

**A REVIEW OF *ASTRAGALUS MULFORDIAE* (MULFORD'S MILKVETCH) IN IDAHO,
AND RESULTS OF FIELD INVESTIGATIONS
IN THE OWYHEE FRONT AND BOISE FOOTHILLS**

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ABSTRACT

Astragalus mulfordiae (Mulford's milkvetch) is a low, slender, spring-flowering perennial forb in the legume family. It is endemic to the western Snake River Plain in southwestern Idaho and adjacent eastern Oregon, and populations tend to be local and have low numbers of plants. Conservation threats include habitat destruction associated with urbanization, and habitat degradation, especially weed invasion, from wildfires, livestock grazing, off-highway-motorized vehicles, and other activities. The combination of its limited distribution, usually small-sized populations, and vulnerability to ongoing threats, has kept Mulford's milkvetch a high priority conservation concern in both Idaho and Oregon for many years.

The most vulnerable populations of Mulford's milkvetch are located in the Boise Foothills. Because the U.S. Fish and Wildlife Service recently initiated a Status Review for this species, updated information was needed for these populations. Towards this end, the USFWS contracted the Idaho Department of Fish and Game's Conservation Data Center to review the status of Mulford's milkvetch in the Boise Foothills. Updated abundance, habitat, and threat information was collected during field visits to nearly all of the occurrences in the foothills. The CDC conducted another field investigation for Mulford's milkvetch in the Owyhee Front area (Owyhee County) as part of a Challenge Cost-share agreement with the Bureau of Land Management. Two new occurrences of this BLM Sensitive Species were discovered during the investigation. In addition to results for the Boise Foothills and Owyhee Front projects, this report presents an overview of conservation information for Mulford's milkvetch in Idaho, along with information about its biology.

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INTRODUCTION

Astragalus mulfordiae (Mulford's milkvetch) is a low, slender, spring-flowering perennial forb in the legume family. It is endemic to the western Snake River Plain in southwestern Idaho and adjacent eastern Oregon, with populations tending to be local and having low numbers of plants. Several populations are known to be extirpated, and others reduced in size and/or quality. The main long-term conservation threats include habitat destruction due to urbanization, and habitat degradation, especially weed invasion, from wildfires, livestock grazing, mining, off-highway-motorized vehicles (OHMV), and non-motorized recreational activities. The combination of a limited distribution, usually small population size, and vulnerability to ongoing threats, has kept Mulford's milkvetch a high priority conservation concern in both Idaho and Oregon for many years.

There are 34 extant Mulford's milkvetch occurrences known for Idaho, the majority located fully or partly on private land. The most vulnerable occurrences are located in the Boise Foothills. The last systematic evaluation for most foothill populations was during field visits in 1989 (Moseley 1989), or 1992 (Moseley et al. 1992). Because the U.S. Fish and Wildlife Service (USFWS) recently initiated a Status Review for this species (U.S. Fish and Wildlife Service 1998), updated information was needed for these populations. In 1999, the USFWS provided funding to the Idaho Department of Fish and Game's Conservation Data Center (CDC) to revisit and update the status of Mulford's milkvetch occurrences in the Boise Foothills

In the Owyhee County portion of its range, nearly all occurrences of Mulford's milkvetch are on Bureau of Land Management (BLM) land. The BLM has conducted extensive field surveys for Mulford's milkvetch along the Owyhee Front in the past, but inventory gaps inevitably exist within such a large landscape. In 1998, the BLM identified portions of the Battle Creek and Castle Creek allotments, centered south of Grand View, as needing further field investigation. The Lower Snake River District of the BLM and the CDC entered into a Challenge Cost-share agreement to conduct this field investigation. The purpose of the investigation was to help the BLM with their ongoing conservation efforts on behalf of Mulford's milkvetch by gaining a more comprehensive understanding of its distribution, abundance, and threats within the study area.

The first part of this report summarizes general, rangewide biological and conservation information regarding Mulford's milkvetch. It then reviews the conservation of Idaho occurrences in greater detail. The last sections focus on results from my 1999 field investigations in the Owyhee Front and Boise Foothill areas.

ASTRAGALUS MULFORDIAE (MULFORD'S MILKVETCH)

Distribution

Mulford's milkvetch is endemic to the western Snake River plain in southwestern Idaho, and adjacent eastern Oregon, an area approximately 100 miles by 100 miles in extent. This area is within the Owyhee Uplands section of the Columbia Plateau physiographic province (McNab and Avers 1994). Within the Idaho portion of its range, Mulford's milkvetch occurs in three distinct geographic areas – the Boise Foothills, the Owyhee Front, and the Weiser area (Figure 1). Its distribution in the Boise area extends in an arc approximately seven miles long along the lower foothills. Around the Owyhee Front south of the Snake River there are widely scattered occurrences extending along about a 40 mile transect, from near the towns of Bruneau in the east, to Murphy in the west. Occurrences east and southeast of Weiser are distributed within an area approximately nine miles long by seven miles wide. These include the largest occurrences known in Idaho.

In Oregon, the distribution of Mulford's milkvetch encompasses three separate population centers in the northeastern portion of Malheur County. Thirty-one occurrences have been documented for Figure 1. Distribution map for *Astragalus mulfordiae*

these three areas (S. Vrilakas, Oregon Natural Heritage Program, pers. comm.). The South Alkali metapopulation north of the Malheur River contains the northernmost occurrences in the state. The Adrian metapopulation is located east of the Owyhee River, south and southwest of the town of Adrian. It contains the southernmost group of occurrences. Between these two areas lies the North Harper metapopulation. It is located south of Vale between the Owyhee and Malheur rivers. All documented occurrences in Oregon are located on BLM land, and overall are considered secure (Bureau of Land Management 1998; J. Findley, BLM Vale District botanist, pers. comm.).

Conservation Status

National

U.S. Fish and Wildlife Service: Mulford's milkvetch was a federal candidate species under the Endangered Species Act prior to 1996, but currently has no official federal conservation status. The U.S. Fish and Wildlife Service's Snake River Basin Office maintains a Species of Concern list that includes Mulford's milkvetch.

Bureau of Land Management: It is on the BLM's Sensitive Plant Species lists for both Idaho and Oregon.

Idaho

Idaho Native Plant Society: Mulford's milkvetch is in the INPS Global Priority 2 category (Idaho Native Plant Society 1999).

Conservation Data Center: Because of the small size of most populations and their vulnerability to threats, Mulford's milkvetch has a state conservation rank of S2 (Conservation Data Center 1999).

Oregon

Oregon Department of Agriculture: Mulford's milkvetch is listed as an Endangered Species under Oregon's Endangered Species Act (Oregon Natural Heritage Program 1999).

Oregon Natural Heritage Program: It is considered critically imperiled with a state conservation rank of S1 in Oregon. (Oregon Natural Heritage Program 1999).

Conservation History

The formal recognition of Mulford's milkvetch as a conservation concern has more than a 20 year history. A chronology is summarized below.

1975 Mulford's milkvetch was recommended for federal Threatened status in the original Endangered and Threatened Plant list generated by the federal government in 1975 (Federal Register, July 1, 1975). This list was based largely on recommendations made by participants of a workshop held at the Smithsonian Institution in September, 1974.

1977 A cadre of Idaho botanists published their evaluations of all the Idaho plants earlier proposed for Threatened or Endangered status by the federal government. Because Mulford's milkvetch was known from so few sites, it was recommended the proposed federal status be changed from Threatened to Endangered (Packard 1977).

1980 A later re-evaluation by Packard (1981) recommended federal Threatened status.

1980 In his status report for the U.S. Fish and Wildlife Service, Kennison (1980) stated "available information indicates that the taxon is highly or critically endangered."

1980 Mulford's milkvetch gets listed as a USFWS Category 1 taxon (U.S. Fish and Wildlife Service 1980). This category included taxa with sufficient information to support the biological appropriateness of listing as Endangered or Threatened under the Endangered Species Act.

1983 The federal status of Mulford's milkvetch was changed to USFWS Category 2, a category for taxa needing more information to decide the appropriateness of listing as an Endangered or Threatened species (U.S. Fish and Wildlife Service 1983).

1989 In his conservation status report for Idaho, Moseley (1989) recommends Mulford's milkvetch remain a federal Category 2 candidate until the conservation status of Oregon populations can be determined.

1992 At the eighth annual Idaho Rare Plant Conference the INPS went on record supporting the federal listing of Mulford's milkvetch (Idaho Native Plant Society 1992).

1993 A proposed Rule to list Mulford's milkvetch as an Endangered Species was prepared by the USFWS (U.S. Fish and Wildlife Service 1993). The Rule never progressed beyond the draft stage.

1995 The Oregon Department of Agriculture lists Mulford's milkvetch as Endangered in Oregon under the state's Endangered Species Law. Reasons include its rarity and existing and potential threats.

1995 A Habitat Conservation Assessment for Mulford's milkvetch was prepared as part of the statewide Idaho Conservation Effort (U.S. Fish and Wildlife Service 1995). This document updates and reviews distribution, habitat, population biology, threat, and other information about the species. The Idaho Conservation Effort stalled and a Conservation Strategy for the species was not written.

1996 Mulford's milkvetch was removed from federal candidate status because of poor documentation of threats and the existence of stable populations (U.S. Fish and Wildlife Service 1996a).

1996 The INPS recommended adding Mulford's milkvetch to the USFWS Candidate list at the twelfth annual Idaho Rare Plant Conference (Idaho Native Plant Society 1996).

1998 The USFWS begins a status review process for Mulford's milkvetch and two other rare plant species occurring in southwestern Idaho (U.S. Fish and Wildlife Service 1998). The purpose of the review is to determine if any of the taxa warrant candidate status.

Conservation Agreements

Over the years, two Conservation Agreements have been implemented on behalf of Mulford's milkvetch. One has expired, and one is still active. In addition, an Agreement between the USFWS and the Boise District BLM was written but never finalized.

1992 A Conservation Agreement for Mulford's milkvetch was signed by the Vale District, BLM and the USFWS (U.S. Fish and Wildlife Service 1992). The purpose of the agreement was to protect and ensure the conservation of Mulford's milkvetch and its habitat on BLM land in the Vale Oregon District. The duration of the agreement was for five years. It was not renewed after the expiration date.

1996 A Conservation Agreement for Mulford's milkvetch, Aase's onion (*Allium aseae*), and slickspot peppergrass (*Lepidium papilliferum*) in the Halls Gulch Reserve of the Boise Foothills was signed by the City of Boise and the USFWS (U.S. Fish and Wildlife Service 1996b). The main objective of the agreement is to ensure the conservation of the three species. The duration of the Conservation Agreement is for 10 years.

Habitat

Mulford's milkvetch habitat is characterized by loose, sandy substrates derived from lacustrine and alluvial sediments, and includes unconsolidated sands, decomposed sandstone, and oolitic limestone. It occurs predominantly on southerly to west-facing aspects. Slopes vary from gentle to more often moderately or very steep. In many cases these slopes are prone to relatively high rates of erosion. Populations are often associated with shrub-steppe communities dominated by *Purshia tridentata* that represent late to early seral versions of the *Purshia tridentata/Stipa comata* (antelope bitterbrush/needle-and-thread grass) habitat type. In Owyhee County, Mulford's milkvetch is more often associated with an open mix of desert shrub species such as *Atriplex canescens* (fourwing saltbrush), *Tetradymia* species (horsebrush), and *Chrysothamnus nauseosus* (gray rabbitbrush). Commonly associated species include *Artemisia tridentata* (big sagebrush), *Aristida longiseta* (red threeawn), *Oryzopsis hymenoides* (Indian ricegrass), *Agropyron spicatum* (bluebunch wheatgrass), *Brodiaea douglasii* (Douglas' brodiaea), *Leptodactylon pungens* (prickly phlox), *Chaenactis douglasii* (hoary chaenactis), *Macharanthera canescens* (hoary aster), and *Oenothera pallida* (pale evening primrose). Introduced species such as *Bromus tectorum* (cheatgrass) and *Erodium cicutarium* (storksbill) are also common associates. In Oregon, *Chrysothamnus viscidiflorus* (green rabbitbrush), *Balsamorhiza sagittata* (arrowleaf balsamroot), and *Penstemon acuminatus* (sand dune penstemon) are nearly constant associates. Populations occur between about 2,200 and 3,600 feet elevation. Additional habitat information is provided in Moseley (1989).

Mulford's milkvetch sandy habitat supports other rare plant species in several places. At a few occurrences in the Boise Foothills, Mulford's milkvetch is sympatric with *Allium aaseae* (Aase's onion), another regional endemic and longtime conservation concern in Idaho. Small populations of the federal candidate *Lepidium papilliferum* (slickspot peppergrass) are located in close proximity to two Mulford's milkvetch occurrences in the foothills. *Hackelia cronquistii* (Cronquist's stickseed) is another rare, regionally endemic plant species that has been documented from two of the Oregon metapopulation areas as well as a Mulford's milkvetch occurrence near Weiser.

Autecology

Research regarding the life history and ecology of Mulford's milkvetch is limited, with some information based more on casual observations than empirical data. Mulford's milkvetch is a perennial, but preliminary research and recent observations indicate plants may be relatively short-lived and that population numbers can fluctuate substantially over time (BLM 1998; Pyke 1996; J. Findley, BLM botanist, pers. comm.). Short-term data at study plots in Oregon indicate an annual population turnover rate of about 10% (Pyke 1996; J. Findley, BLM Vale District botanist, pers. comm.). Although maybe short-lived on average, there are individual large, multi-branched plants that appear to get relatively old.

Plants generally begin their regrowth in early to mid- March, with peak flowering in April and May, and sometimes extending into June. Fruits mature during late spring to the middle of summer. Plants can remain green throughout the summer, or they may begin to senesce shortly after the fruits mature. Mulford's milkvetch reproduces strictly by seed that is likely dispersed by gravity and wind. Seed viability and longevity are not known. However, the recovery of a population in Oregon after years of dwindling plant numbers highlights the importance of the seed bank (J. Findley, BLM Vale District botanist, pers. comm.). Demographic research has also found seedling survival rates to vary (Pyke 1996). It is common to find various size plants at larger populations, including seedlings. This suggests larger populations are typically represented by multiple age classes. Various flying insects have been observed visiting flowers, but specifics concerning pollination remain unknown.

Threats

The main long-term conservation threats in Idaho include habitat destruction due to urbanization, and habitat degradation, especially weed invasion, from wildfires, livestock grazing, mining (sand and oolite), off-highway motorized vehicles, and non-motorized recreational activities. The imminence and severity of these threats varies. For example, habitat loss due to urban development is limited to the Boise Foothills area, while habitat degradation from OHMV's is most acute in the Owyhee Front. From a historical perspective, the most widespread modification of Mulford's milkvetch habitat was from livestock grazing.

In more recent years the most widespread threat is probably habitat degradation from wildfires. It is a threat that knows no protection status or land ownership boundaries. More specific information concerning threats in Idaho is provided in the next section of the report.

In Oregon, identified threats include weed invasion, OHMV use, road maintenance, livestock grazing, and crested wheatgrass seedings. The most serious invasive weeds are Scotch thistle (*Onopordum acanthium*) which has established at all three metapopulations, and *Chondrilla juncea* (rush skeletonweed) in the South Alkali and North Harper areas. Although not yet a serious threat, OHMV use has increased at all three metapopulations in recent years. It is probably only a matter of time before some colonies are more directly affected, particularly at North Harper and South Alkali. Road construction projects have destroyed plants at each of the metapopulations within the past decade. Poor communications between different agencies contributed to the inadvertent blading of plants in several cases. All Oregon occurrences are within active grazing allotments, and threats associated with livestock activities occur at portions of all metapopulations, especially North Harper. During the 1960's, large areas of the BLM's Vale District were seeded to *Agropyron cristatum* (crested wheatgrass) as part of a major rangeland restoration project. This project impacted Mulford's milkvetch habitat at the North Harper and Adrian population centers. Portions of the South Alkali population center were seeded to crested wheatgrass following a wildfire in 1986, before Mulford's milkvetch was known from the area. Several colonies within the North Harper metapopulation were sprayed with herbicide in the early 1970's, but this activity is probably not much of a threat anymore (Bureau of Land Management 1998).

Three threat factors routinely considered by the USFWS also play a role in the conservation of Mulford's milkvetch.

1) Disease and predation: It is apparently common for Mulford's milkvetch plants to be seasonally infected by *Uromyces punctatus* (Owen et al. 1994). This is a rust that commonly infects species of *Astragalus* and *Oxytropis*. It is unknown if the rust adversely affects plant viability in any way. I have observed aphids feeding on Mulford's milkvetch plants, but not evidence of more than minor plant damage.

Grasshoppers, rabbits, and small rodents have been implicated as herbivores on Mulford's milkvetch, but no lasting adverse effects have been demonstrated. Cattle have also been observed grazing Mulford's milkvetch. Preliminary monitoring data from a grazing study found a significant reduction in seed production in an area seeded with crested wheatgrass versus one not seeded. However, this may have been due to cattle being attracted to the seeded area and causing higher grazing pressure on Mulford's milkvetch plants. The increased grazing pressure in the seeded area may also have influenced the higher survival of adults in the unseeded area (Pyke 1996).

2) Overutilization: There is no evidence of any use of Mulford's milkvetch for commercial, recreational, scientific, or educational purposes.

3) Inadequacy of existing regulatory mechanisms: There are no regulatory mechanisms to protect the many Idaho populations that occur on private land. On federal lands, the BLM confers special management consideration for Mulford's milkvetch because of its Sensitive Species status.

Field Inventory History

Mulford's milkvetch was first collected in "Boise City, Idaho", in 1892, by A. Isabel Mulford. Prior to the 1970's this species was known from only a handful of additional collections, all from southwestern Idaho. Collections and observations were made by Bob Steele and Barbara Ertter in the foothills around Boise during the 1970's. Field surveys by BLM, College of Idaho, and CDC personnel in the 1980's resulted in the discovery of several new populations in the Weiser, Bruneau, and Boise Foothill areas (Moseley 1989). Survey work in Idaho intensified in the 1990's, led by BLM botanists. In Oregon, Mulford's milkvetch was known from only a single historical collection made near Adrian, until 1988, when additional discoveries were made. The BLM has been responsible for most of the recent field inventories in Oregon as well. A summary of systematic field inventories in the two states is given below.

1989 The CDC revisited known and historical Mulford's milkvetch sites, and searched for new populations throughout the species' Idaho range as part of a conservation status report project for the USFWS (Moseley 1989).

1991 The CDC, INPS, and Friends of Military Reserve mapped the distribution and abundance of rare plant species within Military Park Reserve in the Boise Foothills.

1991 INPS, Golden Eagle Audubon, and the Wetlands Coalition mapped the distribution and abundance of rare plant species in lower Hulls Gulch, Boise.

1991 The CDC and INPS mapped the distribution and abundance of rare plant species within Boise's Camel's Back Reserve.

1992 Boise City Planning and Zoning contracted the CDC for rare plant inventories in the Boise Foothills. Several new occurrences of Mulford's milkvetch were discovered (Moseley et al. 1992).

1993 Surveys were conducted for the BLM at the Rebecca Sand Hill Research Natural Area and other selected sites in the Weiser area (Smithman 1993).

1994-1996 The BLM conducted a series of large-scale field inventories covering approximately 53,000 acres across the Owyhee Front. A few new occurrences of Mulford's milkvetch were found during these surveys (Beisel and Elmore 1994; Carroll et al. 1995; A. DeBolt, BLM Boise District botanist, pers. comm.)

1995 A field survey covering about 5,000 acres was conducted for the BLM in the Weiser and Payette areas. It resulted in the discovery of new occurrences and substantial additions to some that were previously known (Lichthardt 1995).

1997 Approximately 11,000 acres in the Horse Hill area south of Bruneau, Owyhee County, were surveyed by the BLM (Narad et al. 1997). One new occurrence was discovered.

1997-1998 The BLM conducted field inventories covering about 2,000 acres south of Grand View, Owyhee County, around Poison Creek, Birch Creek, Little Valley, and other selected areas. The occurrence near Mud Flat Oolite RNA was found to be more extensive than previously known.

1999 The CDC revisited and updated information for Mulford's milkvetch occurrences in the Boise Foothills using funds provided by the USFWS.

1999 The CDC conducted a field inventory for the BLM at selected sites between Oreana and C.J. Strike Reservoir in Owyhee County. Two new occurrences were discovered.

Monitoring

Monitoring for this species has been limited in Idaho. The Boise District BLM visits selected occurrences on a regular basis, but no formal monitoring program has been established. Plant counts have been conducted at a few sites, but in most cases only general habitat assessments made (A. DeBolt, BLM Boise District botanist, pers. comm.). In 1999, a monitoring program was established at Camel's Back Reserve as a cooperative project between the Boise Parks and Recreation Department and the CDC (Mancuso 1999). Census data, and estimates of weed and ground disturbance attributes were measured at three transects. This protocol was initiated as a hopeful first step towards a more comprehensive monitoring program within the Reserve system. The Vale District BLM has monitoring transects at several occurrences in Oregon, where demographic studies have also been conducted (Pyke 1996).

IDAHO OCCURRENCES

General Information

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 biological “population”, which can be difficult to determine in nature. The three-digit code for each occurrence record corresponds to the reference number in the CDC database. In the case of Mulford’s milkvetch, some occurrences consist of one local cluster of plants, however, most are comprised of two or more discrete clusters, or colonies, in relatively close proximity to one another. These multiple colonies tend to be distributed along a ridge or series of connecting slopes. Commonly, unoccupied suitable-looking habitat separates these colonies.

There are 34 extant and four extirpated occurrences of Mulford’s milkvetch known for Idaho (Tables 1 and 2). Extant occurrences range in size from a few square meters to greater than 100 acres, and from less than 10, to approximately 10,000 individuals. Based on the most recent estimates for each occurrence, the total Idaho population is approximately 21,500 plants - about 3,000 (14%) in the Boise Foothills, 2,000 (9%) in the Owyhee Front, and 16,500 (77%) in the Weiser area population centers. Occurrences in the Weiser area have an order of magnitude more plants than many occurrences from elsewhere in the state. With an estimated 10,000 individuals, the Trail’s Sand Hill occurrence (003) alone accounts for nearly half (47%) of all Mulford’s milkvetch plants known in Idaho. Most occurrences in the Boise Foothills are relatively small, but the extensive Middle Stewart Gulch occurrence (018) contains at least 1,000 plants. This is about one-third (33%) the entire foothills metapopulation. By comparison, plant numbers in the Owyhee Front area are relatively evenly distributed between the nine occurrences.

Total acreage for all occurrences in Idaho is approximately 640 acres – about 230 acres (36%) in the Boise Foothills, 60 acres (9%) in the Owyhee Front, and 350 acres (55%) in the Weiser area. Figure 2 shows patterns in the distribution and size of occurrences. Specific location, size, habitat, ownership, and other information for individual occurrences are contained in the appropriate Element Occurrence Record (Appendix 1).

I have assigned an Element Occurrence Rank (EO Rank) to each occurrence. EO Ranks are a conservation planning tool that provide a relative assessment of the likelihood an occurrence will persist under current prevailing conditions. They are based on current measures of size (e.g., area occupied, number of plants), condition (e.g., species composition and structure, disturbance), and landscape context (e.g., fragmentation, condition of surrounding landscape) factors. The ranks do not reflect factors dependent on uncertain predictions of the future, such as potential threats, manageability, and restorability. EO Ranks for extant occurrences can be either “A” (excellent estimated viability); “B” (good estimated viability); “C” (fair estimated viability); or “D” (poor estimated viability). Seven occurrences (21%) have an “A” rank, 12 (35%) a “B” rank, 8 (24%) a “C” rank, and seven (21%) a “D” rank. For occurrences in the Boise Foothills, seven (35%) have a “D” rank, but only one (5%) has an “A” rank. Seven of the nine (78%) Owyhee Front occurrences have an “A” or “B” rank, and in the Weiser area they all do. EO Ranks are listed in Table 3.

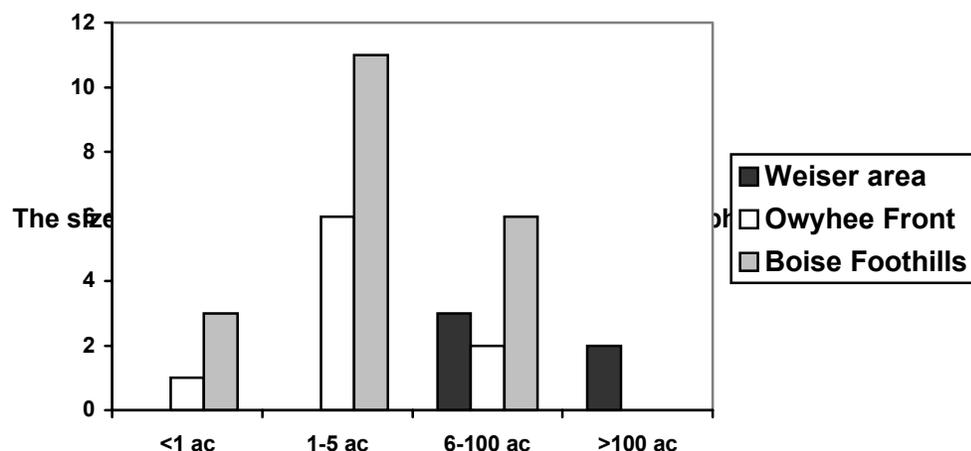
Table 1. Summary of extant Mulford’s milkvetch occurrences in Idaho.

EOR	Site name	Ownership	Size (acres)	Plant # (year)	Last Observed
	Boise Foothills				
700	Lower Powderhouse Gulch	Boise City	2	ca 60 (1999)	1999
701	Military Reserve, Veterans Ridge	Boise City	2	ca 125 (1999)	1999
702	Crestline Drive Trail	Private	15	ca 235 (1999)	1999
703	Resseguie Street Alcove	Private	0.1	13 (1999)	1999
704	Powderhouse Gulch	Private	1	1 (1999)	1999
705	Military Reserve, Cemetery Ridge East	Boise City	3	10 (1999)	1999
706	Military Reserve, Cemetery	Boise City;	2	10 (1999)	1999

	Ridge West	Private			
707	Crestline Drive	Private	0.2	2 (1999)	1999
708	Lower Hulls Gulch	Boise City; Private	10	ca 100 (1999)	1999
709	Hulls Ridge Development	Private	10	15 (1999)	1999
710	Hulls Gulch Tributary	Private	3	30 (1999)	1999
711	Hackberry Divide	Private	5	ca 100 (1999)	1999
712	Winsome Road	Private	3	ca 120 (1999)	1999
713	Clubview Drive	Private	3	ca 160 (1999)	1999
714	Horse	Private	20	ca 450 (1992)	1992
715	Camel's Back Reserve	Boise City	50	ca 260 (1999)	1999
716	Sherman Street Alcove	Private	0.2	17 (1999)	1999
717	Crane Gulch	Private	3	ca 225 (1999)	1999
015	Seaman Gulch	Ada Co.; Private	2	66 (1999)	1999
018	Middle Stewart Gulch	Private; BLM	100	ca 1000 (1999)	1999
	Owyhee Front				
002	Upper Sugar Valley	BLM	1	ca 115 (1997)	1997
004	Horse Hill	BLM	0.1	ca 40 (1997)	1997
005	Little Valley East	BLM	1+	ca 140 (1996&7)	1997
009	Shoofly Creek/Mud Flat Rd.	BLM; Private	4+	ca 400 (1997&8)	1999
010	Lower Vinson Wash	BLM	2	ca 500 (1999)	1999
011	Twentymile Gulch	BLM	30	ca 300 (1999)	1999
013	Con Shea Basin	BLM	5	250-400 (1997)	1998
014	Noble Island	BLM	11	ca 100 (1997)	1998
017	Castle Creek	Private	5	100-200 (1993)	1996
	Weiser area				
003	Trail's Sand Hill	Private	47+	ca 10,000 (1996)	1996
008	Rebecca Sand Hill	BLM; Private	100+	ca 1,800 (1993)	1999
012	Cherry Gulch NE	BLM	100+	>1,000 (1996)	1996
016	Sagebrush Hill	BLM; Private	80	2,000-3,000 (1995)	1999
020	Sand Hollow	BLM	6+	600-1,100 (1995)	1995

Table 2. Summary of extirpated Mulford's milkvetch occurrences in Idaho.

EOR	Site name	Ownership	Last observed
006	Grand View SE	Private	1946
007	Grand View NW	Private	1938
019	Somerset Ridge	Private	1989
021	Hemingway Butte	BLM and/or Private	1979



size (acres)

Table 3. EO Ranks for extant Mulford's milkvetch occurrences in Idaho.

EOR	Site name	EO Rank	Rationale
	Boise Foothills		
700	Lower Powderhouse Gulch	C	Marginal condition; <100 plants; urban landscape
701	Military Reserve, Veterans Ridge	C	Marginal condition; >100 plants; urban landscape
702	Crestline Drive Trail	B	Variable condition; >200 plants; urban border
703	Resseguie Street Alcove	D	Small area and number of plants; urban landscape
704	Powderhouse Gulch	D	Marginal condition; few plants; urban landscape
705	Military Reserve, Cemetery Ridge East	D	Degraded condition in places; few plants; urban area
706	Military Reserve, Cemetery Ridge West	D	Marginal condition; few plants; urban landscape
707	Crestline Drive	D	Small area and number of plants; urban landscape
708	Lower Hulls Gulch	B	OK condition; >100 plants; urban landscape
709	Hulls Ridge Development	C	Marginal condition; <20 plants; urban landscape
710	Hulls Gulch Tributary	D	Poor condition; <50 plants; urban border
711	Hackberry Divide	B	OK condition; >100 plants; mostly undeveloped
712	Winsome Road	C	OK condition in part; >100 plants; urban landscape
713	Clubview Drive	C	Variable condition; >100 plants; urban landscape
714	Horse	B	Condition probably OK; >300 plants; undeveloped
715	Camel's Back Reserve	B	Variable condition; >200 plants; urban landscape
716	Sherman Street Alcove	D	Small area and number of plants; urban landscape
717	Crane Gulch	B	Good condition; >200 plants; mostly undeveloped
015	Seaman Gulch	C	Variable condition; <100 plants; undeveloped
018	Middle Stewart Gulch	A	Good condition; large population; undeveloped
	Owyhee Front		
002	Upper Sugar Valley	B	OK condition; >100 plants; undevel. landscape
004	Horse Hill	C	OK condition; small population; undevel. landscape
005	Little Valley East	B	Good condition; >100 plants; undevel. landscape
009	Shoofly Creek/Mud Flat Rd.	B	Mostly good condition; >300 plants; undeveloped
010	Lower Vinson Wash	A	Good condition; >400 plants; undevelop. landscape
011	Twentymile Gulch	A	Good condition; large area; >300 plants; undevelop.
013	Con Shea Basin	B	Variable condition; >300 plants; undevelop. landscape
014	Noble Island	C	Variable condition; >100 plants; undevelop. landscape
017	Castle Creek	B	OK condition; >100 plants; mostly undeveloped
	Weiser area		
003	Trail's Sand Hill	A	Good condition; large area; >10,000 plants; undevel.
008	Rebecca Sand Hill	A	Mostly good condition; large area; >1500 plants; undevelop. landscape
012	Cherry Gulch NE	A	OK condition; large area; >1000 plants; undevelop.

016	Sagebrush Hill	A	OK condition; large area; >2000 plants; undevelop.
020	Sand Hollow	B	Variable condition; >1000 plants; undeveloped

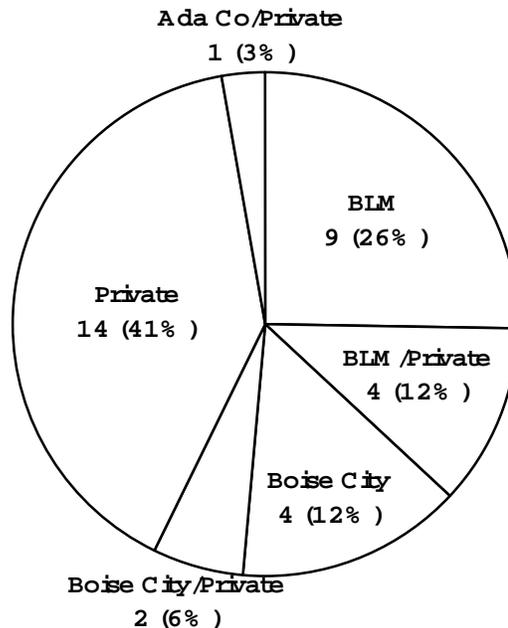
Land Ownership

Land ownership for Mulford’s milkvetch in Idaho includes the BLM, Boise City, Ada County, and private property. A majority of the 34 extant occurrences are located fully or partly on private land (Figure 3). However, the pattern of land ownership varies between the three Idaho distribution centers (Table 4). Most occurrences in the Boise area are on private property, or to a lesser extent on lands administered by the Boise Parks and Recreation Department. Those in Owyhee County and the Weiser area occur mostly on BLM land or a mix of BLM and private land.

Table 4. Land ownership for Mulford’s Milkvetch in Idaho by geographic area. Number of occurrences (%).

	Private	Boise City	Boise/Private	BLM	BLM/Private	Ada Co./Private
Boise Foothills	12 (60%)	4 (20%)	2 (10%)	---	1 (5%)	1 (5%)
Owyhee Front	1 (11%)	---	---	7 (78%)	1 (11%)	---
Weiser area	1 (20%)	---	---	2 (40%)	2 (40%)	---

Figure 3.
Land ownership for extant Mulford's milkvetch occurrences in Idaho.



Threats

Threats are based on observations made during the last visit to an occurrence. Activities adversely affecting the viability of an occurrence are listed as existing threats. Potential threats consider activities that were not a problem at levels observed during the last visit, but judged to have the potential to become a threat. Habitat degradation is the most common manifestation of these threat activities. Threats at occurrences in the Owyhee Front and Weiser area are summarized in Table 5, while threats in the Boise Foothills are detailed in a later section of this report. Statewide threat information patterns are shown in Figures 4 and 5.

Table 5. Summary of existing and potential threats at Mulford's milkvetch occurrences in the Owyhee Front and Weiser areas.

EOR	Site Name	Existing threats	Potential threats
	Owyhee Front		
002	Upper Sugar Valley	None	OHMV use poses a threat if it increases substantially over current levels
004	Horse Hill	OHMV use is increasing in area	Further increases in OHMV use; increases in livestock grazing
005	Little Valley East	OHMV use	Increases in OHMV use; livestock grazing impacts
009	Shoofly Creek/Mud Flat Road	Construction of 1400 acre enclosure fence in 1999 to alleviate habitat degradation from livestock and OHMV uses.	Trespass OHMV use; trampling and grazing by trespass livestock; oolite mining
010	Lower Vinson Wash	None	Increased OHMV and/or livestock use on slopes above the wash
011	Twentymile Gulch	Sand quarrying	Increase in OHMV use; increase in livestock use; sand quarry expansion
013	Con Shea Basin	OHMV use; horseback riding; high cheatgrass cover	Increases in OHMV use; expansion of horse trail network
014	Noble Island	Long-term viability of portions of occurrence in doubt due to OHMV impacts	Increases in OHMV use
017	Castle Creek	None	Oolite and sandstone mining
	Weiser area		
003	Trail's Sand Hill	None	Increases in livestock grazing
008	Rebecca Sand Hill	Weed invasion	Increased weed invasion
012	Cherry Gulch NE	Weed invasion	Increased weed invasion; resumption of livestock grazing
016	Sagebrush Hill	Livestock grazing	Weed invasion; OHMV use; increase in livestock grazing use
020	Sand Hollow	Weed invasion; livestock trampling and associated habitat degradation	Increased weed invasion

Figure 4.
Existing threats at Mulford's milkvetch occurrences in Idaho.

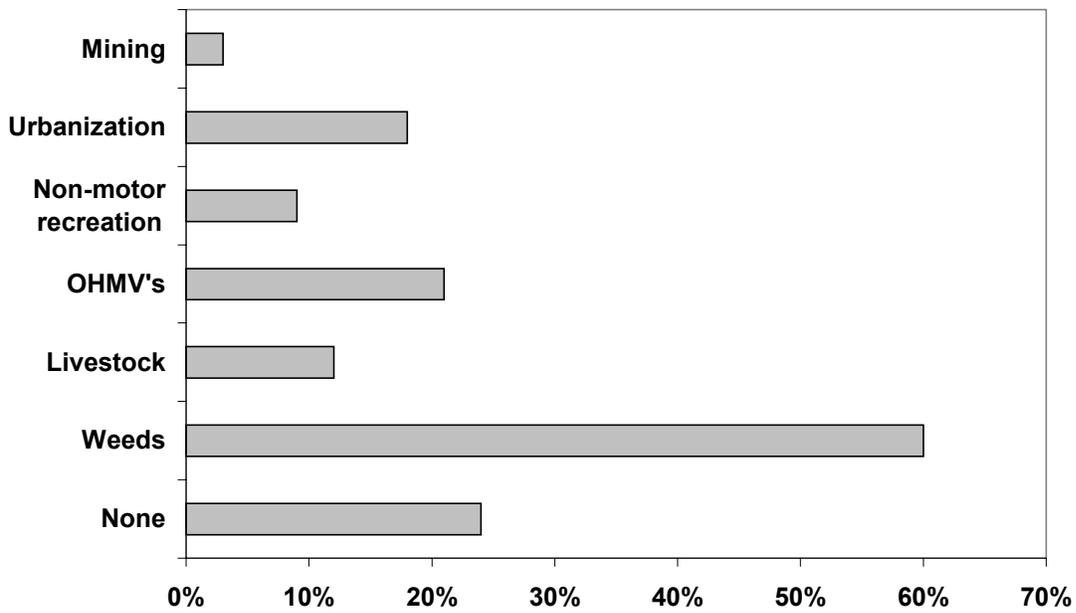
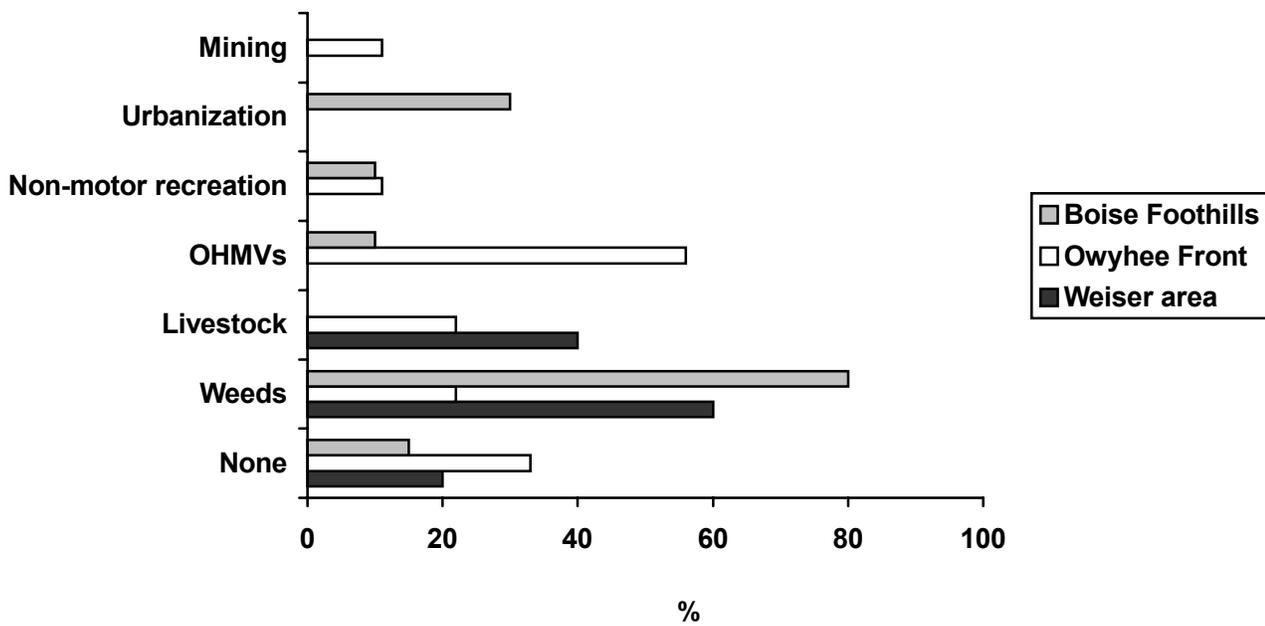


Figure 5.
Existing threats at Mulford's milkvetch occurrences in Idaho by geographic area.



OWYHEE FRONT FIELD INVESTIGATION

Methods

The BLM has conducted extensive field surveys for Mulford's milkvetch and other Sensitive plant species along the Owyhee Front, but inventory gaps inevitably exist within such a large landscape. In 1998, the BLM identified portions of the Battle Creek and Castle Creek allotments, centered south of Grand View in Owyhee County, as an area with potential Mulford's milkvetch habitat in need of further field investigation. In 1999, the Lower Snake River District of the BLM and the CDC entered into a Challenge Cost-share agreement to conduct this field investigation. The purpose of the investigation was to help the BLM with their ongoing conservation efforts on behalf of Mulford's milkvetch by gaining a more comprehensive understanding of its distribution, abundance, and threats within the study area.

The project study area extended from Castle Creek, west of Oreana, southeastward to the C.J. Strike Reservoir area about five miles northwest from Bruneau, in Owyhee County (Figure 6). Within this large area, surveys concentrated on BLM land south of Grand View because of the relatively large amount of potential habitat, much of it in good ecological condition. A total of approximately 2,900 acres were directly surveyed. Miles of additional habitat were assessed while travelling in the study area. Areas searched included portions of Birch Creek, Browns Creek, Castle Creek, C.J. Strike Reservoir, Halfway Gulch, Poison Gulch, Twentymile Gulch, and Vinson Wash. Descriptions for the areas searched, acreages, and associated maps are in Appendix 2. Field surveys were conducted between May 24 and June 10, 1999. Known occurrences in Owyhee County, the Weiser area, or Oregon, were not revisited as part of this investigation.

Results

Two new Mulford's milkvetch occurrences were discovered during the field investigation. One of these was along lower Vinson Wash about three miles southwest of Grand View, the other about seven miles south of Grand View along a one mile segment of Twentymile Gulch. Both were located on land managed by the BLM's Bruneau Field Office. They are summarized below. More detailed information can be found in the appropriate Occurrence Record (Appendix 1). Location maps for the new occurrences are also provided (Appendix 3).

Lower Vinson Wash (010)

This occurrence consists of two colonies supporting an estimated 500 plants over two acres. An open mix of *Chrysothamnus nauseosus*, *C. viscidiflorus*, *Atriplex canescens*, *Tetradymia glabrata*, and *Artemisia tridentata wyomingensis* characterized the desert shrub vegetation. *Stipa comata* and *Oryzopsis hymenoides* dominated the herbaceous layer. The sand bed geology was mapped as part of the Miocene to Pliocene age Idaho Group Sediments (Jenks et al. 1999). Small exposures of this sandy habitat were scattered along both sides of lower Vinson Wash, but Mulford's milkvetch was not found anywhere else in the area. A two-track dirt road bisects one of the colonies. OHMV and livestock use both appeared to be light. The occurrence may be susceptible to wildfire as it was near the perimeter of an old burn and an area now dominated by cheatgrass.

Twentymile Gulch (011)

This occurrence consists of a series of small colonies scattered along a one mile segment on both sides of the gulch and supporting a total of at least 300 plants. The open vegetation was similar to lower Vinson Gulch, except for greater associated forb diversity. The majority of plants occurred along the brow and upper slope positions. None were found within the wash. The extensive sandy habitat was mapped as Vegetated dune sand, a Holocene to Pleistocene age sedimentary unit derived from nearby sand beds (Jenks et al. 1999). Mulford's milkvetch was largely confined to

Figure 6 Map of Owyhee Front study area

areas of loose sand. It was rarely seen in areas of crusty to cemented sand, or where gravels dominated the surface. There was a lot of unsuitable-looking habitat in the general area. Vehicle tracks were common in the wash bottom, but only a few motorcycle tracks were observed cutting up the slopes. One of these tracks was near a small cluster of Mulford's milkvetch. Part of the occurrence was located close to a large sand quarry pit. Construction of the quarry undoubtedly destroyed some Mulford's milkvetch habitat. It was unclear if the quarry was still active. Livestock use was observed mainly along the wash bottoms or nearby uplands. Only light use was observed across the sandy slopes.

Discussion

Potential habitat for Mulford's milkvetch was identified by the surficial presence of sand, sandstone, or oolitic substrate. In the study area, inclusions of potential habitat were intermixed within large expanses of unsuitable habitat characterized by more clayey and silty soils, or gravelly surfaces. The sandy habitats suitable for Mulford's milkvetch contrasted with the prevailing vegetation in several ways, including (1) lower shrub cover; (2) little if any sagebrush (*Artemisia* species) cover; (3) less *Agropyron spicatum* (bluebunch wheatgrass), and more *Stipa comata* and *Oryzopsis hymenoides*; (4) a different suite of forbs adapted to loose, sandy substrates such as *Arenaria franklinii*; (5) little if any cryptogamic crust cover; and (6) higher amounts of bare ground, in this case loose sand.

The scattered patches of potential habitat were usually less than 100 acres in size, ranging from small outcrops of less than an acre, to exposures over one mile long. Mulford's milkvetch was found at only a fraction of the suitable-appearing habitat surveyed in the study area, a pattern consistent with other surveys done throughout the species' range. Many of the areas where I did not find Mulford's milkvetch during this field survey appeared to have identical habitat characteristics as the sites at Twentymile Gulch and Vinson Wash. It was hard for me to believe it was not present at some of these other sites. OHMV disturbances appeared to be minor or absent at all of the areas I looked at, while evidence of livestock grazing intensity varied from none to moderate.

The vegetated sand dune geology of Jenks et al. (1998) was widespread in the study area, but many exposures were too small to be mapped separately by them. Many of the sandy exposures I surveyed were mapped as part of gravel surfaces/lenses or Idaho Group Sediments units. Even with this scale limitation, the geology map can be used to identify other areas with potential Mulford's milkvetch habitat on BLM land. A few areas that may warrant further investigation include:

- 1) Approximately 0.5 mile northeast of Hinton Reservoir, about five miles southeast of Grand View, in T6S R4E Section 7. Portions of a relatively large block mapped as "Vegetated dune sand" occurs on BLM land.
- 2) Approximately one mile south of Hinton Reservoir, about six miles southeast of Grand View, in T6S R3E Section 13. A smaller area mapped as "Vegetated dune sand" occurs partly on BLM land.
- 3) Several small pockets of "Vegetated dune sand" geology have been mapped near Twentymile Gulch, about a mile northwest of occurrence 011, in T6S R3E Section 30. It would also be worth revisiting the extensive sandy outcrops above Twentymile Gulch, further south in Section 31, and adjacent R2 Section 36. This area has more suitable-looking habitat than I was able to survey.
- 4) Some large blocks of "Vegetated dune sand" geology have been mapped between Little Valley and Horse Hill. This segment of the Owyhee Front was outside the study area of this investigation.

BOISE FOOTHILLS FIELD INVESTIGATION

Methods

There are 20 extant occurrences of Mulford's milkvetch in the Boise Foothills. The series of eighteen occurrences between Military Reserve Park on the southeast, and Bogus Basin Road on the northwest are referenced as the Boise Foothills Metapopulation in the CDC database. Relatively small distances separate these occurrences from one another. The metapopulation occurrences use code numbers in the "700's" for database management purposes.

I was able to revisit all but one of the known Mulford's milkvetch occurrences in the Foothills in 1999. The "Horse" (714) occurrence was not revisited due to a lack of access. Access restrictions or other reasons also prevented me from visiting portions of a few other occurrences. During these revisits I updated population number, size, habitat, threat, and other occurrence information. GPS coordinates were obtained at each occurrence, and in many cases for each colony within the occurrence.

Results

In the foothills, Mulford's milkvetch occurrences range in size from less than 10, to over 1,000 individuals. Some foothills occurrences consist of a single cluster of plants, while others have two or more clusters in relatively close proximity to one another. These multiple clusters or colonies are usually distributed along a ridge or series of connecting slopes. The numbers of plants I counted or estimated in 1999 are listed in Table 6, along with estimates from previous years. In 1999, eight (40%) occurrences had less than 50 plants, seven (35%) had 50-200 plants, four (20%) had 200-500 plants, and one (5%) had more than 500 plants. Ten (53%) occurrences contained roughly the same number of plants in 1999 compared to the early 1990's, 7 (37%) occurrences showed a substantial decrease, and two (10%) a substantial increase. Only portions of some occurrences were visited in 1999. This limitation should be kept in mind when making year to year comparisons. Mulford's milkvetch is a difficult species to look for when not flowering, and 1999 was a mediocre flowering year rangewide. This means my plant number estimates may be conservative, especially for the large occurrences. A descriptive summary focusing on updated habitat and threat information for each Foothills occurrence follows.

Lower Powderhouse Gulch (700)

The mostly herbaceous vegetation was dominated by *Stipa comata*, *Oryzopsis hymenoides*, and *Bromus tectorum*, with scattered *Purshia tridentata* and *Chrysothamnus nauseosus* shrubs. *Chondrilla juncea* and *Centaurea cyanus* (blue bachelor buttons) were widespread in the general area, including several scattered dense patches. These two weeds have increased dramatically the past few years. The small, scattered clumps or individuals of Mulford's milkvetch were nearly all restricted to relatively weed-free openings. Only a few plants were found on the flats along either side of the erosion gully, and overall, only 30% as many as in 1991. A portion of the occurrence continues to be threatened by enlargement of an erosion gully caused by runoff diverted from the road further upslope. A large storm event could widen and deepen the gully that looked the same in 1999, as previous years.

Military Reserve, Veterans Ridge (701)

This occurrence was comprised of a series of small colonies covering a couple of acres. The area burned in 1987, and only scattered *Purshia tridentata* and *Chrysothamnus nauseosus* shrubs remain. *Stipa comata* or *Aristida longiseta* dominated the vegetation, with *Bromus tectorum* filling in most of the spaces between the bunchgrasses. Both *Chondrilla juncea* and *Centaurea cyanus* were well established in the area. Much of the occurrence has high weed cover and overall habitat quality in

Table 6. Chronology of population estimates for Mulford's milkvetch in the Boise Foothills.

EOR	Site name	Number of plants
700	Lower Powderhouse Gulch	1985 – ca 125; 1989 – 38 1991 – ca 220; 1999 - ca 60
701	Military Reserve, Veterans Ridge	1991- ca 420 1999 – ca 125
702	Crestline Drive trail	1981 – local 1989 – ca 275; 2 colonies

		1992 – ca 600; 3 colonies with 50-400 plants each 1999 - ca 235; 3 colonies
703	Resseguie Street Alcove	1989 – 12 1999 – 13
704	Powderhouse Gulch	1980 – not common 1989 – 7 1999 – 1
705	Military Reserve, Cemetery Ridge East	1991 – 14; 3 colonies 1999 – 10; only 1 colony relocated
706	Military Reserve, Cemetery Ridge West	1991 – 16 1999 – 10
707	Crestline Drive	1989 – 6 1999 – 2
708	Lower Hulls Gulch	1991 – ca 1150; 3 colonies 1999 – ca 100
709	Hulls Ridge Development	1990 – ca 135; 3 colonies 1991 – 80; all of one colony and part of another were destroyed in the past 1999 – 15; one colony visited
710	Hulls Gulch tributary	1992 – ca 40 1999 – 30
711	Hackberry Divide	1988 – ca 40; 2 colonies 1992 – ca 280; 5 colonies 1999 – ca 100; 3 colonies revisited
712	Winsome Road	1992 – 25; 2 colonies 1999 – ca 120; 2 colonies
713	Clubview Drive	1986 – ca 12 1992 – ca 100 1999 – ca 160
714	Horse	1988 – 16 1992 – ca 450; 4 colonies 1999 – not revisited
715	Camel's Back Reserve	1989 – 47; west slope 1991 – ca 500; east slope 1992 – ca 1000; 7 colonies 1999 – ca 260; most of Reserve revisited
716	Sherman Street Alcove	1993 – 11 1999 – 17
717	Crane Gulch	1992 – ca 250; 3 colonies 1999 – ca 225; 2 colonies visited
015	Seaman Gulch	1992 – 60; 6 colonies 1999 – 71; most colonies were relocated
018	Middle Stewart Gulch	1985 – ca 500; 1 colony 1992 – ca 2000; 5 colonies 1999 – ca 1000; not all colonies revisited

the area has deteriorated in recent years. Approximately 30% as many Mulford's milkvetch plants were counted in 1999 compared to 1991. The westernmost colony contained at least 75% of these plants. This colony was in relatively good ecological condition, despite high *Bromus tectorum*. The general area is popular with hikers and mountain bicyclists that probably contribute to erosion problems along the trails that dissect the occurrence. There were recent motorcycle or OHMV tracks cutting across the slope near the easternmost colony of Mulford's milkvetch. This sort of illegal disturbance increases local erosion and weed establishment problems.

Crestline Drive trail (702)

All three colonies in the occurrence burned during the 1996 Eighth Street fire. This killed most of the *Purshia tridentata* in the area. *Aristida longiseta* and *Stipa comata* are still the main bunchgrasses, but *Bromus tectorum* is now locally abundant. Since the fire, *Chondrilla juncea* has become well established, although this weed was uncommon at the easternmost and largest of the Mulford's milkvetch colonies. Habitat degradation appears to be the worst at the westernmost colony. Mulford's milkvetch was very sparse in this area, and may be extirpated from former portions of the colony. Approximately 85% of the plants observed in 1999 were found at the easternmost colony, an area that also has a nice population of *Allium aaseae*. Overall, an estimated 60% fewer plants were counted in 1999 compared to 1992. Future urban development looms as a large potential threat for this occurrence. Recreational use was confined to trails and not impacting the population.

Resseguie Street alcove (703)

The number of plants at this small occurrence has remained about the same between 1989 and 1999. The vegetation was characterized by *Purshia tridentata* with a mix of *Aristida longiseta*, *Stipa comata*, and *Bromus tectorum*. The general area around the occurrence has a high cover of weeds, including *Chondrilla juncea* and *Centaurea cyanus*. Development remains a potential threat.

Powderhouse Gulch (704)

This occurrence was never known to have much Mulford's milkvetch, and only one plant was found in 1999. The most notable change to the vegetation in recent years has been the dramatic increase of *Chondrilla juncea* and *Centaurea cyanus*. *Bromus tectorum* and *Secale cereale* were also common within the open *Purshia tridentata* community. Part of the occurrence area burned in the past and the gully at the head of the gulch appears prone to erosion. Development and related impacts remain a potential threat. A new house under construction along the ridge above the occurrence was not disturbing habitat further downslope.

Military Reserve, Cemetery Ridge East (705)

This occurrence in Military Reserve Park was comprised of three colonies. I was unable to find Mulford's milkvetch at the two colonies along the alluvial flat and toeslope positions. These areas burned in 1987, and are now very weedy. *Chondrilla juncea* has invaded this part of the occurrence, and *Centaurea cyanus* also appears to be increasing rapidly. The establishment of *Cardaria draba* (hoary whitetop) along the Mountain Cove roadway has the potential to spread to the occurrence area and exacerbate habitat degradation problems. High quality habitat remains further upslope at the third colony. A small group of Mulford's milkvetch plants persists there.

Military Reserve, Cemetery Ridge West (706)

Most of this area also burned in 1987, and has become very weedy, including the invasion of *Chondrilla juncea* in recent years. At this time it supports an open *Purshia tridentata*/*Bromus tectorum* community. I found ten Mulford's milkvetch plants in 1999, a few less than reported in 1991. This occurrence is mostly within Military Reserve Park, but a small segment extends onto adjacent private land. Recreational impacts appear to be minimal at the occurrence.

Crestline Drive (707)

This small occurrence is tucked between housing developments on private property owned by the local Homeowners Association that treat it as a "community commons". This offers the area some level of protection, but two building sites could conceivably be developed in the future. Children playing in the area have caused some local ground disturbances. *Chondrilla juncea* and *Cardaria draba* occur on nearby disturbed areas, but have not yet invaded the small Mulford's milkvetch site. I found only two plants in 1999, a few less than the original report ten years ago.

Lower Hulls Gulch (708)

Most of this occurrence is now within the Hulls Gulch/Camel's Back Reserve and protected from development. The vegetation is dominated by native shrubs and bunchgrasses, but with high cover of *Chrysothamnus nauseosus* across the alluvial flats, an area with little Mulford's milkvetch in 1999. My

survey covered most of the occurrence, but I was able to find only about 10% as many Mulford's milkvetch plants compared to the 1991 estimate. *Chondrilla juncea* was widespread, but not common except for some small, scattered patches.

Hulls Ridge Development (709)

This occurrence originally consisted of three colonies. All of one and part of another colony were destroyed in 1990 during a construction phase of the Hulls Ridge development. There has not been any direct habitat loss since 1990, but the remaining colonies remain vulnerable to future development. Due to access problems I revisited only the "middle" colony (partly destroyed in 1990) in 1999. Habitat quality in the area has decreased due to the invasion of *Chondrilla juncea* and *Centaurea cyanus*. Both were abundant in places, and extensive rodent piles were a common microsite for establishment of *C. juncea*. Approximately 20% as many Mulford's milkvetch plants were found at the colony compared to 1990. Most individuals were found in relatively weed-free spots.

Hulls Gulch tributary (710)

This occurrence burned during the 1996 Eighth Street fire, killing most of the *Purshia tridentata* in the area that now has scattered *Chrysothamnus nauseosus* shrubs and *Aristida longiseta* as the dominant bunchgrass. *Bromus tectorum* was abundant in 1999. There was also abundant *Chondrilla juncea*, with many plants established on the incredibly numerous pocket gopher piles dotting the slopes. Approximately the same amount of Mulford's milkvetch was counted in 1999 as before the fire. Mountain bicyclists and others use a nearby ridge trail, but do not venture onto the open slope with the milkvetch. Development remains a future threat.

Hackberry Divide (711)

This occurrence consists of at least four colonies. Another colony just above Crane Gulch was destroyed during construction by Crane Creek golf course. Additional housing was under construction in 1999, and if future development moves up the ridges, more Mulford's milkvetch could conceivably be lost. Good condition *Purshia tridentata* habitat dominated most segments of the occurrence. *Bromus tectorum* was locally abundant, but *Chondrilla juncea* was sparse. I did not relocate one colony reported to have about 100 Mulford's milkvetch plants in 1992, or have time to find another colony reported to have three plants. Of those I did find, one colony had about the same number of plants as past reports, and one had less. I also discovered one new colony with about 30 plants. A jeep trail bisects the occurrence, and although some off-road use occurs, it does not appear to be a problem at this time.

Winsome Road (712)

This occurrence consists of two colonies. The small colony near the LDS church is in a very disturbed area and probably not viable over the long-term. A larger colony is located behind and uphill from a row of houses along Bogus Basin Road. This location seems to protect Mulford's milkvetch from most disturbances and from direct future development. The large undeveloped area lying northwest of this colony will probably make a nice housing development someday. If this happens, at least part of the colony could be vulnerable from construction activities. A walking trail along the upper part of the colony presents no obvious problems at this time. The vegetation is dominated by *Oryzopsis hymenoides*, with lesser amounts of other bunchgrasses and a few scattered shrubs. *Chondrilla juncea* is rare in this area. I counted about 100 more Mulford's milkvetch plants than reported in 1992.

Clubview Drive (713)

The majority of Mulford's milkvetch at this occurrence was scattered across the very upper slopes, along and above a narrow sandstone exposure. Plants were also observed along and in the sandy track that follows the ridgecrest contour. Few plants were found along the middle slope positions, but small groups of plants occur at several toeslope locations, including one section that was illegally graded several years ago. I counted about 60% more Mulford's milkvetch than in 1992, probably due to a more thorough survey. Ecological condition of the *Purshia tridentata/Stipa comata* plant community was highest along the upper slopes, and the lower slope areas towards the eastern end of the occurrence. Most mid-slope sections had a high cover of *Bromus tectorum*. *Centaurea cyanus* was widespread and appears to be increasing. Most *Chondrilla juncea* was restricted to disturbed areas along the dirt road leading into the occurrence area.

The occurrence is located in the proposed Somerset II housing development. Toe and lower slope portions of the occurrence will likely be destroyed during construction phases. Future use around the new development may potentially impact portions further upslope and near the ridgecrest as well. The bulk of the occurrence can probably be saved if proactive precautions are taken. Mulford's milkvetch is not threatened by recreational activities associated with the dirt road along the bottom of the occurrence, or the sandy ridgecrest track.

Horse (714)

Lack of access prevented me from revisiting this occurrence. Development remains a potential threat for at least portions of the occurrence.

Camel's Back Reserve (715)

One of the largest Foothill populations occurs in Hulls Gulch/Camel's Back Reserve, on land managed by the Boise Parks and Recreation Department. Scattered colonies of Mulford's milkvetch occur along both the west and east faces of Camel's Back Reserve. Weed cover has increased in the Reserve in recent years, including a dramatic rise in *Centaurea cyanus* the past two years. *Chondrilla juncea* was also widespread and becoming more common. Approximately 75% less Mulford's milkvetch were counted in 1999, compared to 1992 estimates. Finding fewer plants on the east face accounts for most of this discrepancy.

Due to resource damage concerns, Parks and Recreation completed a series of erosion control projects at Camel's Back in 1999. Portions of the trail improvements, rerouting, and closings were located in places supporting Mulford's milkvetch. The erosion control measures were meant to benefit all of the Reserve's resources, including rare plants and their associated hillside and ridgetop habitat. Erosion and trampling threats along some segments of the trail system dissecting the population will likely persist because of the area's popularity. Beginning in 1999, pond sediments were dumped on the low hillside near the flood control pond immediately adjacent to an area with Mulford's milkvetch. This activity may potentially impact portions of the occurrence in the future. A program to monitor the effects of several of the erosion control projects on Mulford's milkvetch was established in 1999 (Mancuso 1999).

Sherman Street Alcove (716)

This occurrence consists of two small colonies. The one near the head of the alcove is undisturbed, while the colony closest to Sherman Street gets some neighborhood kid use. The alcove has apparently seen little change in recent years, except for the establishment of *Centaurea cyanus*, which is common, and *Chondrilla juncea*, which is relatively uncommon. Development remains a potential threat.

Crane Gulch (717)

I was able to revisit two of the three colonies comprising this occurrence. They had approximately the same number of Mulford's milkvetch plants as in 1992. This occurrence has some of the highest ecological condition *Purshia tridentata* habitat I observed during my field survey. In most places there was no more than 10% *Bromus tectorum* cover, and *Chondrilla juncea* was present in only trace amounts. Jeep trails pass through the occurrence, but only minor amounts of off-road use was noted. This is private land, so perhaps development should be considered a future threat.

Seaman Gulch (015)

This occurrence was comprised of scattered small colonies both east and west of Seaman Gulch. The colonies east of Seaman Gulch Road are on private land, while those west of the road are on land owned by the Ada County landfill. The habitat at all colonies east of the road appeared to be more or less the same as in 1992. More Mulford's milkvetch was counted at the small sand quarry colony than in 1992, despite the continued use of motorcycles in the area. I still consider motorcycle use a threat to this colony. I could not find any plants at the southeasternmost colony, and am unclear if I just missed them or there were none. The vegetation at this colony continues to recover from a pre-1992 fire. West of the road, the two small colonies near Point 2953 were similar to 1992, but the colony approximately 0.2 mile further north may be extirpated. Road building, slope remediation, and other earth-moving activities associated with landfill operations have taken place near the location of this colony. I did not survey this

area until October, too late in the year to be certain whether or not Mulford's milkvetch persists. This area will have to be visited in the spring to check the fate of this small colony. *Chondrilla juncea* was uncommon at a few colonies and absent from others. It was more common in the area disturbed by landfill activities.

Middle Stewart Gulch (018)

Only portions of this extensive occurrence were visited and likely accounts for the lower number of Mulford's milkvetch plants reported for 1999. The colonies I visited all looked healthy and the *Purshia tridentata*/bunchgrass communities in good ecological condition overall. Only a trace amount of *Chondrilla juncea* was observed. Deer and cattle churn the sandy slopes in places, and I did observe a few trampled Mulford's milkvetch plants. However, the present level of livestock grazing does not appear to be having any largescale adverse affects on this species or its habitat. A single motorcycle track was observed crossing through the upper part of the easternmost colony. Motorcycle activity may be a threat at colonies in the western part of the occurrence due to their location near the Little Owyhee Motorcycle Park. I was unable to verify this, however. The Stewart Gulch area was one of five proposed conservation sites for rare plants in the Boise Foothills (Moseley 1996). It was evaluated as the least disturbed and most defensible of the proposed sites. This is still the premier Mulford's milkvetch occurrence in the Boise Foothills.

Discussion

The first documented extirpation of a Mulford's milkvetch occurrence in the Boise foothills was in 1990, during construction of the Somerset Ridge subdivision. Beginning a century ago, earlier phases of urban development in the Boise Foothills contributed to the local extirpation of an unknown number of other populations. This incremental population and habitat loss has left Mulford's milkvetch in a precarious conservation position today throughout the Boise Foothills portion of its range.

Urban development is the most serious threat Mulford's milkvetch faces in the Boise area because it irrevocably destroys habitat. Some of the ongoing and planned developments in the foothills will undoubtedly result in additional extirpations over time. For example, in Fall 1999, the city of Boise approved another phase of development near Somerset Ridge that will destroy portions of another Mulford's milkvetch occurrence (713). Habitat degradation from fires and other instigators of weed invasion continues to be a widespread problem in the foothills, and threatens Mulford's milkvetch by reducing population vigor and probably making recolonization of what was once suitable habitat more difficult. Two weeds in particular grabbed my attention during revisits to occurrences in 1999. *Chondrilla juncea* is a perennial noxious weed that has just exploded in the Boise Foothills the past five years. *Centaurea cyanus* is an annual exotic that has recently invaded the foothills. It has many of the attributes to be a problematic weed in Mulford's milkvetch open shrubland habitat. The spread of *Chondrilla juncea* has been particularly rapid into recently burned areas. It was also establishing on the abundant pocket gopher piles present in 1999, even in occurrences with unburned, good quality habitat.

The one-two punch of habitat destruction and degradation has resulted in a diminished amount and increased fragmentation of high quality Mulford's milkvetch habitat in the foothills. These factors, along with the small size of many occurrences makes their long-term viability questionable. Another factor to consider is land ownership. Most of the lower foothills are privately owned and further limits conservation options in the area.

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Appendix 1

Occurrence Records for *Astragalus mulfordiae* in Idaho.

Appendix 2

Maps and descriptions for areas investigated during 1999 field surveys in the Owyhee Front.

Appendix 3

Map locations for *Astragalus mulfordiae* occurrences discovered in the Owyhee Front in 1999.

Descriptions for areas surveyed during field investigations for Mulford's milkvetch along the Owyhee Front.

Browns Creek area (Map 1) – Potentially suitable Mulford's milkvetch habitat was very minimal in the low hills south of Oreana, an area dominated by desert shrub vegetation. No large exposures of sand were found. I did search approximately 80 acres in an area near Browns Creek, about three miles south of Oreana. It had several plant species indicative of sandy soils, such as *Stipa comata*, *Oryzopsis hymenoides*, and *Penstemon acuminatus*.

Castle Creek area (Maps 2 and 3) - I surveyed several exposures of high quality, suitable-appearing habitat west of the Mulford's milkvetch occurrence at Castle Creek (016). Much to my surprise none contained Mulford's milkvetch. The sand and oolite exposure along the south-facing slope of a small ravine (T5S R1E Sections 18, 19) supported an open mix of shrubs with *Stipa comata* and *Oryzopsis hymenoides* adjacent to a large, late-seral stand of the two grasses. At least some of the colored sands in this area seemed to be derived from an old corral reef. Less than a 0.5 mile further east (T5S R1E Sec 17 SW4) I searched a beautiful, sparsely vegetated, and extensive oolite outcrop. The eastern end of this outcrop was being mined and claim markers in the area indicated the operation has the potential to expand. About one mile further north, a low ridge of sand dune vegetation perched atop a sandstone shelf (T5S R1E Sec 8) appeared to be excellent potential habitat. Smaller areas along the road system were also looked at. All these exposures of potential Mulford's milkvetch habitat occur as inclusions within the area's dominant gravelly soils and desert shrub vegetation. A total of about 80 acres were directly surveyed in the Castle Creek area.

Birch Creek area (Maps 4) – I was able to drive about 1.2 miles down and 1.0 mile up the Birch Creek wash from the Poison Creek Cutoff Road. No suitable habitat for Mulford's milkvetch was found along these reaches. Sandy habitats were not found in the upper Garbutt Wash (Cloudburst Wash) area either. An extensive sand lens just west of the Cutoff Road (T5S R1E Sections 22, 23, 26, 27) looked like excellent Mulford's milkvetch habitat. The sandy exposures in the vicinity of Birch triangulation point were too gravelly or crusty to be considered good Mulford's milkvetch habitat in most places. About 400 acres were directly surveyed in the Birch Creek area. I did not search south of the Birch triangulation point area as no suitable-looking habitat was seen from this vantage point.

Twentymile Gulch area (Maps 5, 11, and 14) – Potential habitat for Mulford's milkvetch began a little east of the sand quarry pits located in T6S R3E Section 21. Mulford's milkvetch was discovered along this segment of Twentymile Gulch, but a lot of good condition, suitable-looking habitat was unoccupied. Vegetated sand dune habitat more or less disappears upstream of occurrence 011, before reappearing about one mile further upstream. No additional colonies were found in this upstream area, along the south-facing slopes above Twentymile Gulch (T6S R3E Section 1 and R2E Section 36). Uplands extending away from the gulch support a mosaic of Wyoming sagebrush and desert shrub communities, with soils varying from clays and silts to desert pavement. A large area between Poison Creek and Twentymile Gulch, north of Mulford's milkvetch occurrence 009 was also surveyed. Except for some scattered sandy outcrops most of this area south of Twentymile Gulch contains habitat unsuitable for Mulford's milkvetch. All together, about 900 acres were searched in the Twentymile Gulch area.

Vinson Wash area (Maps 6, 7, 8) - The majority of Vinson Wash was surveyed from the Poison Creek Cutoff Road, downstream to private land near its lower end. Potential Mulford's milkvetch habitat was scattered on both sides of the wash and some of its small tributaries. Extensive areas of unsuitable desert shrub habitat, including some large winterfat (*Eurotia lanata*) communities surrounded these sandy inclusions. Much of the upland vegetation was in relatively good condition, except where it had burned. It was puzzling not to find more Mulford's milkvetch in the general vicinity of 010, because some of the other nearby sand exposures contained excellent potential habitat. Much of the area along nearby Jensen Wash has burned and no good habitat was observed. Overall, close to 500 acres were surveyed in the Vinson Wash area.

Poison Gulch area (Maps 9 and 10) – Sandy habitat was exposed in several places in lower Poison Gulch near its confluence with Vinson Wash. A few additional areas with potential habitat occurred about

2 miles further upgulch. The best potential habitat was even further south (T6S R2E Sections 16, 17, 20, and 21), but even here it was spotty. The great majority of the Poison Gulch area had clayey, to silty, or gravelly soils, including segments with white clay badlands. Various desert shrub communities characterized the vegetation. Approximately 250 acres were directly surveyed.

Twentymile Flat area (Maps 11 and 12) – BLM land approaches Twentymile Flat in several areas. Little potential habitat was found to the north of occurrence 011. However, the extensive sand dune ridge south of Twentymile Flat and bordering a fork of Twentymile Gulch (mainly T6S R3E Sections 18, 19) had excellent-looking potential Mulford's milkvetch habitat. I do not know why there was no Mulford's milkvetch in this area. Much of Twentymile Flat itself has been converted for agricultural purposes. Approximately 250 acres were surveyed for this area.

Halfway Gulch area (Maps 13 and 14) - Sandy exposures were limited in this area dominated by silty, clayey, or rocky soils. The best potential habitat was found along a series of elongated sandy spur ridges about two miles north of Halfway Gulch (T6S R4E Section 31 NW4, and adjoining portions of T6S R3E Sections 25 and 36). A sandy slope north of the Shoofly Cutoff Road and east of the Mud Flat Road (T7S R3E Section 3) contained additional sandy habitat that was surveyed. A mosaic of desert shrub and Wyoming sagebrush communities characterized most of the Halfway Gulch area. Approximately 250 acres of potential habitat were directly surveyed in the area. Approximately seven miles of roads were also driven looking for suitable habitat.

C.J. Strike Reservoir area (Map 15) – The area surveyed near the reservoir is referenced as Pasture 8 by the BLM. A convenient access point is the old Emigrant Trail that is now a Sportsman Access Road. A series of low hills separated by small drainages typifies the landscape south of the road. The area was dominated by desert shrub vegetation with a high cover of cheatgrass in most places. None of the few, tiny, scattered, south-facing sandy inclusions contained Mulford's milkvetch. Both *Astragalus camptopus* (Murphy milkvetch) and *Astragalus kentrophyta jessicae* (thistle milkvetch) were encountered in several places. The gently sloping terrain north of the road burned in the past and now supports a sea of cheatgrass in most places. There were some interesting clay outcrops, but no suitable Mulford's milkvetch habitat was found in this area. Approximately 200 acres were directly surveyed throughout the area.

South of Highway 78, BLM parcels are intermixed with blocks of private, agricultural land. I drove by a few of these BLM parcels, but did not conduct any field surveys. The vegetation in these areas was too disturbed to be considered good potential habitat for Mulford's milkvetch.