalus jejunus* var. *articulatus* was obtained from scientific literature, specimens from the Rocky Mountain Herbarium (RM), unpublished reports, 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 Laura Welp and Walter Fertig of WYNDD in July 1998, July 1999, and June 2000 (survey routes are shown in Appendix B). Data on habitat, reproduction, phenology, and associated species were collected using WYNDD plant survey forms. Populations were mapped on 7.5 minute USGS topographic maps and digitized as an Arc-View theme. Voucher specimens were collected for deposit at the RM. Information gathered in the field was entered into the computerized Element Occurrence database of WYNDD.

Four permanent demographic monitoring plots were established following the protocol of Lesica (1987). These transects consisted of a single belt 1 meter x 25-50 meters long, subdivided into 1 meter x 1 meter plots. Within each plot, individual plants were counted and assigned to one of four age classes: seedling, vegetative (non-reproductive), reproductive, and dead. This technique was designed to gauge population density and assess population change over time. Data from these transects are included in Appendix C.

SPECIES INFORMATION

Classification

Scientific Name: *Astragalus jejunus* Wats. var. *articulatus* Dorn (Dorn 1988, p. 297). Holotype: USA: Wyoming, Big Horn County, T49N R88W S22, dry red hills, 5800 ft., 22 June 1979, *Dorn 3250* (RM).

Common Name: Hyattville milkvetch.

Family: Fabaceae or Leguminosae (Pea family).

Synonyms: None.

Phylogenetic Relationships: 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 in Wyoming. *A. jejunus* is most closely related to *A. limnocharis* and *A. montii*, both local endemics of central and southern Utah with a comparable dwarf, subacaulescent growth form and bladdery, unilocular, purplish-mottled fruits (Barneby 1989; Welsh et al. 1993). Barneby (1964) placed these species in their own taxonomic Section, *Jejuni. A. jejunus* var. *articulatus* is probably derived from the more widespread *A. jejunus* var. *jejunus*, or the two taxa share a recent, common ancestor. Barneby (1989) notes that one of the important taxonomic characters distinguishing var. *articulatus* from var. *jejunus* (the terminal leaflet being jointed, rather than continuous with the leafstalk) has arisen independently in Idaho and Nevada populations of *A. jejunus.*

Legal Status: *Astragalus jejunus var. articulatus* 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. With the elimination of the C2 program in 1996, Hyattville milkvetch no longer has any legal status under the Endangered Species Act (US Fish and Wildlife Service 1996). The BLM Wyoming State Office is currently considering this species for possible designation as Sensitive (Jeff Carroll, personal communication, December 2000).*

Natural Heritage Rank: The Association for Biodiversity Information (formerly the heritage division of The Nature Conservancy) and the network of natural heritage programs gives *Astragalus jejunus* var. *articulatus* a rank of G3T1, indicating that the full species is "rare or local throughout its range" (usually known from 21-100 extant occurrences), but that the variety is "critically imperiled because of extreme rarity" rangewide (known from fewer than 5 extant populations or very few remaining individuals). In Wyoming, this taxon is also ranked S1 because of extreme rarity within the state (Fertig and Beauvais 1999).

* As of 28 February 2001, no final decision has been made on the creation of a state Sensitive species list by the Wyoming BLM.

Figure 1. Line drawing of *Astragalus jejunus* var. *articulatus* by Walter Fertig from Fertig et al. (1994).

Description: Hyattville milkvetch is a low-growing, multi-stemmed perennial forb (Figures 1-2). The leaves are pinnately compound, 1-7 cm long, and have 9-21 linear to elliptic leaflets mostly less than 5 mm long and 1.5 mm wide. The terminal leaflet is not continuous with the leafstalk. The inflorescence is a 3-7 flowered raceme. Pea-like flowers are white or tinged with lavender, 5-6.5 mm long, and blunt-keeled. Fruits are stalkless, papery, inflated pods, 12-15 mm long and mottled with red or purple (Dorn 1988, 1989; Fertig et al. 1994).

Similar Species: *Astragalus jejunus* var. *jejunus* has purplish flowers, shorter stems, and terminal leaflets that are continuous with the leafstalk. *A. ceramicus* has fewer leaflets and larger fruits. *A. kentrophyta* has sharp, spiny-tipped leaflets. *A. miser* var. *decumbens* has greenish-yellow, narrowly elongate, flattened pods and flowers with a sharp-tipped keel (Dorn 1992; Fertig et al. 1994).

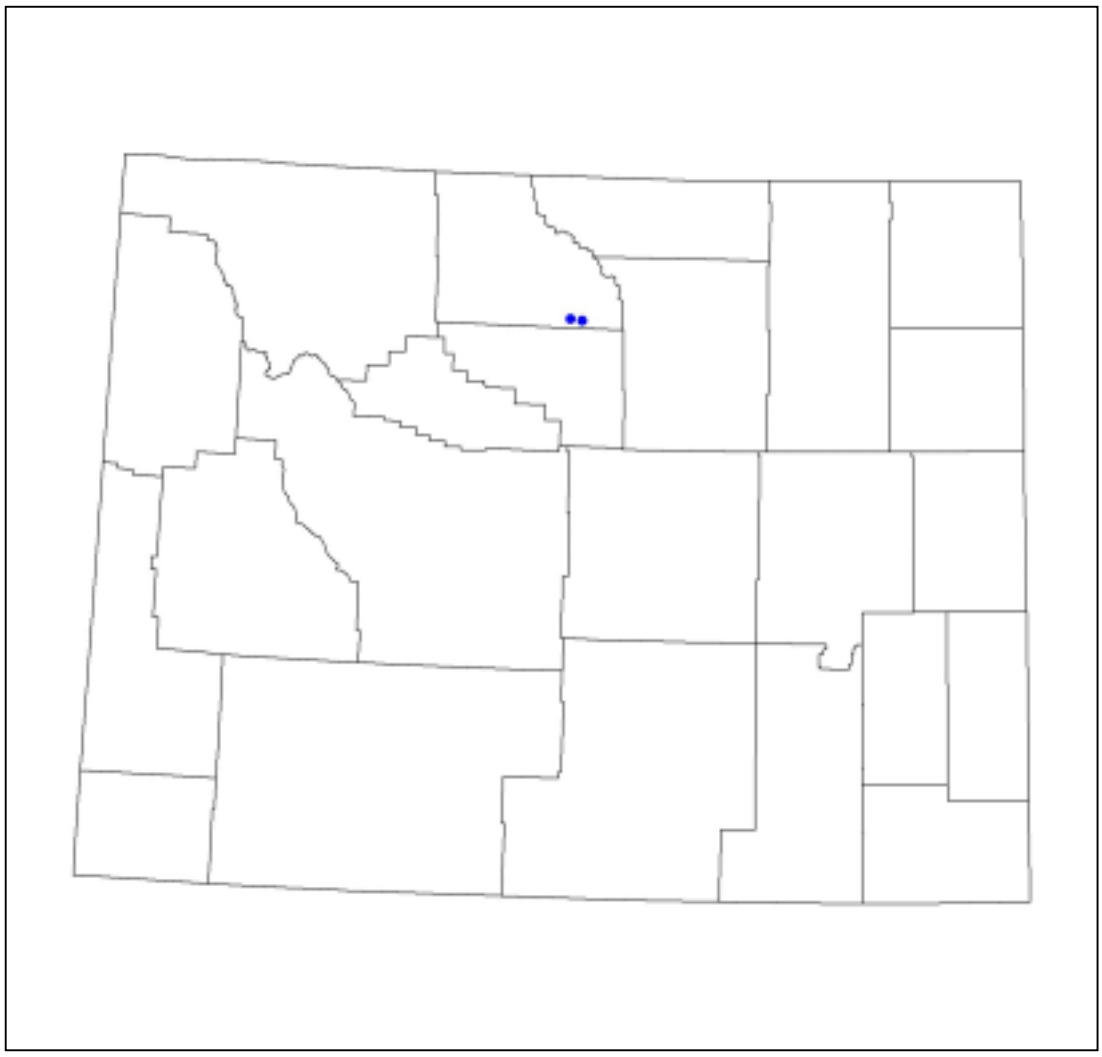
Figure 2. Photograph of *Astragalus jejunus* var. *articulatus* in flower and fruit from the northwest slope of Cedar Mountain, Big Horn County, Wyoming, by Charmaine Refsdal Delmatier, 22 June 1993 (from Fertig et al. 1994).

Geographic Range: Hyattville milkvetch is a local endemic restricted to the western slopes of the Bighorn Range and eastern rim of the Bighorn Basin (Big Horn County) near Hyattville, Wyoming (Figure 3). Populations are limited to the ridges between Luman and Military Creeks and Cottonwood Draw and the northwest slope of Cedar Mountain, 3.5-8 miles east of Hyattville. The entire world population consists of two primary occurrences (consisting of 12 small colonies) within a 5 mile area and covers a total area of approximately 35 acres.

The location of the Wyoming populations is summarized in Table 1 and more detailed population data are provided in Appendix A.

Extent of Surveys in Wyoming: The Military Creek/Cottonwood Draw population was discovered independently by Ron Hartman and Ann Odasz and Robert Dorn in June 1979. B.E. Nelson discovered a second population on the north side of Cedar Mountain in June 1980. No additional surveys were undertaken specifically for this plant until 1989, when Dorn revisited the Hyattville area to conduct a status survey for the US Fish and Wildlife Service (Dorn 1989). Dorn discovered two additional small colonies between Luman and Military Creeks and searched unsuccessfully for

Figure 3. Global distribution of *Astragalus jejunus* var*. articulatus.*



Hartman and Odasz' 1979 collection locality (T49N R88W S20). Charmaine Refsdal Delmatier revisited the Cedar Mountain population in June 1993 to photograph specimens for the *Wyoming Rare Plant Field Guide* (Fertig et al. 1994). Laura Welp and Walter Fertig surveyed potential habitat along the west slope of the Bighorn Range from the vicinity of Ten Sleep to Bighorn Canyon in 1998-2000, but failed to locate any additional populations (see Appendix C for survey routes).

Table 1.
Locations of *Astragalus jejunus* var*. articulatus* in Wyoming

---

Occurrence # 001
County: Big Horn
USGS Quad Name: Pierce Draw
Latitude: 44° 12’ 12” N (centrum)
Southern-most Latitude: 44° 12’ 05” N
Northern-most Latitude: 44° 14’ 12” N
Longitude: 107° 26’ 48” W (centrum)
Eastern-most Longitude: 107° 26’ 25” W
Western-most Longitude: 107° 27’ 30” W
Town/Range/Section: T49N R88W Sec 9 (NE4 of SW4 & SE4 of NW4NW4), Sec 21 (NE4NE4 of SE4 & SE4SE4 of NE4), Sec 22 (N2 of SW4 of NW4).
Location: Eastern Bighorn Basin, on ridge between Military Creek and Cottonwood Draw (along and south of BLM Road 1117) and ridge between Military Creek and Luman Creek, ca 7.5-8 air miles east and southeast of Hyattville.

Occurrence # 002
County: Big Horn
USGS Quad Name: Hyattville
Latitude: 44° 12’ 40” N (centrum)
Southern-most Latitude: 44° 12’ 24” N
Northern-most Latitude: 44° 12’ 51” N
Longitude: 107° 32’ 08” W (centrum)
Eastern-most Longitude: 107° 31’ 10” W
Western-most Longitude: 107° 32’ 40” W
Town/Range/Section: T49N R89W Sec 15 (SW4SW4SW4 & S4 OF SW4 OF SE4), SEC 16 SE4SE4), SEC 22 (N2 OF NE4 & N4 OF NE4 OF NW4).
Location: Eastern Bighorn Basin, northwest slope of Cedar Mountain on the south side of BLM Road 1117, ca 3.5-4 air miles southeast of Hyattville.

Habitat: Hyattville milkvetch is found primarily in sparsely vegetated cushion plant/ bunchgrass/low shrub communities within a matrix of *Artemisia tridentata/Juniperus osteosperma/Elymus spicatus* or *Chrysothamnus nauseosus/Atriplex canescens* grasslands (Figures 4-6). These sites are often dominated by *Penstemon laricifolius, Cryptantha celosioides, Senecio canus, Phlox hoodii, Haplopappus nuttallii, Gutierrezia sarothrae,* and *Koeleria macrantha* (Table 2). Total vegetative cover is typically less than 25-30%. *A. jejunus* var. *articulatus* colonies are found on dry reddish clay soils which are sometimes mixed with whitish sandstone fragments or inclusions of gypsum. These soils are derived from the Triassic and Permian age Goose Egg and Chugwater formations, but may be intermixed with Permian/Pennsylvanian age Tensleep Sandstone (Love and Christiansen 1985; Dorn 1989). Populations are found on flats, ridgecrests, and north or west-facing slopes up to 45º. Hyattville milkvetch becomes sparse to absent on lower slopes or adjacent bottoms and swales with loose sand or finer clays and denser shrub cover. Dorn (1989) also notes that this species is sparse to absent on gypsum-rich outcroppings. Populations range in elevation from 4900-5900 feet (1490-1800 m).

Figure 4. Habitat of *Astragalus jejunus* var. *articulatus* on thin-soiled reddish slopes in cushion plant/bunchgrass community in opening within juniper woodlands (center) Located on divide between Military Creek and Cottonwood Draw (Occurrence # 001). WYNDD photo by Walter Fertig, 16 July 1999.

Figure 5. Habitat of *Astragalus jejunus* var. *articulatus* on thin-soiled reddish outcrops in cushion plant/bunchgrass community at the edge of juniper woodlands. Located on divide between Military Creek and Cottonwood Draw, just south of BLM Road 1117 (Occurrence # 001). WYNDD photo by Walter Fertig, 16 July 1999.

Average annual precipitation in the Hyattville/Tensleep area is 12.72 inches (323 mm), with peak precipitation coming as rain from April-June. Mean annual temperature is 42.9° F (6.1° C). January mean high and low temperatures are 29.5° F and 3.1° F (-1.4° C and – 16.1° C). July mean high temperature is 88.9° F (31.6° C) and July low temperature averages 50.8° F (10.4° C). The average number of days at or below freezing is 200, while the average number of days exceeding 90° F is 30 (Martner 1986).

Figure 6. Habitat of *Astragalus jejunus* var. *articulatus* on reddish clay soils in openings in sparsely vegetated cushion plant/bunchgrass/*Yucca glauca* community within matrix of Wyoming big sagebrush grassland. Located at the base of the northwest slope of Cedar Ridge (Occurrence # 002). WYNDD photo by Laura Welp, 25 June 1999.

Population Size and Trends: *Astragalus jejunus* var. *articulatus* is currently known from two main occurrences worldwide, consisting of 12 small to medium-sized subpopulations (each ranging in size from 0.2-8 acres). The entire global range is restricted to a narrow belt 5.5 miles x 2.5 miles wide. Dorn (1989) recognized three main subpopulations covering a total area of 35 acres and numbering an estimated 6750 plants. In 1998-99, Welp and Fertig derived a comparable estimate of 5100-6500 plants. The largest population is found along the ridge system between Luman Creek and Cottonwood Draw and numbered 3000-3500 plants at 4 of 6 known subpopulations in 1998-99. The Cedar Mountain population is currently estimated at 2100-3000 individuals. These estimates are derived from extrapolations from monitoring plots and ground surveys and from the amount of available habitat.

These populations are probably stable at present, although they may be subject to annual or short-term fluctuations based on climatic conditions. Laura Welp noted a possible decline during a cursory visit to the two populations in June 2000, probably as a result of drought conditions. Additional qualitative and semi-quantitative monitoring data are needed to determine the longevity of individual plants, seedling survival rates, and short term population trends.

Table 2. Species Commonly Associated with *Astragalus jejunus* var. *articulatus*

Scientific Name	**Common Name**	**Growth Form**
Artemisia tridentata var. *Wyomingensis*	Wyoming big sagebrush	Shrub
Astragalus gilviflorus	Plains orophaca	Perennial forb
Atriplex canescens	Fourwing saltbush	Shrub
Chaenactis douglasii	Hoary dusty-maiden	Perennial forb
Chrysothamnus nauseosus	Rubber rabbitbrush	Shrub
Cryptantha celosioides	Cocks-comb cryptantha	Perennial forb
Eriogonum pauciflorum	Few-flowered buckwheat	Perennial forb
Gutierrezia sarothrae	Broom snakeweed	Shrub
Haplopappus nuttallii	Nuttall's goldenweed	Perennial forb
Koeleria macrantha	Prairie junegrass	Perennial graminoid
Krascheninnikovia lanata	Winterfat	Shrub
Leptodactylon caespitosum	Mat prickly-phlox	Shrub
Linum lewisii	Blue flax	Perennial forb
Opuntia polyacantha	Plains prickly-pear	Perennial forb
Oryzopsis hymenoides	Indian ricegrass	Perennial graminoid
Oxytropis besseyi var. *fallax*	Bessey's locoweed	Perennial forb
Oxytropis sericea	White locoweed	Perennial forb
Penstemon laricifolius	Larch-leaved beardtongue	Perennial forb
Phlox hoodii	Hood's phlox	Perennial forb
Senecio canus	Woolly groundsel	Perennial forb
Stipa comata	Needle-and-thread	Perennial graminoid
Yucca glauca	Soapwell	Shrub

Population Biology and Ecology: Hyattville milkvetch flowers from late May to late June or early July. Fruits are produced from early June to mid-July. The pollinator of this species is not known, but is probably a small fly, bee, or wasp. Fruit production may be very high, depending on the size and condition of the plant. One robust individual observed in July 1999 had 60 fruits. Seeds are black or brown with dark spots and remain attached to the dehisced fruit pods (with 4-5 present per pod). The light-weight bladdery pods are readily transported by the wind and are probably the primary seed dispersal vector. Seeds may be deposited in cracks in dried clay soils. Many fruits and seeds appear to get caught in the stems of adult plants and probably germinate close to established plants, accounting for the clumped distribution pattern typical of the species. Germination requirements are not known (Dorn 1989). Establishment is probably episodic, depending on spring and summer precipitation levels. Dorn observed little evidence of seedlings in 1989, but Welp noted high numbers of seedlings in 1999 monitoring studies (0.3-0.5 per square meter).

Table 3.
Demographic Data from Wyoming Occurrences of *Astragalus jejunus* var. *articulatus*

Occurrence # 001 (6 main subpopulations)
Area: 13 acres.
Number of Plants: Population estimated at 3000-3500 plants by Welp and Fertig in 1998-1999.
Density: Welp measured densities of 1.4-3.8 plants per square meter at two monitoring transects in 1999.
Evidence of Reproduction: Plants observed in flower and fruit in 1979, 1989, 1998, 1999, and 2000.
Trends: Probably stable, although population may vary seasonally in response to climatic factors.

Occurrence # 002 (6 main subpopulations)
Area: 22 acres.
Number of Plants: Population estimated at 2100-3000 plants by Welp and Fertig in 1998-1999.
Density: Welp measured density of 1.5 plants per square meter at one monitoring transect in 1999.
Evidence of Reproduction: Plants observed in flower and fruit in 1980, 1989, 1993, 1998, 1999, and 2000.
Trends: Probably stable.

Populations are typically sparse, with plants occurring in small clusters that are often widely scattered. This species does not occupy all suitable, potential habitat. It is usually most abundant on sites with low competing cover, suggesting that it is a poor competitor or dependent on disturbance to prevent other taxa from becoming established. Populations are capable of withstanding infrequent disturbance and can re-colonize roadcuts if the proper substrate is exposed. Density varies from 1.43-3.8 plants per square meter. Reproductive output may vary from 98% (observed by Dorn in 1989) to 60-85% in 1998-99.

There is little direct evidence of herbivory on Hyattville milkvetch plants by livestock or large grazers. Some insect damage has been observed, as well as insect or spider webbing on individual plants. This species does not hybridize with other *Astragalus* species in its range.

Current Management: The entire range of Hyattville milkvetch falls on lands managed by the BLM Worland Field Office and state of Wyoming. At present, these areas are all managed for multiple use with an emphasis on grazing, mineral development, and recreation. Although found nearby, this species is not known to occur in the Wyoming Game and Fish Department's Renner Wildlife Habitat Management Unit. Though it receives no formal protection, *Astragalus jejunus* var. *articulatus* has been proposed for designation as a BLM state Sensitive species (Jeff Carroll, personal communication, December 2000).

Under the current BLM management plan, the habitat of both populations of Hyattville milkvetch is managed with seasonal No Surface Disturbance stipulations for oil and gas leasing (USDI Bureau of Land Management 1988). The Cedar Mountain area (Occurrence # 002) has permanent No Surface Occupancy regulations to enhance wildlife values. The entire range of the milkvetch is identified as having low hydrocarbon potential, but does have potential for bentonite or gypsum mining (USDI Bureau of Land Management 1988, maps 3, 4). Off-road vehicle use in the ridge system between Luman Creek and Cottonwood Draw (Occurrence # 001) is restricted to designated roads and trails at appropriate seasons, but no seasonal use restrictions exist for the Cedar Mountain area. Both populations are managed for full wildfire suppression (USDI Bureau of Land Management 1988, map 10).

Existing and Potential Threats:

Dorn (1989) noted no major threats to Hyattville milkvetch under current management, but recommended that the BLM avoid "major surface disturbances on or near known sites". Observations in 1999-2000 suggest that off-road vehicles and road maintenance may be detrimental to existing plants, although such disturbances can create newly exposed soil for future establishment (provided that disturbances are infrequent). High recreation use from off-road vehicles could impact populations through trampling of plants, enhanced soil erosion, or soil compaction (Fertig 1999). No evidence of grazing has been observed on this species. Location of salt blocks, water tanks, or other actions resulting in the congregation of livestock could result in enhanced erosion, soil compaction, or facilitate the establishment of competing weed species. The potential for oil and gas development in the area is low, but some sites could be adversely affected by gypsum mining. Some populations could also be impacted by the replacement of existing cushion plant/bunchgrass communities by Utah juniper woodlands in the absence of periodic fire.

SUMMARY

Hyattville milkvetch (*Astragalus jejunus* var. *articulatus*) is a narrow endemic restricted to the west slope of the Bighorn Range and the eastern rim of the Bighorn Basin in Big Horn County, Wyoming. This species is found primarily in sparsely vegetated cushion plant/bunchgrass/low shrub communities within a matrix of Wyoming big sagebrush/Utah juniper grasslands on gentle slopes and ridgecrests of dry, reddish clay soils with a surface of whitish sandstone fragments derived from the Goose Egg and Chugwater formations. Since first being discovered in 1979, Hyattville milkvetch has been documented from 12 small to medium-sized colonies in 2 main populations within a 5 mile area covering approximately 35 acres. Surveys by Robert Dorn in 1989 estimated the total population at 6750 individuals. Follow-up surveys in 1998-2000 documented a comparable number of plants (5100-6500), but no new populations. These populations are probably stable at present, although they may be subject to annual or short-term fluctuations based on climatic conditions. Monitoring studies initiated in 1999 documented population densities of 1.4-3.8 plants per square meter. Under present management, threats are relatively low, but include mortality or soil compaction and erosion from off-road vehicle recreation and road maintenance, habitat degradation from invasion of Utah juniper due to fire suppression, and gypsum mining. *A. jejunus* var. *articulatus* was formerly a Category 2 candidate for potential listing under the Endangered Species Act, and was proposed for listing as Sensitive by the BLM Wyoming State Office in 2000. Continued monitoring is needed to better assess population trends and response to threats.

LITERATURE CITED

Barneby, R.C. 1964. Atlas of North American *Astragalus*. Memoirs of the New York Botanical Garden 13:1-1188.

Barneby, R.C. 1989. Vol. 3 Part B. Fabales. In: A. Cronquist, A.H. Holmgren, N.H. Holmgren, J.L. Reveal, and P.K. Holmgren, eds. Intermountain Flora, Vascular Plants of the Intermountain West, USA. New York Botanical Garden, Bronx, NY.

Dorn, R.D. 1988. Vascular Plants of Wyoming. Mountain West Publ., Cheyenne, WY.

Dorn, R.D. 1989. Report on the status of *Astragalus jejunus* var. *articulatus*, a candidate Threatened species. Prepared for the US Fish and Wildlife Service by Mountain West Environmental Services, Cheyenne, WY.

Dorn, R.D. 1992. Vascular Plants of Wyoming, second edition. Mountain West Publ., Cheyenne, WY.

Fertig, W. 1997. Has anyone seen the Hyattville milkvetch? Castilleja 16(2):6.

Fertig, W. 1999. The status of rare plants in the Bighorn Landscape. Report prepared for The Nature Conservancy Wyoming Field Office by the Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W. and G. Beauvais. 1999. Wyoming Plant and Animal Species of Special Concern. Wyoming Natural Diversity Database, Laramie, WY.

Fertig, W., C. Refsdal, and J. Whipple. 1994. Wyoming Rare Plant Field Guide. Wyoming Rare Plant Technical Committee, Cheyenne, WY.

Lesica, P. 1987. A technique for monitoring nonrhizomatous, perennial plant species in permanent belt transects. Natural Areas Journal 7(2):65-68.

Love, J. D. and A. C. Christiansen. 1985. Geologic Map of Wyoming. US Geological Survey.

Martner, B. 1986. Wyoming Climate Atlas. Univ. of Nebraska Press, Lincoln, NE.

USDI Bureau of Land Management. 1988. Record of Decision and approved Resource Management Plan for the Washakie Resource Area. Bureau of Land Management Washakie Resource Area, Worland District, Worland, WY.

US Fish and Wildlife Service. 1985. Endangered and Threatened wildlife and plants; review of plant taxa for listing as Endangered or Threatened Species. Federal Register 50 (188):39525-39584.

US Fish and Wildlife Service. 1993. Plant taxa for listing as Endangered or Threatened species; Notice of Review. Federal Register 58(188):51144-51190.

US Fish and Wildlife Service. 1996. Endangered and Threatened species, plant and animal taxa; Proposed rule. Federal Register 61(40):7596-7613.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins, (eds). 1993. A Utah Flora, second edition, revised. Brigham Young University Print Services, Provo, UT.

Appendix A.
Element Occurrence Records and Population Maps

WYOMING NATURAL DIVERSITY DATABASE
-Element Occurrence Record-

ASTRAGALUS JEJUNUS VAR. *ARTICULATUS*
HYATTVILLE MILKVETCH
Occurrence # 001

Status
Data Sensitive?: No
Identification verified: Yes
TNC Global Rank: G3T1
WYNDD State Rank: S1
Federal Status: None; former C2 Candidate; Proposed for BLM State Sensitive list
WY Distribution Note: State endemic

Location
County: Big Horn
USGS Quad Name: Pierce Draw
Latitude: 441212N (centrum)
Southern-most Latitude: 441205N
Northern-most Latitude: 441412N
Longitude: 1072648W (centrum)
Eastern-most Longitude: 1072625W
Western-most Longitude: 1072730W

Map Accuracy: Precise; location is within a 75 foot radius of point on USGS topo map.

Town/Range/Section: T49N R88W Sec 9 (NE4 of SW4 & SE4 of NW4NW4), Sec 21 (NE4NE4 of SE4 & SE4SE4 of NE4), Sec 22 (N2 of SW4 of NW4).

Location: Eastern Bighorn Basin, on ridge between Military Creek and Cottonwood Draw (along and south of BLM Road 1117) and ridge between Military Creek and Luman Creek, ca 7.5-8 air miles east and southeast of Hyattville.

Population Data
Last Observed: 2000-06-29
First Observed: 1979-06-21
Data: Occurrence consists of 6 small extant colonies in 2 main subpopulations in a 0.5 x 2 mile area. A seventh colony in Sec 20 reported by R.L. Hartman in 1979 has not been relocated since and is either extirpated or inaccurately located (Dorn 1989).

2000-06-29: Sec 21-222 colonies: Briefly visited by Laura Welp. Population appeared smaller near transects 2 and 3 than in 1998.

1999-07-16: Sec 21-22 colonies: Population estimated at 1000-1500 plants by W. Fertig and Ann Humphrey. Plants mostly in fruit or vegetative condition (2 observed still in flower). Distribution clumped and patchy. Occurs with *Penstemon laricifolius, Senecio canus, Cryptantha celosioides, Phlox hoodii, Haplopappus nuttallii, Gutierrezia sarothrae, Koeleria macrantha, Eriogonum pauciflorum,* and *Astragalus hyalinus*.

1999-06-28: Sec 21-22 colonies: 1153 plants counted in 4 small to medium-sized colonies by Laura Welp. Population estimated at 2000. 70-75% of plants in flower or fruit, 25-30% vegetative. 25 dead plants observed. Density at two monitoring plots (#'s 2 and 3) ranges from 1.43-3.8 plants per square meter. Seedling density ranges from 0.48-0.5 per square meter, and flowering/fruiting plant density varies from 0.67-2.4 per square meter.

1998-07-05: Sec 21-22 colonies: two colonies

observed by Laura Welp on the north side of the county road in a 60 x 15 meter area and a 20 x 60 meter area. 592 plants counted (670 estimated), with 80-90% in fruit and 20-15% vegetative. A third 60 x 60 meter colony on the south side of the road had 182 plants counted (600 estimated) with 85% fruiting and 15% vegetative.

1989-06-23: Sec 21-22 and Sec 9 subpopulations surveyed by Robert Dorn. Total population here and in EO # 002 (NW slopes of Cedar Mountain in T49N R89W S15-16, 22) estimated at 6750 plants. Ca 98% in flower or fruit. Rarely dominant, usually very spotty. Occurs with *Yucca glauca, Penstemon laricifolius, Senecio canus, Phlox hoodii, Haplopappus nuttallii, Astragalus gilviflorus, Cryptantha celosioides, Oxytropis besseyi*, and *Eriogonum pauciflorum*. Sec 20 colony: Dorn (1989) reports "the original collection [Hartman 9232] from Section 20 may well have come from an adjacent section as no plants could be found in Section 20 despite an intensive search in 1989".

1979-06-22: Sec 20: Observed in flower and fruit by R.L. Hartman.

Habitat: Sparsely-vegetated cushion plant/bunchgrass community dominated by stunted *Chrysothamnus nauseosus*, *Haplopappus nuttallii, Penstemon laricifolius*, and *Koeleria macarantha* on ridgecrests and slopes to 45 degrees within openings in *Artemisia tridentata/Juniperus osteosperma/Elymus spicatus* communities. Soil reddish clay with whitish sandstone rocks or traces of gypsum on the surface derived from the Goose Egg and Chugwater formations (with some intermixing of Tensleep Sandstone). Vegetative cover typically less than 25-30%.
Elevation: 4900-5900 feet
Size: 13 acres

Comments: Formerly included Occurrence # 002 from ca 3.5 miles to the west. No occupied habitat is present in the intervening area.

Managed Area: BLM Worland Field Office and State of Wyoming.

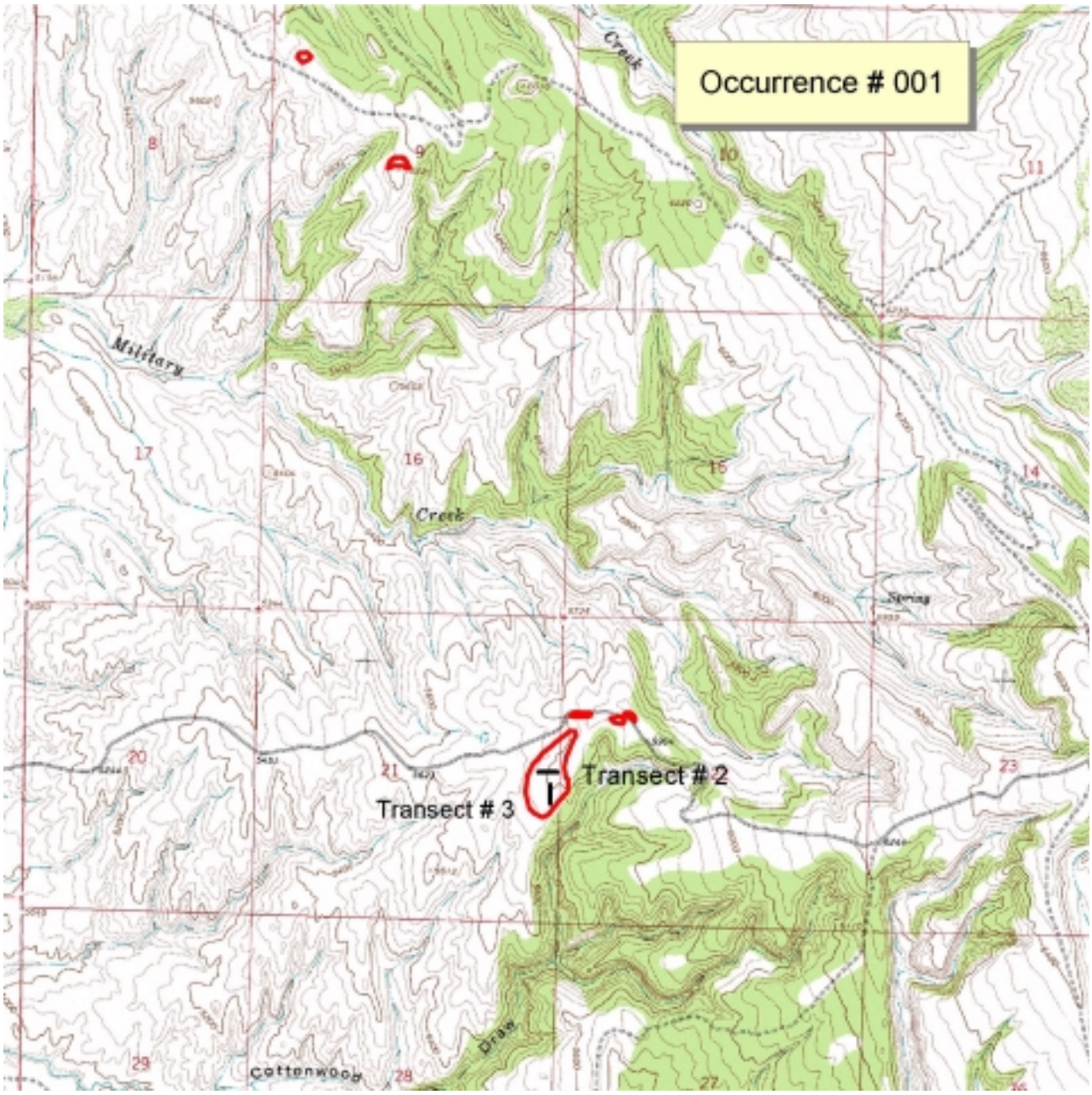
Specimens:
Dorn, R.D. (3250). 1979. (RM Holotype); (5000, 5001). 1989. RM.
Hartman, R.L. (9232). 1979. RM.
Welp, L. (7872). 1998. RM.

Sources:
Dorn, Robert D. 1989. Report on the status of *Astragalus jejunus* var. *articulatus*, a Candidate Threatened species. Prepared for the US Fish and Wildlife Service by Mountain West Environmental Services, Cheyenne, WY.

Author: Walter Fertig
Edition Date: 01-02-17

Astragalus jejunus var. *articulatus* Occurrence # 001
Pierce Draw 1:24,000 Quad

T49N R88W S9, 21-22
Ridge between Military Creek and Cottonwood Draw (along and south of BLM Road 1117) and ridge between Military Creek and Luman Creek, ca 7.5-8 air miles east and southeast of Hyattville.



WYOMING NATURAL DIVERSITY DATABASE
-Element Occurrence Record-

ASTRAGALUS JEJUNUS VAR. *ARTICULATUS*
HYATTVILLE MILKVETCH
Occurrence # 002

Status
Data Sensitive?: No
Identification verified: Yes
TNC Global Rank: G3T1
WYNDD State Rank: S1
Federal Status: None; former C2 Candidate;
Proposed for BLM State Sensitive list
WY Distribution Note: State endemic

Location
County: Big Horn
USGS Quad Name: Hyattville

Latitude: 441240N (centrum)
Southern-most Latitude: 441224N
Northern-most Latitude: 441251N
Longitude: 1073208W (centrum)
Eastern-most Longitude: 1073110W
Western-most Longitude: 1073240W

Map Accuracy: Precise; location is within a 75 foot radius of point on USGS topo map.

Town/Range/Section: T49N R89W Sec 15 (SW4SW4SW4 & S4 OF SW4 OF SE4), SEC 16 SE4SE4), SEC 22 (N2 OF NE4 & N4 OF NE4 OF NW4).

Location: Eastern Bighorn Basin, northwest slope of Cedar Mountain on the south side of BLM Road 1117, ca 3.5-4 air miles southeast of Hyattville.

Population Data
Last Observed: 2000-06-29
First Observed: 1980-06-17

Data: Population consists of 6 essentially contiguous subpopulations in an area of 0.25 x 1.3 miles.

2000-06-29: Sec 15 colony: site revisited by Laura Welp. Population observed to be less dense than in previous years, perhaps as a result of 2000 drought.

1999-07-16: Sec 15-16 colony: Plants observed by Walter Fertig and Ann Humphrey. Population estimated at 500-1000. Plants typically clumped, but clumps widely distributed and patchy.

1999-06-28: Sec 15 (SW4SW4) colony: 45 plants observed in monitoring transect (#1). 17% of plants in flower or fruit. 20% of the population comprised of seedlings. Density measured at 1.55 plants per square meter.

1999-06-27: Sec 22 NE4 colony (N side of road): 72 plants observed by Laura Welp. Individuals widely scattered. Only 8 observed with flowers or fruit. Sec 16 (SE4) colony: 457 plants observed in survey. 60% in flower and fruit, 40% vegetative. Most abundant on top of rim with *Chaenactis douglasii, Chrysothamnus viscidiflorus*, and *Oxytropis besseyi* var. *fallax*. Plants show some evidence of insect predation. Density of 2.48 plants per square meter measured in one 50 meter belt.

1998-07-05: Sec 22 NE4 colony (north side of BLM Road 1117): 73 plants observed in 300 x 70 meter area by Laura Welp (total population estimated at 200 plants). 30% of population in fruit and 70% vegetative. Sec 22 N2 colony (south of BLM road): 45 plants observed, all widely scattered over a 0.25 mile area. 40% of plants in fruit and 60% vegetative. Occurs with *Haplopappus nuttallii, Krascheninnikovia lanata, Opuntia polyacantha, Cryptantha celosioides*, and

Yucca glauca.

1993-06-22: Observed in flower and fruit by Charmaine Refsdal Delmatier. Photos taken for *Wyoming Rare Plant Field Guide.*

1989-06-22: This population and EO # 001 surveyed by Robert Dorn. Total population at both sites estimated at 6750 plants. Individual plants widely scattered and rarely locally dominant. Plants in flower and fruit.

1980-06-17: Observed in flower and fruit by B.E. Nelson.

Habitat: Sparsely vegetated cushion plant/ bunchgrass/low shrub community on flats and lower slopes of fine red clay soil derived from the Goose Egg and Chugwater formations within a matrix of sparse *Artemisia tridentata, Chrysothamnus nauseosus,* and *Atriplex canescens*.
Elevation: 4900-5100 feet
Size: 22 acres

Comments: Originally included in EO # 001, although separated by 3.5 miles of unoccupied habitat.

Managed Area: BLM Worland Field Office and State of Wyoming.

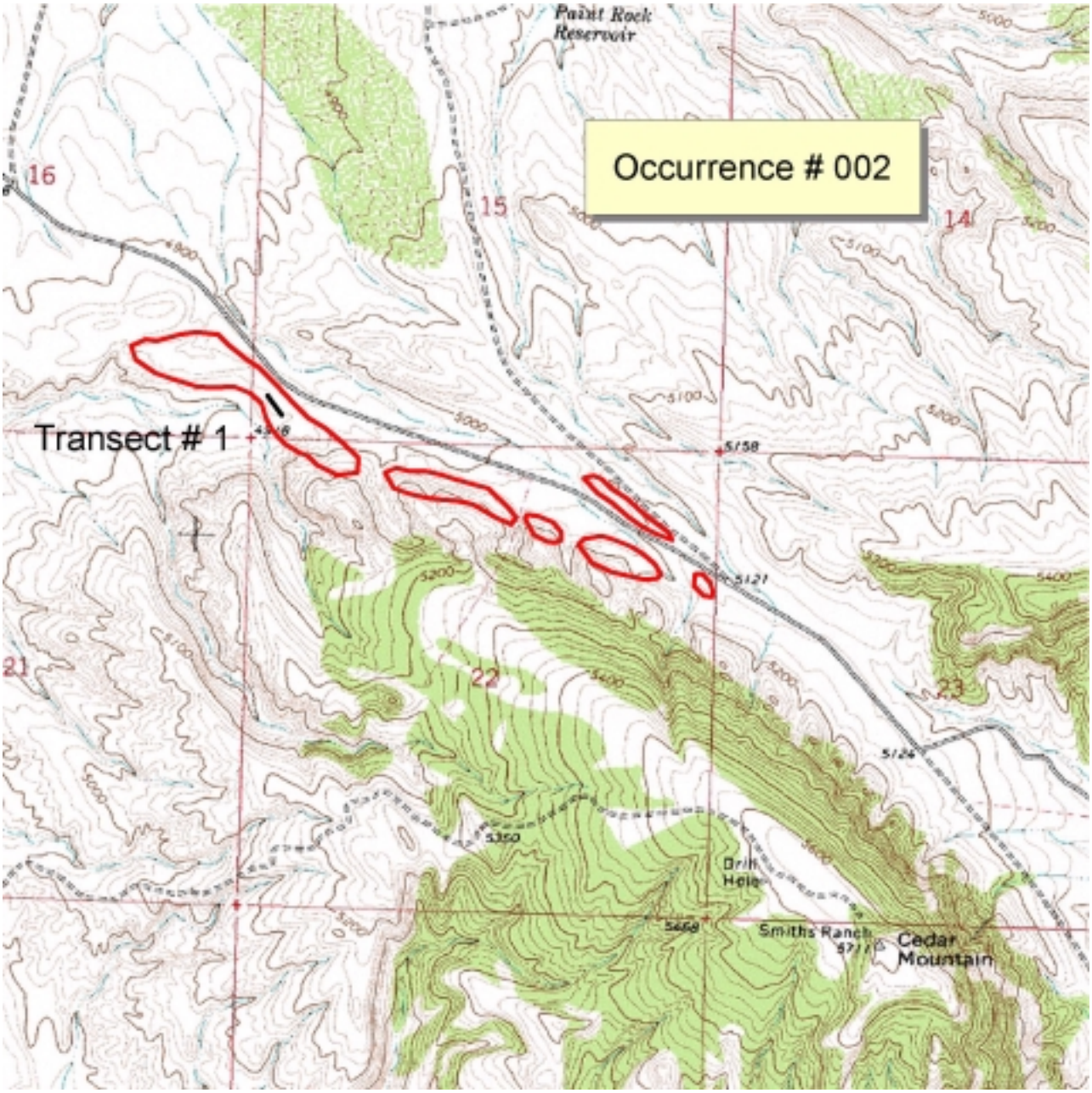
Specimens:
Nelson, B.E. (5706). 1980. RM.
Dorn, R.D. (5002). 1989. RM.
Refsdal, C. (81). 1993. RM.
Welp, L. (7987). 1999. RM.

Sources:
Dorn, Robert D. 1989. Report on the status of *Astragalus jejunus* var. *articulatus,* a Candidate Threatened species. Prepared for the US Fish and Wildlife Service by Mountain West Environmental Services, Cheyenne, WY.

Author: Walter Fertig
Edition Date: 01-01-08

Astragalus jejunus var. *articulatus* Occurrence # 002
Hyattville 1:24,000 Quad

T49N R89W S15-16, 21-22
Northwest slope of Cedar Mountain on the south side of BLM Road 1117, ca 3.5-4 air miles southeast of Hyattville.



Appendix B.
Survey Routes

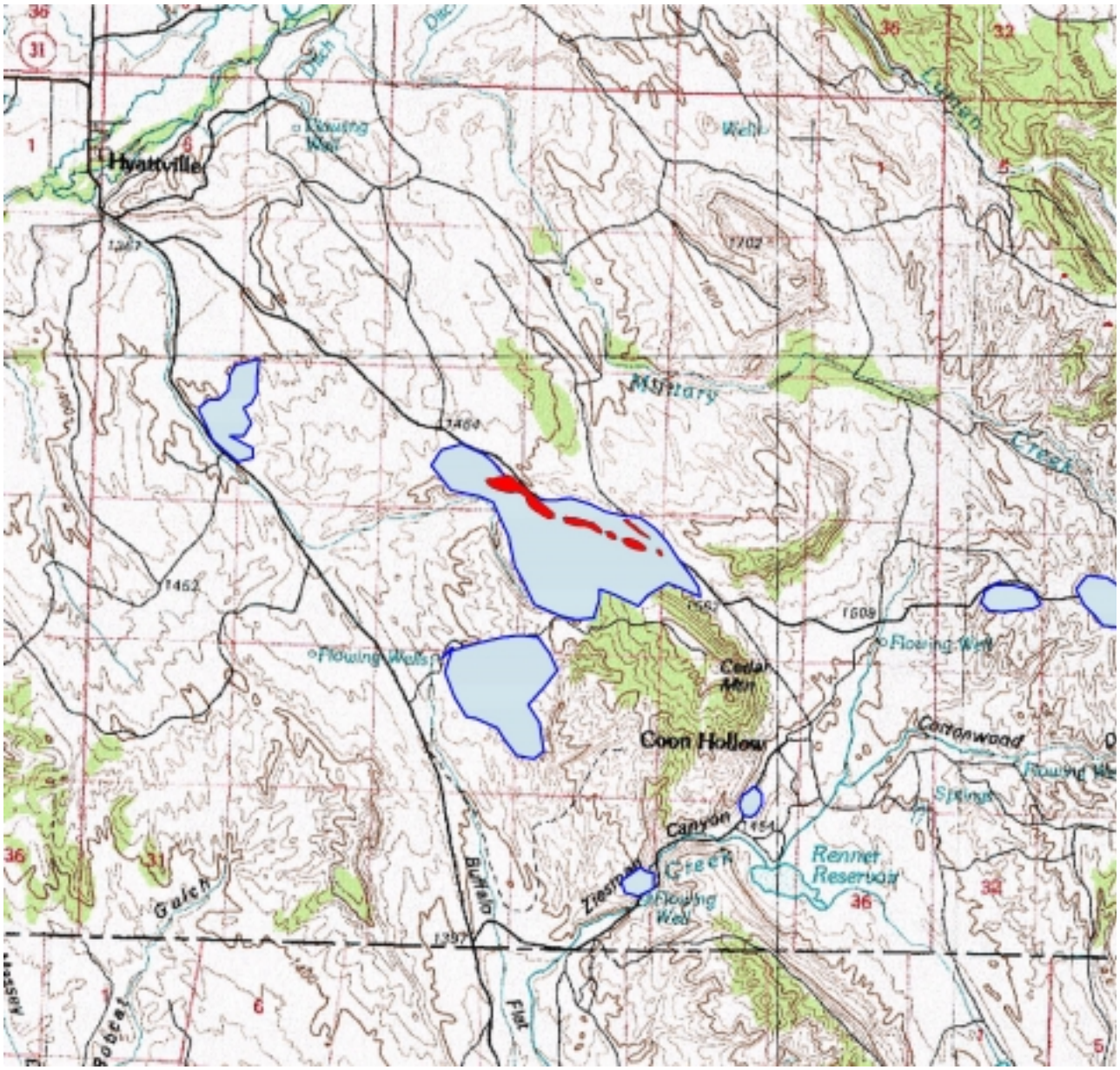
Surveys for Hyattville milkvetch were conducted by Laura Welp (1998-2000) and Walter Fertig (July 1999). Potential areas for survey were determined from BLM land management maps and USGS topographic maps based on the presence of suitable habitat on accessible public lands. Surveyed locations are depicted on the accompanying maps and are summarized below:

Surveyed Sites 1998-2000
(see the following maps for exact locations)

DATE	SURVEYOR	COORDINATES	HYATTVILLE MILKVETCH FOUND?
5 July 1998, 28 June 1999, 29 June 2000 16 July 1999	Welp Fertig & Humphrey	T49N R89W S15-16,21-23	Yes
28 June 1999	Welp	T49N R89W S21-22,27-28	No
28 June 1999	Welp	T49N R89W S17-18	No
28 June 1999	Welp	T49N R89W S26, 35	No
28 June 1999	Welp	T49N R89W S34	No
28 June 1999	Welp	T49N R88W S20	No
5 July 1998, 28 June 1999, 29 June 2000 16 July 1999	Welp Fertig & Humphrey	T49N R88W S21	Yes
5 July 1998, 28 June 1999, 29 June 2000 16 July 1999	Welp Fertig & Humphrey	T49N R88W S22	Yes
28 June 2000	Welp	T49N R88W S23-24	No
28 June 2000	Welp	T49N R87W S19	No
28 June 2000	Welp	T49N R88W S25	No
27 June 2000	Welp	T48N R88W S14	No
27 June 2000	Welp	T48N R87W S6 S1/2	No

1998-2000 Survey Routes
Worland BLM 1:100,000 Quads
T48-50N R88-90W

Blue hatching = 1998-2000 survey routes
Red = Populations of *Astragalus jejunus* var. *articulatus*

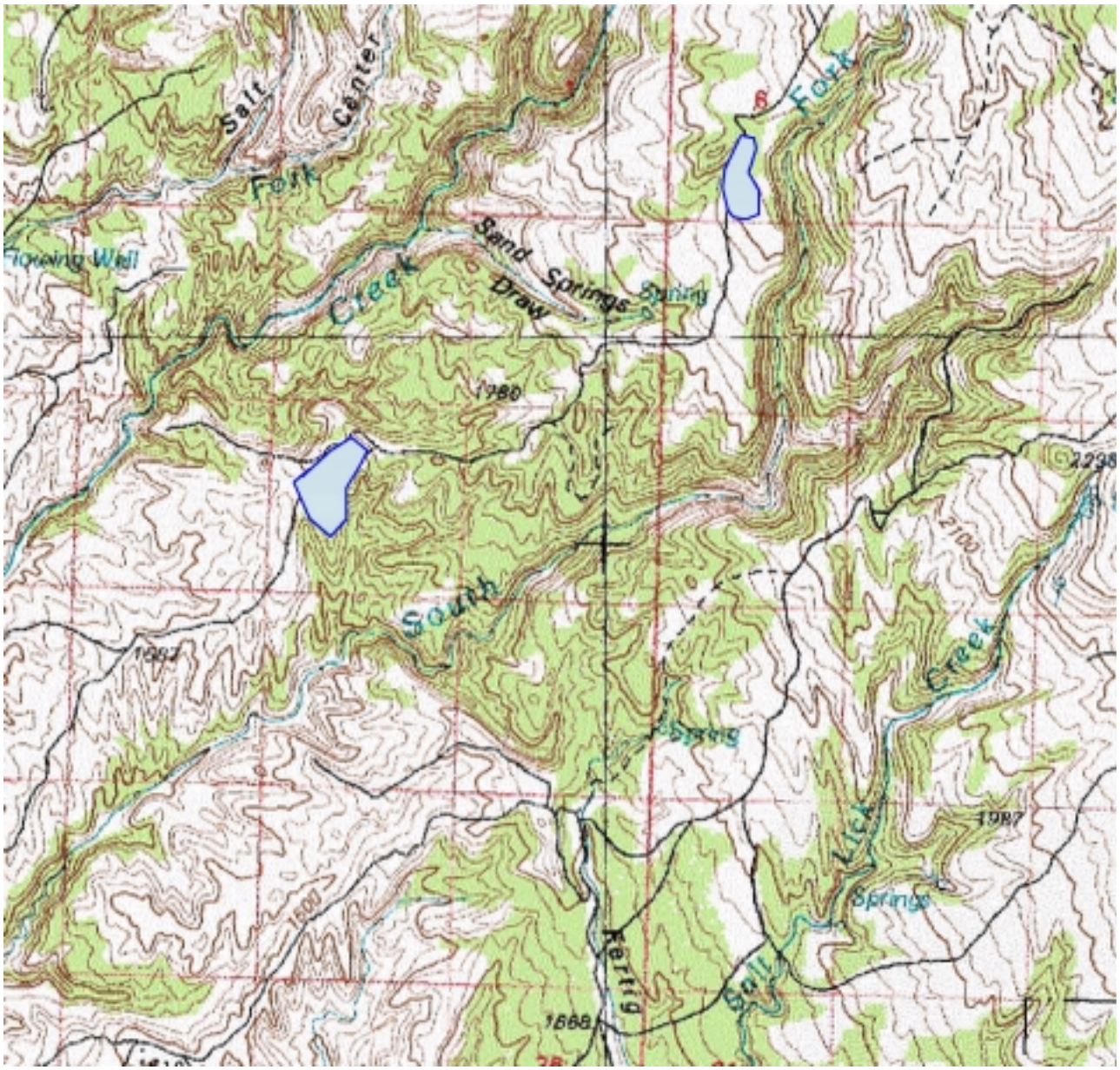


1998-2000 Survey Routes
Worland BLM 1:100,000 Quads
T48-50N R87-88W

Blue hatching = 1998-2000 survey routes
Red = Populations of *Astragalus jejunus* var. *articulatus*

1998-2000 Survey Routes
Worland BLM 1:100,000 Quads
T48-49N R87-88W

Blue hatching = 1998-2000 survey routes



Appendix C.

1999 Monitoring Data for *Astragalus jejunus* var. *articulatus*

Transect Locations:

Transect # 1
County: Big Horn.
Occurrence: # 002 (see Map in Appendix A, page 23).
Legal Description: T49N R89W S15 (SW4SW4SW4).
Transect Bearing (from 0 towards 29 m): 298° WNW.
USGS Quad: Hyattville.
Directions: Northwest slope of Cedar Mountain on south side of BLM Road 1117, ca 3.2 road miles SE of junction of BLM Road 1117 and BLM Road 49.
Habitat: Sparsely vegetated cushion plant/bunchgrass/low shrub community on flats and lower slopes of fine red clay soil derived from the Goose Egg and Chugwater formations.
Comments: Original transect was placed in Sec 16 on state lands and later relocated to BLM lands in Sec 15. New site has fewer plants, but less evidence of fruit herbivory. At least 3 plants were covered with a webbing produced by an insect or spider.

Transect # 2
County: Big Horn.
Occurrence: # 001 (see map in Appendix A, page 20)
Legal Description: T49N R88W S21 (SE4SE4 of NE4)
Transect Bearing (from 0 towards 25 m): 220° SW.
USGS Quad: Pierce Draw.
Directions: West end of N-S trending ridge on divide between Military Creek and Cottonwood Draw, ca 0.1 miles south of BLM Road 1117. Follow Section line fence ca 0.1 miles S; transect starts near the fence and is oriented from east to west (approximately parallel to BLM Road 1117).
Habitat: Community of *Gutierrezia sarothrae/Elymus spicatus* within a matrix of sagebrush and juniper.
Comments: Plants diminish in abundance towards the base of the slope (from plot # 23 onward, suitable habitat is no longer present).

Right: View of Transect # 002 from west (endpoint) to east (origin). Section 21/22 fenceline is visible in the background near the origin.

Transect # 3
County: Big Horn.
Occurrence: # 001 (see map in Appendix A, page 20)
Legal Description: T49N R88W S21 (NE4NE4 of SE4).
Transect Bearing (from 0 towards 30 m): 240° SW.
USGS Quad: Pierce Draw.
Directions: On west slope of N-S trending ridge on divide between Military Creek and Cottonwood Draw, ca 0.2 miles south of BLM Road 1117. Follow the Section line fence south ca 0.2 miles to section marker and walk 70 m at 242° from the marker to the rebar at the south end of the transect (transect runs from north to south and is approximately perpendicular to BLM Road 1117.)

Right: View of Transect # 003 from south (endpoint) to north along western edge of N-S trending ridge south of BLM Road 1117 on divide between Military Creek and Cottonwood Draw. Photo by Laura Welp, 28 June 1999.

Habitat*:* Community of *Gutierrezia sarothrae/Elymus spicatus* within a matrix of sagebrush and juniper.

Sampling Method:
Three permanent 1 x 25-50 meter belt transects were established following the protocol of Lesica (1987). Plots were selected subjectively at known *Astragalus jejunus* var. *articulatus* colonies to reflect "typical" density and habitat conditions. Starting points were marked by re-bar and low rock piles. For each transect, 1 x 1 meter plots were framed by meter sticks and read from the left side

of the baseline tape. In each plot, data were collected on the number of individual plants in each of four age/size classes: Seedlings (non-flowering rosettes less than 2 cm in diameter), Vegetative (non-flowering rosettes greater than 2 cm in diameter), Reproductive (flowering or fruiting plants with at least 1 inflorescence), and Dead (dead plants of any size class).

Summary of Results: Total density ranged from 1.4 and 1.5 plants per square meter in Transects 3 and 1 respectively, to 3.8 plants per square meter in transect 2. Seedling density varied from 0.3-0.5 per square meter and vegetative rosette density ranged from 0.2-0.9. Density of reproductive plants was 0.2-2.4 plants per square meter. Transect # 2 had the highest density of Hyattville milkvetch plants, as well as a slightly higher density of vegetation (35.4% compared to 22-26% for the other transects).

Recommendations: Follow-up monitoring should be conducted on an annual to biennial basis over the next 5-10 years to determine the longevity of individual plants and to assess whether populations experience shifts in distribution or abundance. Qualitative to semi-quantitative assessments should also be conducted on a frequent basis to assess gross population trend and impacts from possible threats.

Astragalus jejunus var. *articulatus*
Transect # 1 Census Data

Date: 28 June 1999 Surveyor: Laura Welp

Plot #	Total #	# Seedlings	# Vegetative	# Reproductive	# Dead	% Veg Cover
1	0	0	0	0	0	20
2	2	1	1	0	0	20
3	0	0	0	0	0	25
4	2	0	1	1	0	20
5	1	0	1	0	0	15
6	1	0	0	0	1	20
7	0	0	0	0	0	20
8	1	0	1	0	0	25
9	2	0	2	0	0	40
10	3	1	1	1	0	20
11	0	0	0	0	0	35
12	0	0	0	0	0	15
13	2	0	2	0	0	15
14	1	0	1	0	0	15
15	1	0	0	1	0	15
16	1	1	0	0	0	20
17	2	1	0	1	0	30
18	1	0	1	0	0	40
19	3	1	1	1	0	35
20	2	2	0	0	0	15
21	1	0	1	0	0	20
22	4	0	4	0	0	25
23	3	0	2	1	0	15
24	2	0	2	0	0	20
25	0	0	0	0	0	20
26	2	0	0	2	0	20

27	3	0	3	0	0	20
28	0	0	0	0	0	15
29	5	2	3	0	0	20
TOTAL	45	9	27	8	1	Ave = 21.9

Transect: 29 square meters
Seedlings per square meter: 0.31
Vegetative rosettes per square meter: 0.93
Reproductive plants per square meter: 0.28
Total # of plants per square meter: 1.55

Astragalus jejunus var. *articulatus*
Transect # 2 Census Data

Date: 28 June 1999 Surveyor: Laura Welp

Plot #	Total #	# Seedlings	# Vegetative	# Reproductive	# Dead	% Veg Cover
1	1	0	1	0	0	45
2	4	0	0	4	0	40
3	3	0	2	1	0	35
4	5	4	0	1	0	35
5	2	1	1	0	0	30
6	5	2	1	2	0	40
7	7	0	2	5	0	30
8	6	2	0	4	0	35
9	6	0	4	2	0	35
10	9	0	0	9	0	35
11	11	0	1	10	0	30
12	17	1	5	11	0	30
13	2	0	0	2	0	30
14	4	1	2	1	0	40
15	0	0	0	0	0	35
16	3	0	0	3	0	30
17	1	0	0	1	0	40
18	7	0	4	3	0	35
19	2	1	0	1	0	45
20	0	0	0	0	0	35
21	0	0	0	0	0	35
22	0	0	0	0	0	35
23	0	0	0	0	0	30
24	0	0	0	0	0	35
25	0	0	0	0	0	40
TOTAL	95	12	23	60	0	Ave = 35.4

Transect: 25 square meters.
Seedlings per square meter: 0.48
Vegetative rosettes per square meter: 0.92
Reproductive plants per square meter: 2.4
Total # of plants per square meter: 3.8

Astragalus jejunus var. *articulatus*
Transect # 3 Census Data

Date: 28 June 1999 Surveyor: Laura Welp

Plot #	Total #	# Seedlings	# Vegetative	# Reproductive	# Dead	% Veg Cover
1	0	0	0	0	0	15
2	1	0	1	0	0	20
3	3	2	0	1	0	25
4	1	0	0	1	0	30
5	0	0	0	0	0	25
6	0	0	0	0	0	15
7	0	0	0	0	0	30
8	0	0	0	0	0	40
9	0	0	0	0	0	45
10	0	0	0	0	0	40
11	0	0	0	0	0	20
12	0	0	0	0	0	20
13	2	0	2	0	0	20
14	2	1	0	1	0	25
15	5	3	2	0	0	25
16	13	5	2	6	0	30
17	7	2	1	4	0	25
18	0	0	0	0	0	20
19	2	0	0	2	0	20
20	0	0	0	0	0	30
21	0	0	0	0	0	30
22	0	0	0	0	0	30
23	0	0	0	0	0	30
24	0	0	0	0	0	15
25	3	1	0	2	0	25
26	2	0	0	2	0	35
27	2	1	0	1	0	15
28	0	0	0	0	0	20
29	0	0	0	0	0	25
30	0	0	0	0	0	35
TOTAL	43	15	8	20	0	Ave = 26

Transect: 30 meters
Seedlings per square meter: 0.5
Vegetative rosettes per square meter: 0.27
Reproductive plants per square meter: 0.67
Total # of plants per square meter: 1.43