THE STATUS OF *ASTRAGALUS CUSICKII* VAR. *PACKARDIAE* (PACKARD'S MILKVETCH)

by

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ABSTRACT

Packard's milkvetch (*Astragalus cusickii* var. *packardiae*) is a perennial forb endemic to a small area in northeastern Payette County, southwestern Idaho. Conservation interest in this species was heightened following its rediscovery in 1997, after not being reported for about 20 years. Because so little information about Packard's milkvetch was available, the BLM's Lower Snake River District and Idaho Department of Fish and Game's Conservation Data Center entered into a Challenge Cost-share agreement to conduct a comprehensive field investigation for this species in 1999. During the investigation, five of the six known occurrences were discovered and an estimated 4,500 plants tallied. Packard's milkvetch is restricted to localized and visually distinct sediments characterized by a whitish color, sparse vegetation, and high percentage of bare ground. The edaphic habitats supporting Packard's milkvetch have been more or less resistant to weed invasion or other obvious signs of serious degradation despite a surrounding landscape dominated by annual grassland vegetation. As long as these habitats remains intact, the long-term conservation prospects for Packard's milkvetch appear favorable. This report summarizes the field investigation results and provides information on the taxonomy, distribution, abundance, biology, habitat, threats, and conservation status of Packard's milkvetch, one of the rarest members of Idaho's flora.

ACKNOWLEDGEMENT

I thank Nancy Brossman for the illustration of *Astragalus cusickii* var. *packardiae* used in this report.

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INTRODUCTION

Packard's milkvetch (*Astragalus cusickii* var. *packardiae*) is a perennial forb endemic to a small area in northeastern Payette County, southwestern Idaho. It was not discovered until 1980, and then not seen again until a population was found on BLM land in 1997. The rediscovery prompted a heightened conservation concern for the species. The BLM recognized a field survey would be necessary to determine the conservation status of Packard's milkvetch and provide information needed to help maintain populations on land they administer. Towards this end, the Idaho Department of Fish and Game's Conservation Data Center (CDC) entered into a Challenge Cost-share agreement with the BLM's Lower Snake River District to conduct a comprehensive field investigation for Packard's milkvetch.

METHODS

The field investigation for Packard's milkvetch was centered in the northeastern corner of Payette County, approximately 15 miles north of Emmett, and also about 15 miles east of Payette. Prior to initiating fieldwork, aerial photos were used to help locate and map the scattered whitish-colored, sparsely vegetated exposures indicative of potential Packard's milkvetch habitat in the study area. These exposures were concentrated north of Big Willow Creek, between Stone Quarry Gulch on the west and Dry Creek to the east. Potential habitat was also identified in several outlying areas. Fieldwork was conducted between May 13 and June 7, 1999. I visited as many of these target areas on BLM and State land as possible during the investigation. Location, population, and other pertinent conservation information were collected at each Packard's milkvetch occurrence. GPS coordinates were also obtained at each occurrence.

RESULTS

Five new Packard's milkvetch occurrences were discovered during the survey. In addition, I revisited and updated information concerning the single occurrence known prior to 1999. The occurrences contained an estimated 4,500 plants over approximately 13 acres. Packard's milkvetch was found to be restricted to localized and visually distinct sedimentary exposures characterized by a whitish color, relatively sparse vegetation, and high percentage of bare ground. Few other species were adapted to the edaphic attributes of these exposures, and the narrow distribution of Packard's milkvetch seems to correspond to its narrow habitat specificity and the limited regional extent of the necessary surficial geology. Four of the six known occurrences were located at least partly on BLM land, and two wholly on State land.

This report summarizes information regarding the taxonomy, distribution, abundance, biology, habitat, threats, and conservation status of Packard's milkvetch. Management recommendations are made at the end of the report. A description and maps of the 1999 survey areas are included as appendices.

ASTRAGALUS CUSICKII VAR. *PACKARDIAE*

TAXONOMY

Scientific name: *Astragalus cusickii* A. Gray var. *packardiae* Barneby.

Full bibliographic citation: Barneby, R.C. 1989. Page 78 *In:* Intermountain Flora. Vascular plants of the Intermountain West, U.S.A., Volume 3, Part B.

Type specimen: United States, Idaho, Payette County; on a small tributary of Dry Creek. May 18, 1980. J. Grimes and P.L. Packard 1583 (Holotype: NY).

Pertinent synonyms: None.

Common name: Packard's milkvetch.

Size of genus: *Astragalus* is one of the largest genera of vascular plants in the world, with approximately 1,600 taxa. It is most highly diversified in regions with arid continental, desert, and Mediterranean climates (Barneby 1989). The two areas of the world with the greatest species diversity are the steppes, mountains, and semi-deserts of central Asia and the Intermountain region of western North America (Liston 1997). Over 100 species of *Astragalus* occur in the Pacific Northwest. Idaho has approximately 70 species.

Family name: Fabaceae; Leguminosae.

Common name for family: Legume; Pea; Bean.

History of knowledge of taxon in Idaho: Packard's milkvetch was discovered in 1980 in Payette County, Idaho, by botanists James Grimes and Patricia Packard. The specimen they collected was sent to Dr. Rupert Barneby, a taxonomist specializing in legumes at the New York Botanical Garden. He described it as a new taxon in 1989 and named it in honor of Dr. Packard. For several years this taxon was known from only the type collection. In the spring of 1997, I stumbled across a milkvetch I did not recognize while conducting a rare plant survey for *Stanleya confertiflora* (Malheur prince's plume; Mancuso 1997). It turned out to be Packard's milkvetch. BLM botanist Ann DeBolt, Dr. Packard, and I revisited the site in 1998 to collect preliminary population information. In 1999, I conducted the first systematic survey for Packard's milkvetch.

Packard's milkvetch was first recognized as a possible conservation concern at the 1991 Idaho Rare Plant Conference, when it was added to the Idaho Native Plant Society's (INPS) rare plant list as a Review species (Idaho Native Plant Society 1991). The Review category contains rare plant taxa in need of more information before a conservation assessment can be made. The status of Packard's milkvetch was updated to one of the globally rare categories at the 1998 Idaho Rare Plant Conference following its rediscovery (Idaho Native Plant Society 1998).

Alternative taxonomic treatments: Isley (1998) does not include var. *packardiae* in his treatment of Leguminosae of the United States. He offers no explanation why it is not recognized.

LEGAL OR OTHER FORMAL STATUS

National

U.S. Fish and Wildlife Service: None.

Bureau of Land Management: This taxon is presently not on the Idaho BLM's Sensitive Species plant list. However, management at the Lower Snake River District's Cascade Resource Area is treating it as such until the list gets updated, probably during the year 2000. At that time, Packard's milkvetch will likely be added to the Sensitive Species plant list (A. DeBolt, BLM botanist, pers. comm.).

Other current formal status recommendations: The Nature Conservancy and network of Natural Heritage Programs and Conservation Data Centers have given Packard's milkvetch a global rank of G1. This rank is for taxa critically imperiled throughout their range because of extreme rarity or because of some biological factor making it especially vulnerable to extinction (Idaho Conservation Data Center 1999).

Idaho

Idaho Native Plant Society: Packard's milkvetch is on the INPS Global Priority 1 list, which has the same definition described for G1 (Idaho Native Plant Society 1999).

Conservation Data Center: Its S1 conservation rank has the same definition as for G1, except at the state level (Idaho Conservation Data Center 1999).

DESCRIPTION

General non-technical description: Erect, perennial herb with multiple stems arising from the root crown at ground level. Plants are mostly 25 to 50 cm tall, and have a dull green color due to appressed, whitish hairs. Leaves have only a few small, well-spaced leaflets, or are reduced to a naked rachis (no leaflets). Leaflets are usually no more than about 1 mm wide and 7 mm long. Flowering stems have up to about 20 flowers that decline with age. The petals are clear- to creamy-white and suffused with purple. The banner is about 1 cm long with purple pencilling, while the smaller keel has purple concentrated towards the tip. The wing petals are intermediate in size and lightly tinged with purple. The sepals have black hairs and are about 4 mm long. The pendulous fruit pods are inflated, narrowly ellipsoid in shape, and up to about 4 cm long. The thin, lustrous, yellow-green pods usually have a red mottling.

Technical description: Slender, sparsely leafy and subjunceous, perennial herb (1)2-6(7) dm tall, thinly strigulose with appressed, basafixed hairs; stems arising from a multicipital root-crown at the level of the soil, or from a short, branched caudex; stipules 1-5 mm long, the lowest aerial and all subterranean ones connate into a papery membranous sheath, the distal ones progressively smaller, firmer, and less connate or only semiamplexicaul and free, their herbaceous blades deltate or triangular-subulate, erect or deflexed; leaves 3-11(14) cm long, the upper leaves reduced to a naked rachis; leaflets distant, 2-9, linear, emarginate, (1)2-7(12) mm long, sometimes fewer, smaller or obsolete in distal leaves, the lateral ones petiolulate though sometimes obscurely so, the terminal one either petiolulate or decurrent into the rachis; peduncles erect or incurved ascending 2-16 cm long; racemes loosely 2-19 flowered, the flowers declined in age; calyx black strigulose, 3.7-4.3 mm long, the deltate or broadly triangular-subulate teeth 0.5-1.0 mm long; petals clear white to creamy-white and suffused with purple, banner 8.5-10 mm long and with purple pencilling, keel 6.5-7.5 mm long; ovary glabrous; ovules 10-20; pod narrowly ellipsoid, bladdery-inflated,18(20)-48 mm long and 7-10 mm or more wide when pressed, contracted at the apex into a low-deltate, sometimes obscure laterally compressed beak, elsewhere terete or a trifle dorsiventrally compressed, the filiform sutures either equally convex as viewed in profile or the ventral ones less so, straight, or sometimes shallowly concave, the pale green or sometimes red-mottled, subdiaphanous valves becoming papery-membranous, lustrously stramineous, not inflexed; dehiscence primarily through the stipe, often only after fall of the pod with its marcescent calyx and pedicel (adapted from Barneby 1989).

Local field characters: *Astragalus* is a large, but distinctive genus in southwestern Idaho. Packard's milkvetch has an erect, multi-stemmed habit, although small plants can have a thin appearance. The herbage has a dull green color due to appressed, whitish hairs. The leaves usually have only a few small, well-spaced leaflets, or are no more than a naked rachis. Flowers are purplish and relatively small. Depending on the number of stems, plants can appear quite floriferous. After flowering, plants provide a stunning display of hanging, inflated, shiny, yellowish-green to almost light gold pods often mottled with red.

This species should not be confused with anything but a couple of other congeners. I observed four other astragali within the range of Packard's milkvetch – *Astragalus beckwithii* (Beckwith's milkvetch), *A. purshii* (Pursh's milkvetch), *A. eremiticus* (hermit milkvetch), and *A. filipes* (basalt milkvetch). The first two species are easily distinguished by their low-growing habit, larger, more numerous and evenly distributed leaflets, and larger flowers. In addition, the pods of Beckwith's milkvetch become leathery with age, while those of Pursh's milkvetch are covered by dense pubescence. Hermit milkvetch can be readily differentiated by its numerous leaflets, larger, yellowish flowers, and erect, stiff pods. Superficially, basalt milkvetch looks the most similar, but it also has several distinguishing characteristics. Plants tend to be taller, brighter green in color, and have larger, more numerous, well-spaced leaflets. Flowers are also larger, and more or less cream-colored. Finally, the compressed pods hang from an elongated stipe.

The range of *Astragalus cusickii* var. *cusickii* (Cusick's milkvetch) is known to extend as far south as Washington County, Idaho, north of the range of the closely related Packard's milkvetch. Cusick's milkvetch has equably leafy stems and none reduced to a naked rachis, larger, cream- to yellowish-colored flowers, and a larger, more inflated pod with little if any red mottling. *Astragalus toanus* (toano milkvetch) is another milkvetch that looks superficially similar because of its multi-branched, sparsely leafy habit and pink-purple petals. Its larger flowers, ascending and fleshy fruit pods, and several other less obvious field characteristics can distinguish it. In southwestern Idaho, the range of toano milkvetch does not extend as far north as Payette County.

Photos and line drawings: There is a line drawing in Barneby (1989) and an illustration in Appendix 1 of this report. The CDC has a collection of slides showing the habit and habitat of Packard's milkvetch. Several have been reproduced in Appendix 2.

DISTRIBUTION

Global distribution: Packard's milkvetch is an Idaho endemic so far known only from the northeastern corner of Payette County, about 15 miles north of the town of Emmett (Figure 1). This area is near the northern margin of the Owyhee Uplands section of the Columbia Plateau physiographic province (McNab and Avers 1994). Packard's milkvetch's distribution follows a series of peculiar sedimentary outcrops exposed between Big Willow Creek on the south, Little Willow Creek on the north, the Dry Creek area to the east, and Stone Quarry Gulch to the west. The entire known range of the species covers an area about six miles long, by two miles wide.

Table 1 summarizes location information for the six known occurrences. Precise occurrence locations have been mapped (Appendix 3), and additional location and other occurrence data detailed in the appropriate Occurrence Record (Appendix 4). It is unclear which occurrence corresponds to the original type locality for Packard's milkvetch. The three-digit code (e.g., 001) associated with each occurrence corresponds to the data management Element Occurrence Record (EOR) number used by the CDC.

Figure 1. Distribution map for Astragalus cusickii var. packardiae

Table 1. Location information for occurrences of *Astragalus cusickii* var. *packardiae*.

EOR	Name	Legal description	Latitude/Longitude (centrum)	USGS 7.5' quad.
001	Bannister Basin	T9N R2W S29 SW4 T9N R2W S32	440439N 1163544W	Hog Cove Butte
002	Bannister Basin North	T9N R2W S28 W2	440517N 1163528W	Hog Cove Butte
003	Dry Creek	T9N R2W S27 SW4	440451N 1163412W	Hog Cove Butte
004	Dry Creek Tributary	T9N R2W S27 NW4 T9N R2W S28 NE4	440537N 1163442W	Hog Cove Butte
005	Sulphur Gulch	T9N R2W S35 E2	440424N 1163214W	Hog Cove Butte
006	Sheep Ridge	T9N R3W S36 S2	440412N 1163832W	Sheep Ridge

Unverified/undocumented reports: None.

Synopsis of past and needed inventories: Until 1997, Packard's milkvetch was known only from the type collection. Location information associated with the type specimen was vague, referring simply to a "tributary of Dry Creek." Our 1999 field investigation was the first of its kind for Packard's milkvetch. Field surveys concentrated on BLM and State lands in the Big Willow Creek/Dry Creek area in northeastern Payette County, extending a little into adjacent parts of Gem and Washington counties. Appendix 5 has maps and descriptions of the specific areas I surveyed. Suitable Packard's milkvetch habitat may occur outside the 1999 study area. Outcrops of the peculiar Idaho Group sediments or related geology may occur further west in Oregon and north in the Crane Creek drainage. At this time there is no evidence that Packard's milkvetch occurs in these or other areas.

I have identified several additional areas on BLM and State land known or suspected to have potential habitat for Packard's milkvetch based on aerial photographs, geology maps, and personal observations. I was unable to visit these areas in 1999.

1. Alkali Creek and the North Fork Alkali Creek in T9N R2W Sections 16 and 17.
2. Sheep Ridge, about two miles east of Sheep Gulch, in T9N R3W Section 34 SW4 and/or adjacent T8N R3W Section 3.
3. Upper Alley Gulch on the north side of Sheep Ridge, in T9N R3W Section 25 SW4.
4. Outcrops in two small areas between Sucker and Bissel creeks about four miles southeast of French Corner in T8N R1W Sections 18 SE4, and 20 NW4.
5. The steep slopes west of Bissel Creek in T8N R2W Sections 25 SW4 and adjacent parts of 26 and 35, about eight miles north of Emmett. I surveyed outcrops north of this area that turned out not to be good Packard's milkvetch habitat. I am unsure if this series of light-colored opening further south will be any different.
6. Aerial photographs and the Payette County soil survey map (Rasmussen 1976) show an extensive band of what may be potential habitat about three miles south-southeast of French Corner, beginning near Point 2744 in T8N R2W Section 19, and extending eastward to near Point 3050 in Section 20. This area includes an isolated block of BLM land surrounded by private land. The difficult access was the main reason I did not survey this area.

I did not survey several additional areas with potential habitat because they were located on private land. They include:
1. Several scattered outcrops north of French Corner and west of the Dry Creek road. Most occur along steep upper slopes that can be seen from vantage points along the main Big Willow Creek or Dry Creek roads. I strongly suspect some of these outcrops have Packard's milkvetch.

2. Lower Alley Gulch approximately 0.7 mile east of the Stone Quarry Gulch road, in T9N R3W Section 27 NE4. The steep slopes on the south face of Point 2902 looked promising. There was at least one other outcrop about 0.3 mile south of Point 2902.
3. Near Bradford Spring south of Little Willow Creek in T9N R3W Section 24.
4. Lower Alkali Creek in T9N R2W Sections 17 NW4 and 18 N2.
5. A series of badland-like outcrops and knolls north of the Little Willow Creek road near Ringer Gulch, in T9N R3W Section 20 NE4NE4 and adjacent portions of Sections 16 and 17. *Eriogonum ochrocephalum* var. *calcareum* (calcareous buckwheat) probably occurs in this area too.
6. Sand Hollow is an area dominated by sandy soils unsuitable for Packard's milkvetch. However, the geology map shows a couple of small units of what may be potential habitat about eight miles northeast of Payette, in T9N R4W Section 2.

HABITAT

General habitat description: Packard's milkvetch occurs in an area characterized by rolling uplands and steep slopes descending to terraced bottomlands of the main creeks or numerous minor tributaries. Shrub-steppe, and to a lesser extent bunchgrass grassland communities, originally dominated the vegetation of this area. However, wildfires and livestock grazing have greatly modified the landscape over the past century, and today annual grasslands dominate most of the area. This relatively new vegetation mosaic relegates intact native plant communities to unburned inclusions of varying ecological condition. Late seral vegetation was restricted to places with minimal historic livestock disturbance, such as steep and/or sparsely vegetated slopes. This included a few of the Packard's milkvetch sites.

Packard's milkvetch was found to be restricted to localized exposures of a visually distinct substrate. The whitish color, relatively sparse vegetation, and high percentage of bare ground were the most striking visual cues of the exposures. Besides being geographically restricted, suitable habitat was discontinuous and small in aerial extent. Edaphic factors have been frequently implicated to explain the narrow distribution of rare endemics (Kruckeberg and Rabinowitz 1985).

Packard's milkvetch was most often associated with an open *Artemisia tridentata* ssp. *wyomingensis* (Wyoming sagebrush) community that apparently represents an undescribed, edaphic association. Herbaceous species cover was low at all occurrences. It occurred on all aspects, but southeastern to western aspects were by far the most common. Regional erosion patterns have exposed a greater extent of suitable habitat on southerly and westerly faces. Packard's milkvetch was most common on steep slopes, but varied from almost flat to nearly vertical. It was found from the base up to the brow of slopes, with plants at most occurrences concentrated along either upper or toe slope positions. Occurrences ranged in elevation from approximately 2,700 to 3,200 feet elevation. Habitat information for each occurrence is summarized in the appropriate Occurrence Record (Appendix 4).

Payette County has a semiarid continental climate moderated by Pacific maritime influences. Summers are hot and dry. Most precipitation falls in the winter and averages about 16 inches/year in the northeastern part of the county (Rasmussen 1976).

Geology and soils: The range of Packard's milkvetch in northeastern Payette County is underlain mostly by sedimentary deposits mapped as the Idaho Formation and bordering extensive exposures of basalt to the east and north (Mitchell and Bennett 1979). The basalts are part of the Weiser Embayment, an area containing the southeastern-most lobe of the Miocene-aged Columbia River Basalt Group (Fitzgerald 1982). Idaho Formation deposits are younger than the great basalt flows and associated with Lake Idaho, a body of water that once covered a large portion of southwestern Idaho. This lake probably originated in the late Miocene and had numerous major and minor fluctuations before its disappearance during the Pleistocene (Jenks et al. 1998). Older sediments occurring within the basalts of the Columbia River Group have been referred to as the Payette Formation (Savage 1961).

I found that Packard's milkvetch was restricted to scattered sedimentary exposures visually distinct from the typical Idaho Formation sediments dominating the area. Except for the large exposures at Bannister Basin and Sulphur Gulch, most exposures supporting Packard's milkvetch were too small to be shown on the regional geology maps. These larger exposures were mapped as Poison Creek Formation (?) by Mitchell and Bennett (1979), and as a post-basalt "Upper" Payette Formation equivalent by Fitzgerald (1982). The two units are apparently quite similar, being comprised of clay, ash, silt, and sands. Regardless of the correct Formation or other unit assignment, Packard's milkvetch is apparently restricted to Tertiary sediments that pre-date the Idaho Formation as it was interpreted for many years (Kirkham 1931).

In light of the uncertainty concerning the names and stratigraphic relationships of the regional Tertiary sediments, Jenks et al. (1998) adopted a simple designation - Idaho Group undifferentiated - for all these fine-grained sediments. I follow this recent interpretation and use the name Idaho Group sediments in this report. Outcrops supporting Packard's milkvetch are a peculiar subset of the Idaho Group geology that covers only a small fraction of Payette County or adjacent areas. I suspect edaphic factors associated with the local geology play a key role in the occurrence and narrow distribution of Packard's milkvetch. However, I do not know what these factors are, nor if they may be associated with chemical alterations to the original sediments by hydrothermal or other geologic processes. Future geologic study in the area may reveal more information and precise assignment of the exposures supporting Packard's milkvetch.

Soils at Packard's milkvetch occurrences were probably largely formed from residuum. The soils have a granular structure and vesicular pores were common in fragments lying on the surface. The ground surface often had a lumpy microtopography distinctive from adjacent habitats. Soil at the Sheep Ridge occurrence had a very fine sandy loam grading to silt loam texture, while those at the Bannister Basin occurrence had a very fine sandy clay loam texture (P. Seronko, BLM soil scientist, pers. comm.).

The regional soil survey map was produced at a scale too large to distinguish the small outcrops with Packard's milkvetch. Most occurrences are located in soil units mapped as part of the Haw-Saralegui association, characterized by very gently sloping to steep, deep, well-drained loams and course sandy loams on hilly dissected terraces. Occurrences adjacent to the extensive barrens at Bannister Basin and Sulphur Gulch were mapped as the Terrace Escarpments unit, consisting of steep, somewhat even terrace fronts, and having variable texture and depth (Rasmussen1976).

Plant community and associated species: Packard's milkvetch was most often associated with an open Wyoming sagebrush community. Low cover of other medium-sized shrubs such as *Purshia tridentata* (antelope bitterbrush), *Chrysothamnus nauseosus* (gray rabbitbrush), and *Atriplex canescens* (four-wing saltbrush) were occasionally intermixed. These communities probably represent an undescribed, edaphic, sagebrush association. Although charred stems or other evidence was found at only one occurrence, past wildfires were the likely reason portions of several occurrences did not have sagebrush. In the absence of sagebrush the vegetation was characterized by unique assortments of plant species such as *Eriogonum strictum/Sitanion hystrix; Monardella odoratissima/Sitanion hystrix; Monardella odoratissima/Elymus cinereus/Lomatium dissectum; Monardella odoratissima/Agropyron spicatum/Lomatium dissectum;* and one place where Packard's milkvetch itself was the community dominant. There were several other locations where Packard's milkvetch was the most abundant herbaceous species. Bare ground cover at all occurrences was generally at least 90%. At unburned occurrences, Packard's milkvetch was never found in areas that had well developed sagebrush (e.g., *Artemisia tridentata wyomingensis/Agropyron spicatum* c.t.) or bunchgrass (e.g., *Festuca idahoensis-Agropyron spicatum* c.t.) communities.

Throughout the range of Packard's milkvetch there were raw, small to large exposures supporting an undescribed *Eriogonum ochrocephalum* var*. calcareum* (calcareous buckwheat) barrens c.t.

The white-colored substrate looked superficially suitable for Packard's milkvetch, but obviously posed conditions very few species have adapted to. I also noticed an interesting pattern regarding Packard's milkvetch and hermit milkvetch, a widespread species in the area. These two species appeared to be mutually exclusive of each other. Some of the small whitish-colored outcrops without Packard's milkvetch would have hermit milkvetch instead, especially in the Sheep Ridge area. In several other places hermit milkvetch was observed growing up to the edge, but never within a Packard's milkvetch site.

Herbaceous species cover was low at all occurrences, and it was not unusual to have all associated forb and graminoid species present in only trace amounts. *Sitanion hystrix* (squirreltail) and/or *Poa secunda* (Sandberg's bluegrass) tended to be the main bunchgrasses, but again, always at low cover. Associated low shrubs or forbs that I observed at two or more occurrences included *Asclepias cryptoceras* (pallid milkweed), *Chaenactis douglasii* (hoary chaenactis), *Cleome platycarpa* (golden spiderflower), *Eriophyllum lanatum* (wooly eriophyllum), *Epilobium paniculatum* (annual willow-herb), *Erysimum asperum* (rough wallflower), *Lomatium dissectum* (fern-leaved lomatium), and *Monardella odoratissima* (monardella). Other species that were relatively prominent at a single occurrence included basalt milkvetch, *Atriplex nuttallii* (saltsage), *Cirsium canovirens* (gray-green thistle), *Eriogonum strictum* (strict buckwheat), and *Machaeranthera canescens* (hoary aster).

With a couple of exceptions *Bromus tectorum* (cheatgrass) abundance was very low at all occurrences. This contrasted sharply with its dominance and high cover over much of the surrounding landscape. At most occurrences, cheatgrass grew thick right up to the edge of the distinct Packard's milkvetch outcrop. Other annual grass or weedy forb species do not seem to be adapted to Packard's milkvetch sites either. I observed only a few blades of *Bromus japonicus* (Japanese brome) and *Elymus caput-medusae* (medusahead wildrye) at one occurrence, and a trace of *Lepidium perfoliatum* (clasping peppergrass) at another.

Other rare species: *Eriogonum ochrocephalum* var. *calcareum* was the only other rare plant species I observed during my field investigation for Packard's milkvetch. It was locally common in the Bannister Basin and Sulphur Gulch areas, and smaller populations were scattered throughout the study area. It was restricted to raw Idaho Group sediments that had a very depauperate flora. Calcareous buckwheat was the community dominant on these edaphic barrens. Packard's milkvetch was never observed on these barrens. Calcareous buckwheat is an Idaho BLM Sensitive Plant Species.

Another BLM Sensitive Species known from the Weiser area is *Stanleya confertiflora*. Clay outcrops in the Dry Creek area, near Dry Creek Reservoir, contained habitat that looked suitable for this rare species, although it was not found. It may be worth returning to this area during a wetter spring to check again.

POPULATION BIOLOGY

Population size and condition: An occurrence is a data management unit based on biological information used to track elements of biodiversity by the Natural Heritage Program/ Conservation Data Center network. It is not necessarily equivalent to a "population", which can be difficult to determine in nature. Most occurrences of Packard's milkvetch consist of two or more discrete areas or colonies of plants in relatively close proximity to one another. They represent separate, suitable edaphic outcrops surrounded by areas of unsuitable habitat.

Packard's milkvetch is known from six occurrences. Five of these were discovered in 1999. They range in size from approximately 0.2 acre to 5 acres, with the number of plants ranging between about 100 and 1,500. Various size plants were observed at all occurrences. This probably indicates representation by a range of age classes and at least periodic recruitment. Packard's milkvetch density was usually low, similar to the pattern other herbaceous species showed on the

relatively harsh edaphic sites. It was the most common forb at several occurrences. Population information is summarized in Table 2.

I have assigned an Element Occurrence Rank (EO Rank) to each occurrence. The ranks provide a relative assessment of the likelihood an occurrence will persist under current prevailing conditions based on size, ecological condition, and landscape context factors. The ranks do not reflect measures dependent on uncertain predictions of the future such as potential threats, manageability, and restorability. EO Ranks for known extant occurrences can be either "A" (excellent estimated viability), "B" (good estimated viability), "C" (fair estimated viability), or "D" (poor estimated viability). Three (50%) Packard's milkvetch occurrences have been assigned an "A" rank because of their relatively large size and number of plants and good local-scale habitat quality. Because local-scale habitat conditions remain relatively intact, no occurrences were deemed to have deteriorated to the point of a "D" rank. This contrasts to the mostly poor ecological condition of the surrounding landscape at most occurrences. EO Ranks are also included in Table 2.

Table 2. Occurrence information and Element Occurrence Ranks for *Astragalus cusickii* var. *packardiae*.

EOR	Name	Size (ca acres)	# of Plants (1999 estimates)	# of Colonies	EO Rank
001	Bannister Basin	5	1500	1 large, 6 small	A
002	Bannister Basin North	2	200	2	B
003	Dry Creek	0.2	100-200	1	C
004	Dry Creek Tributary	4	1000-1500	5	A
005	Sulphur Gulch	3	600-1000	2	A
006	Sheep Ridge	0.2	80-100	3	C

Phenology: Seasonal weather patterns apparently influence the onset of flowering. During the unseasonable cool spring of 1999, flowering was delayed compared to the previous two years at the one occurrence with this kind of data. Late May seems to be the peak flowering period on average. Developing fruits and flowers typically occur on the same inflorescence. The seeds probably mature during June and early summer. Dehiscence usually occurs after the unopened pod is shed in Cusick's milkvetch, a related taxon (Barneby 1989). This is probably also the case for Packard's milkvetch.

Reproductive biology: No reproductive biology or related natural history research has been done for Packard's milkvetch. Specifics regarding seed dispersal, viability, dormancy, or germination requirements are unknown. This species reproduces by seed. Barneby (1989) reports 10-20 ovules/pod for Cusick's milkvetch. Packard's milkvetch seems similar to this based on the few pods I looked at. The seeds of some other desert astragali are known to retain their viability for thirty years or more (Barneby 1964), and many require scarification to break dormancy (Kaye 1999). I observed small bees visiting flowers at several occurrences, but no specifics concerning pollination are known. The genetic structure of populations is unknown. The limited distribution and rarity of Packard's milkvetch does not automatically mean it has low levels of genetic polymorphism (Karron et al. 1988). Quantitative population data are also missing, but often important for conservation assessment purposes (Elzinga et al. 1998).

Biological interactions: Unknown.

Competition: Packard's milkvetch does not occur in areas with zonal soils and well developed vegetation. Its limitation to small areas with special edaphic conditions indicates it may be a poor competitor. These conditions exclude most other species, and the relatively few species that can establish tend to be well-spaced. Weedy species were important competitors at other habitats in the general area, but even they were minimal at all occurrences. Many species of *Astragalus* are

adapted to resource-poor, low competition habitats and absent from nearby resource-rich, high competition environments (Liston 1997). Packard's milkvetch certainly seems to fit this profile.

Herbivory: Domestic livestock grazing is the predominant land use within the range of Packard's milkvetch. I observed cattle grazing Packard's milkvetch plants at one occurrence and found plants that were very likely grazed by sheep at another. Both inflorescences and herbage were grazed. I estimated less than 50% of above-ground plant biomass was removed from most plants that were grazed. Although relatively little forage was available at the occurrences, something attracted the livestock. Cattle selectively grazed the large and numerous fern-leaved lomatium inflorescences, and/or bunchgrasses such as *Elymus cinereus* (basin wildrye) and *Agropyron spicatum* (bluebunch wheatgrass) at several colonies in the Bannister Basin area. Herbivory on the Packard's milkvetch was likely opportunistic. Sheep herbivory north of Bannister Basin also appeared opportunistic, as only readily accessible plants near the ridgeline were grazed. Livestock grazing occurred at the other four occurrences in the past, but I did not see any evidence of recent (1999) use. I did not observe predation by insects.

It is unknown if livestock herbivory has any adverse effects on the population dynamics of Packard's milkvetch. The congener *Astragalus scaphoides* (bitterroot milkvetch) is a long-lived perennial endemic to a small area of east-central Idaho and adjacent Montana subject to fairly intense livestock predation. In spite of pre-dispersal fecundity losses from factors such as inflorescence predation by livestock, populations can persist and even grow larger (Lesica 1995). On the other hand, preliminary research in eastern Oregon found cattle grazing significantly reduced seed production for the rare species *Astragalus mulfordiae* (Mulford's milkvetch). This occurred in areas seeded with crested wheatgrass (*Agropyron cristatum*), and the increased grazing pressure on Mulford's milkvetch plants may have been the result of cattle being attracted to the seedings (Pyke 1996).

LAND OWNERSHIP AND THREATS

Land ownership: Occurrences were located on BLM, Idaho Department of Lands, and private lands. BLM lands are managed by the Lower Snake River District's Cascade Resource Area. Private land occurs within 0.2 mile of all occurrences except Sheep Ridge (006). The Sheep Ridge occurrence is about 0.8 mile from the closest private land. Ownership is summarized in Table 3.

Table 3. Ownership for occurrences of *Astragalus cusickii* var. *packardiae*.

EOR	Name	Ownership
001	Bannister Basin	BLM land; one colony may extend onto nearby private land
002	Bannister Basin North	All or most of one colony occurs on BLM land; a second colony is all or mostly on private land
003	Dry Creek	BLM
004	Dry Creek Tributary	One colony on BLM land and three on nearby private land
005	Sulphur Gulch	State land
006	Sheep Ridge	State land

Land use and threats: Livestock grazing is the predominant land use within upland habitats regardless of land ownership. Irrigated farmland covers most of the surrounding bottomlands along Big Willow Creek, Little Willow Creek, and Dry Creek. Packard's milkvetch occurrences were part of a vegetation mosaic dominated by early seral annual grassland vegetation. Significant improvements to the condition of these annual grasslands may not be possible due to the shortened fire-return interval and depleted ecosystem resilience now in place (Shaw et al. 1999). Unburned areas in better ecological condition were a minority component of the vegetation

mosaic. Maintaining the higher seral status of these unburned areas will be a challenge for local land management agencies. The openness of the relatively sparsely vegetated Packard's milkvetch outcrops makes them less prone to burn. However, occurrences with open shrub vegetation are vulnerable to wildfire, at least under certain conditions.

The long-term persistence of Packard's milkvetch is probably most threatened by incremental habitat degradation from wildfires and livestock grazing. Increased weed invasion is one form of degradation that would be detrimental to an apparently poor competitor like Packard's milkvetch. Edaphic factors have apparently kept the invasion of weedy annual grasses and forbs to a minimum. Are there disturbance thresholds that can tip this balance? Several notorious perennial weedy forb species loom on the horizon. Rush skeletonweed (*Chondrilla junceae*) was fairly widespread, but not yet abundant within the range of Packard's milkvetch. I did not see any leafy spurge (*Euphorbia esula*), but it has been increasing in the nearby Weiser area. It is probably just a matter of time before one or more of these or other noxious weeds become more common in the Big Willow Creek/Dry Creek area. What will be the consequences if they are better adapted to Packard's milkvetch sites?

Livestock directly affects Packard's milkvetch when plants are grazed. It is unknown if current grazing levels or patterns are detrimental to the species' long-term conservation. Other than livestock grazing activities, the general Big Willow Creek/Dry Creek area appears to receive little use. Hunting season probably brings the largest seasonal pulse of recreational activity. I did not notice off-highway motorized vehicle (OHMV) use at any of the occurrences. The western half of Packard's milkvetch range falls within the Weiser Quicksilver Mining District boundaries. However, there has been little if any record of metallic mineral production in Payette County (Savage 1961). The odd geologic exposures in Bannister Basin and Sulphur Gulch may be large enough for a mining operation if the material was ever found to have economic value. I did not come across any mining claim markers during my field investigation. Threats for each occurrence are summarized below.

Bannister Basin (001) – Cattle grazed Packard's milkvetch plants at nearly all colonies in 1999. They also contributed to local ground disturbance and erosion problems. Wildfire has impacted most colonies and annual grassland vegetation surrounds the occurrence. A massive landslide some time in the past destroyed part of one colony (see photo 6 in Appendix 2). I do not know if the post-fire replacement of native shrub-steppe by annual grassland vegetation contributed to this event.

Bannister Basin North (002) – A network of livestock/(game?) trails criss-cross the steep slopes at this occurrence. Sheep at one colony grazed a few Packard's milkvetch plants. Soil movement caused by sheep traversing across this same colony was exposing the roots of some smaller sagebrush shrubs.

Dry Creek (003) – The steep exposure appears prone to slumping and is surrounded by annual grassland vegetation.

Dry Creek Tributary (004) – A livestock trail traverses across part of one colony, but there was no evidence of recent use near any of the colonies. Most colonies burned in the past and annual grassland vegetation dominates the surrounding area. Cheatgrass cover was relatively high at one colony.

Sulphur Gulch (005) – One colony has a livestock/game trail cutting across it, but livestock use appeared minimal in 1999. There is a partially overgrown two-track tread along the low ridge near this same colony. It probably gets periodic use to check on livestock in the general area.

Sheep Ridge (006) – There is a jeep trail along the crest of Sheep Ridge, but I did not see any OHMV use near this occurrence. One colony has evidence of wildfire and annual grassland

vegetation was common in the general area. There was no evidence of recent livestock use within this occurrence.

ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

Conservation assessment: Packard's milkvetch is known from six occurrences with a rangewide distribution covering less than 15 square miles. Based on the geographic range, habitat specificity, and population size criteria circumscribing Rabinowitz's et al. (1986) seven forms of rarity, it falls into the rarest category. Taxa in this category often have limited conservation options. No matter how one looks at it, Packard's milkvetch is one of the rarest members of Idaho's flora.

Wildfire and/or livestock grazing have affected several occurrences, but baseline data are unavailable to reliably assess the effects of these disturbances. I suspect several edaphic localities have been adversely affected and may account for the absence of Packard's milkvetch at some places with suitable-looking habitat and the paucity of plants at others. On the other hand, these disturbances have probably not resulted in any appreciable range contraction or wholesale loss of potential habitat despite their pervasiveness in the general area.

All occurrences are located at least partly on BLM or State land, and livestock grazing will likely remain the predominant regional land use. Habitat destruction due to urban or commercial development, mining, roads, or other activities seems unlikely for the foreseeable future. From a landscape perspective, the distinctive edaphic habitats supporting Packard's milkvetch take on the appearance of small "islands" of native vegetation surrounded by a sea of annual grasslands. Up to now, these specialized habitats have been more or less resistant to weed invasion or other obvious signs of degradation. As long as these habitats remains intact, the long-term conservation prospects for Packard's milkvetch appear favorable. The big conservation question mark is whether or not this resistance can be maintained over the long-term.

It is not uncommon for the uniqueness of truly narrow endemics to extend to the community level (Kruckeberg and Rabinowitz 1985). The undescribed edaphic Wyoming sagebrush community typifying Packard's milkvetch habitat is a case in point. The conservation of Packard's milkvetch and its habitat will confer a level of conservation to associated biota as well.

Recommendations:

1. Packard's milkvetch should be added to the Idaho BLM's Sensitive Species plant list. The conservation of occurrences on BLM land should be a priority for the agency. In this context, the BLM should evaluate current allotment management plans to minimize livestock disturbances at Packard's milkvetch occurrences. The Bannister Basin (001) and Bannister Basin North (002) occurrences are the two most in need of such an evaluation.

2. I was unable to survey several areas on BLM and State land known or suspected to contain habitat suitable for Packard's milkvetch. These areas were listed earlier in the report (page 6) and should be inventoried as time allows. BLM field personnel should be made aware of known occurrences and the potential for discovering additional sites within the Cascade Resource Area.

3. I recommend initiation of a monitoring program for this species. Conservation questions related to livestock grazing, weed invasion, and other habitat disturbances should be part of the program. A small-scale demography study would also be helpful for conservation purposes.

4. I recommend the BLM consider the extensive terrace escarpment in Bannister Basin (T9N R22 Section 32 NE4) for ACEC designation. It supports a large Packard's milkvetch colony, as well as a population of calcareous buckwheat. The outstanding geology of this area also supports several interesting edaphic plant communities. The opposing steep, east-facing slope should also be considered because of its large, intact, native grassland habitat.

5. Maintaining the higher seral status of unburned areas within the range of Packard's milkvetch should be a priority for local land management agencies. Management that promotes the conservation of the area's remaining shrub-steppe vegetation will be necessary for any future restoration/rehabilitation efforts. It will also benefit a wide diversity of plant and animal species in the area.

6. I recommend the BLM discuss Packard's milkvetch and the two occurrences on State land with the Idaho Department of Lands. Conservation measures such as evaluation of livestock management activities and monitoring will likely be more efficient and comprehensive if coordinated between the BLM and State.

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Appendix 1

Illustration of *Astragalus cusickii* var. *packardiae*.
(by Nancy Brossman)

Appendix 2

Photographs of *Astragalus cusickii* var. *packardiae* and its habitat.

Appendix 3

Occurrence maps for *Astragalus cusickii* var. *packardiae*.

Appendix 4

Element Occurrence Records for *Astragalus cusickii* var. *packardiae*.

Appendix 5

Descriptions and maps of areas surveyed for *Astragalus cusickii* var. *packardiae*.

Areas surveyed for Packard's milkvetch in 1999.

North of Bannister Basin area (Map 1) – Scattered, local outcrops of suitable-looking Packard's milkvetch habitat were searched in the upper Sheep Gulch, upper Road Gulch, and Dry Creek road areas. Only outcrops without Packard's milkvetch are shown on Map 1. I was surprised not to find this species on at least a few of these outcrops, especially those in upper Road Gulch. Outcrops in this general area with colonies of Packard's milkvetch make up the Bannister Basin (001) and North of Bannister Basin (002) occurrences (see Appendix 3). This area is a mosaic of burned and unburned habitats.

Dry Creek area (Map 2) – Potential Packard's milkvetch habitat becomes scarce east of the Dry Creek Tributary (004) occurrence. I surveyed a large, mostly roadless area north of Dry Creek about 2-3 miles north of French Corner. Potential Packard's milkvetch habitat was widely scattered in this area as basalt geology begins to dominate the landscape. Map 2 shows the location of the largest outcrops. None of the outcrops had the "classic" Packard's milkvetch look, so its absence was not too much of a surprise. The clay outcrop shown in Section 27 SE4 appeared to be good *Stanleya confertiflora* habitat except for its southerly exposure. The nearby colorful, badland-like clay knolls adjacent to Dry Creek Reservoir (not shown on topographic map) in Section 27 SE4SE4 would also be worth looking at. I was unable to directly survey this area because the only access I could find was through private land. The clay knolls around the outcrop shown in Section 26 NW4 (near Point 2741) may also be worth re-checking for *Stanleya confertiflora* during a wetter year. No suitable-looking habitat was observed looking north to Hog Cove Butte, further up Dry Creek, or between Dry Creek and Sulphur Gulch. Annual grassland vegetation covers most of the area west of Dry Creek, in contrast to the unburned habitat east of the creek.

Map 2 also delineates the area I directly surveyed in the Sulphur Gulch area. This area contains the largest exposure of the raw, altered, Idaho Group sediments in the study area. Large segments were dominated by *Eriogonum ochrocephalum* var. *calcareum* barrens, habitat unsuitable for Packard's milkvetch. From several vantage points I did not see any additional Packard's milkvetch habitat to the north or northeast of Sulphur Gulch.

Bissel Creek area (Map 3) – Aerial photographs revealed a series of small, light-colored outcrops west of Bissel Creek, centered in T8N R2W Section 25 N2, and extending into portions of adjacent sections. These turned out to be sandy sites with open antelope bitterbrush and a sparse herbaceous layer. This was not suitable habitat for Packard's milkvetch. I did not see any other potential habitat in the general area from good vantage positions atop Bissel Triangulation Point and elsewhere along my route.

Sheep Ridge area (Map 4) – No suitable Packard's milkvetch habitat was observed along the western terminus of Sheep Ridge. Scattered, small outcrops of potential habitat occur below the ridge, along the steep upper and middle slopes descending to Sheep Gulch. The outcrops begin near Point 3974 in T8N R3W Section 3 NE4NE4, and extend in a northeasterly direction for about 2 miles to near Point 3093 in T9N R3W Section 36. A small area southeast of Sheep Springs in T8N R3W Section 31 NW4 was also searched. I did not see any potential habitat along the opposing slopes south of Sheep Gulch from vantage points along Sheep Ridge and the Sheep Gulch road. No potential habitat was observed between Big Willow Creek and Little Willow Creek while driving the Stone Quarry Gulch road either. Most of the Stone Quarry Gulch, Sheep Ridge, and Sheep Gulch areas were a sea of annual grassland vegetation. However, several steep slopes descending from Sheep Ridge to Sheep Gulch supported high quality shrub-steppe or bunchgrass plant communities.

Wet Gulch and Lower Holland Gulch (Map 5) – These were the two most northerly areas I surveyed. Aerial photographs were the basis for investigating these outlying areas. The outcrop in Wet Gulch had several plants indicative of potential Packard's milkvetch habitat, including *Monardella odoratissima*. There may be small areas of additional potential habitat in Wet Gulch,

but I did not see any. Annual grassland habitat was less common than shrub-steppe in this general area. The interesting outcrops near Point 2967 overlooking Little Willow Creek were more cemented than the typical Packard's milkvetch site. A lot of this area burned in the past and was dominated by annual grassland vegetation.