

**MONITORING MULFORD'S MILKVETCH (*ASTRAGALUS MULFORDIAE*)
IN THE BOISE FOOTHILLS: 2023 RESULTS**

By

Michael Mancuso and Martha Brabec

January 2024

Prepared for:
Boise City Department of Parks and Recreation, Boise, Idaho

ABSTRACT

Mulford's milkvetch (*Astragalus mulfordiae*) is a perennial, whitish-flowered plant species endemic to southwestern Idaho and adjacent eastern Oregon. It has been a priority conservation concern for many years due to its limited distribution range, the small size of most populations, and problems with habitat loss and degradation. Habitat decline and outright habitat loss are most acute and chronic in the Boise Foothills portion of the species' range and largely related to urban development pressures. By the mid-1990s it became clear that monitoring information was needed to help land managers in the Boise Foothills be more proactive in their conservation actions on behalf of Mulford's milkvetch and other rare plant species. To begin obtaining this information, a series of 12 Mulford's milkvetch monitoring plots were established in the Boise Foothills in 1999 and 2000. The objective of the monitoring program is to provide population, habitat, and disturbance trend information for Mulford's milkvetch occurrences to support the species' long-term conservation. Monitoring data at the Boise Foothill plots were collected in 1999, 2000, 2001, 2002, 2005, 2006, 2007, and 2008. After a lapse of 11 years, Boise City and the Idaho Native Plant Society collaborated to resample Mulford's milkvetch monitoring plots located in the Boise Foothills in 2019. The City of Boise resampled the monitoring plots in 2020. In addition, a set of eight new Site Monitoring plots, based on a rapid assessment data collection protocol, were established and sampled at Mulford's milkvetch sites in or adjacent to Camel's Back, Hillside to Hollow, Polecat, and Military reserves. In 2023, Boise City and the Idaho Native Plant Society again collaborated to resample the previously established Mulford's milkvetch monitoring plots and to also establish two new Site Monitoring plots. A total of 22 monitoring plots are now in place. This report summarizes monitoring information collected in 2023 at all plots and provides some comparisons to data collected during previous monitoring years.

In 2023, monitoring at the 12 original plots with long term data documents the continued decline in Mulford's milkvetch abundance in the Boise Foothills compared to earlier, baseline monitoring years. All plots had one or more ground disturbance factors in 2023, but overall mean total ground disturbance for all transects was lower than most previous monitoring years. Plant community data collected in 2023 showed Mulford's milkvetch plots tend to be characterized by a sparse to open shrub layer, high to moderate grass cover dominated by non-native weedy species, and low to moderate cover of a mix of native and introduced forb species. Monitoring indicates cereal rye (*Secale cereale*) canopy cover has increased at three plots in Camel's Back Reserve and two plots in Military Reserve, while needle-and-thread grass (*Hesperostipa comata*) cover has decreased at these same plots. Site monitoring in 2023 showed a decrease in Mulford's milkvetch abundance at six of the eight locations with comparable data from 2020. Overall, monitoring results from 2023 provide further evidence Boise Foothill populations of Mulford's milkvetch are in jeopardy.

ACKNOWLEDGEMENT

We thank Idaho Native Plant Society members Don Essig and Kirsten Severud, Boise State University graduate student Clara Buchholtz, and Boise City Department of Parks and Recreation employee Camille Eells for their field assistance collecting Mulford's milkvetch monitoring data in 2023.

TABLE OF CONTENTS

ABSTRACT.....	i
ACKNOWLEDGMENT	i
TABLE OF CONTENTS	ii
LIST OF FIGURES	ii
LIST OF TABLES.....	ii
LIST OF APPENDICES	iii
INTRODUCTION	1
METHODS.....	2
RESULTS	4
DISCUSSION.....	6
REFERENCES	8

LIST OF FIGURES

Figure 1.	Number of reproductive and non-reproductive Mulford’s milkvetch plants for the 12 original monitoring plots in the Boise Foothills, 2000 – 2023	10
Figure 2.	Overall mean total ground disturbance abundance at Mulford’s milkvetch monitoring plots in the Boise Foothills, 2000 – 2023	10

LIST OF TABLES

Table 1.	Mulford’s milkvetch monitoring plots in the Boise Foothills	3
Table 2.	Mulford’s milkvetch census for monitoring plots, 2023	11
Table 3.	Mulford’s milkvetch census data for monitoring plots by life stage, 2000 – 2023	11
Table 4.	Mulford’s milkvetch off-transect counts in vicinity of monitoring plots, 2019-2023...	13
Table 5.	Ground disturbance percent cover values at Mulford’s milkvetch monitoring plots, 2023.....	13
Table 6.	Total ground disturbance percent cover values at Mulford’s milkvetch monitoring plots, 2000 – 2023	14
Table 7.	Main ground disturbance factors at Mulford’s milkvetch monitoring plots in the Boise Foothills, 2000 – 2023	14
Table 8.	Percent canopy cover values for plant species recorded in Mulford’s milkvetch monitoring plant community plots, 2023	15

Table 9.	Non-statistical trend assessment for selected plant species in Mulford’s milkvetch plant community plots, 2023	16
Table 10.	Mulford’s milkvetch census for Site Monitoring plots, 2020 and 2023.....	17
Table 11.	Weed species abundance for Site Monitoring plots, 2023.....	17
Table 12.	Ground disturbances at Site Monitoring plots, 2023	18

LIST OF APPENDICES

- Appendix 1. Map locations for Mulford’s milkvetch monitoring plots.
- Appendix 2. Copies of 2023 monitoring data collection forms.
- Appendix 3. Photographs for the original Mulford’s milkvetch monitoring plots, 2023.
- Appendix 4: Photographs for Mulford’s milkvetch site monitoring locations, 2023.

INTRODUCTION

Mulford's milkvetch (*Astragalus mulfordiae*) is a perennial plant species with whitish flowers endemic to southwestern Idaho and adjacent eastern Oregon. It has three population centers in Idaho - northern Owyhee County, near Weiser, and the Boise Foothills. Mulford's milkvetch has been a priority conservation concern for many years due to its limited distribution range, the small size of most populations, and problems with habitat loss and degradation. Although Mulford's milkvetch faces conservation problems throughout its range, the Boise Foothills pose special challenges due to its location within a large urban area. Habitat decline exemplified by weed species invasion is pervasive in the Boise Foothills, and outright habitat loss largely related to urban development is ongoing. Multiple Mulford's milkvetch populations have been extirpated or reduced in size in the Boise Foothills during recent decades (Moseley 1989, U.S. Fish and Wildlife Service 1995; personal observations by the authors). In the Boise Foothills, Mulford's milkvetch occupies loose, sandy habitats on dry, usually southerly to west-facing aspects in association with shrub-steppe communities historically dominated by antelope bitterbrush (*Purshia tridentata*) and native bunchgrass species.

The Idaho Natural Heritage Program (formerly the Idaho Conservation Data Center) rare plant database includes four occurrences of Mulford's milkvetch in the Boise Foothills, all consisting of multiple small patches of plants separated by unoccupied habitat (Idaho Department of Fish and Game 2023). Many patches are located on private property, but others occur on Boise City, Ada County, or Bureau of Land Management (BLM) land. This includes locations in a series of reserves managed by the Boise Parks and Recreation Department, one largely confined to the Ada County Sanitary Landfill, and part of another on BLM land in Stewart Gulch.

By the mid-1990s, it became clear that monitoring information was needed to help Boise City, Ada County, and BLM land managers be more pro-active in their conservation actions on behalf of Mulford's milkvetch and other rare plant species in the Boise Foothills - in part because one management objective for some of the city reserves is the maintenance of rare plant populations and their habitat (Boise Parks and Recreation Department 1996). Over time, the need for monitoring information has become even more important as the Treasure Valley population grows and recreation and other pressures on foothill reserves and open space areas continue to escalate.

A pilot Mulford's milkvetch monitoring program consisting of three plots in Boise's Camel's Back Reserve was initiated in 1999 as a cooperative project between the Boise Parks and Recreation Department and the Idaho Department of Fish and Game's Conservation Data Center (IDCDC; Mancuso 1999). In 2000, the U.S. Fish and Wildlife Service (USFWS) funded the IDCDC to establish and sample nine additional Mulford's milkvetch plots in the Boise Foothills (Mancuso 2001). The new plots included five in Military Reserve and one in Lower Halls Gulch Reserve on Boise City property, one in Seaman Gulch on Ada County land, and two in Middle Stewart Gulch on BLM land. All 12 plots were sampled again in 2001 with funding provided by the USFWS (Mancuso 2002). A subset of plots was monitored in 2002 as a volunteer effort sponsored by the IDCDC (unpublished data). Monitoring conducted at the plots by the IDCDC in 2005, 2006, 2007, and 2008 was again funded by the USFWS (Mancuso 2006, Idaho Conservation Data Center 2007 and 2008, Idaho Natural Heritage Program 2009). The 1999 – 2008 monitoring dataset serves as the available baseline for population sizes, habitat conditions, and disturbance factors at Mulford's milkvetch occurrences in the Boise Foothills.

After an 11-year lapse, Boise City and the Idaho Native Plant Society collaborated to resample the 12 Mulford's milkvetch monitoring plots located in the Boise Foothills in 2019 (Mancuso and Brabec 2019). The City of Boise resampled the monitoring plots in 2020 (unpublished data) In

addition, a set of eight new Site Monitoring plots were established and sampled at Mulford's milkvetch sites in or adjacent to Camel's Back, Hillside to Hollow, Polecat, and Military reserves. Site Monitoring uses a rapid assessment data collection protocol. In 2023, Boise City and the Idaho Native Plant Society again collaborated to resample all previously established Mulford's milkvetch monitoring plots in the Boise Foothills and also establish two new Site Monitoring plots. A total of 22 monitoring plots are now in place. This report summarizes monitoring information collected in 2023 at all plots and provides some comparisons to data collected during previous monitoring years.

The monitoring protocol for the 12 original monitoring plots consists of collecting quantitative Mulford's milkvetch census, plant community, weed species, and ground disturbance information at "permanently" marked plots. Photo-point photographs are also taken at each plot. Similar kinds of data are collected in a less quantitative manner at the 10 Site Monitoring locations. Since its inception, the objective of the monitoring program has been to provide population, habitat, and disturbance trend information for Mulford's milkvetch occurrences to support the species' long-term conservation in the Boise Foothills (Mancuso 2001). Monitoring information is intended to help land resource managers meet stewardship objectives such as maintaining populations of rare plant species on lands they administer within a multiple-use management framework. Monitoring information can be used to help prioritize conservation measures, to help assess the efficacy of conservation measures, and evaluate resource protection or other activities occurring in areas supporting Mulford's milkvetch.

METHODS

Original Monitoring Plots

Mulford's milkvetch monitoring in the Boise Foothills includes 12 monitoring plots originally established in 1999 or 2000 (Table 1; Appendix 1). They represent subpopulations within more extensive Boise Foothills occurrences. Previous reports contain location information, coordinates, and other information to help relocate and sample the plots (Mancuso 2001, Mancuso and Brabec 2019).

In response to lessons learned during the monitoring program's history, most protocols have undergone slight modifications over the years to increase efficiency and consistency in data collection. Similar to 2019 and 2020, data acquisition in 2023 included all original protocols except for collecting weed species canopy cover data on the monitoring transects, a relatively time-consuming procedure that requires practice to sample consistently and accurately. The decision to omit this protocol reflects a balance between data reliability and the time and resources available for data collection. Methods to collect Mulford's milkvetch census, vegetation, ground disturbance, and photo point data were detailed in our 2019 monitoring report (Mancuso and Brabec 2019) and are not repeated here except for the following overview.

With one exception, monitoring plots consists of a single 25-meter-long belt transect and an associated 0.1-acre fixed radius (11.3 m, 37 ft.) circular plot. Mulford's milkvetch census and ground disturbance data are collected in 1-meter square quadrats sampled along the transect. Plant community information is collected in the 0.1-acre circular plot. The exception is one plot (705) in Military Reserve having no transect and where all sampling takes place in the 0.1-acre plot.

As part of the Mulford's milkvetch census, each individual on the transect is assigned to a life stage category: (1) Reproductive - individuals with flowers and/or fruits; (2) Non-reproductive – individuals >4 cm tall without flowers or fruits; (3) Seedling – non-reproductive individuals <4 cm tall (or taller if cotyledons present). The amount of ground disturbance reflects the percentage of

Table 1. Mulford's milkvetch monitoring plots in the Boise Foothills.
BLM = Bureau of Land Management, LTTV = Land Trust of the Treasure Valley

Plot Identifier	Site Name	Year Establish	Land Ownership
Original Monitoring Plots			
015-1	Seaman Gulch	2000	Ada County
018-1	Middle Stewart Gulch	2000	BLM
018-1	Middle Stewart Gulch	2000	BLM
700-1	Military Reserve - Powderhouse Gulch	2000	Boise City
701-1	Military Reserve - Veterans Ridge	2000	Boise City
701-2	Military Reserve - Veterans Ridge	2000	Boise City
705-1	Military Reserve - Cemetery Ridge East	2000	Boise City
706-1	Military Reserve - Cemetery Ridge West	2000	Boise City
708	Lower Halls Gulch	2000	Boise City
715-1	Camel's Back Reserve	1999	Boise City
715-2	Camel's Back Reserve	1999	Boise City
715-3	Camel's Back Reserve	1999	Boise City
Site Monitoring Plots			
15 th Street Trail - 1	Camel's Back Reserve	2020	Boise City
15 th Street Trail - 2	Camel's Back Reserve	2020	Boise City
Trail #40	Camel's Back Reserve	2020	Boise City
Red Fox Trail	Camel's Back Reserve	2023	Boise City
Powerline Corridor	Polecat Gulch Reserve	2020	Boise City
Healthwise Trail	Hillside to Hollow	2020	LTTV
East of Fence	Hillside to Hollow	2020	LTTV
West of Fence	Hillside to Hollow	2020	LTTV
Promontory - East	adjacent to Military Reserve	2020	Private
Promontory - West	adjacent to Military Reserve	2023	Private

ground surface clearly broken, compressed, churned, or otherwise disrupted due to animal digging, animal tracks, footprints, or other causes. "Animal digging" disturbance is almost always attributed to pocket gopher excavations. Rodents or other animals are responsible for the "animal burrow/hole" disturbance. Disturbances recorded as "divots" pertain to variously-shaped soil depressions or gouges of uncertain origin. They likely represent old animal tracks in most cases. Other disturbance categories such as "footprints" and "trail" are self-explanatory. Ground disturbance cover classes are based on eight categories: 0 = none; 1 = <1%; 2 = 1-4.9%; 3 = 5-9.9%; 4 = 10-24.9%; 5 = 25-49.9%; 6 = 50-74.9%; 7 = 75-94.9%; 8 = 95-100%. Plant community information is based on visual estimates of canopy cover class values for all vascular plant species occurring within the 0.1-acre circular plot. Cover class estimates are also made for bare ground, litter, and moss/lichen ground cover attributes. Canopy cover classes use the same eight categories as for ground disturbance estimates. Monitoring also includes a series of photo point photographs taken at each plot.

Site Monitoring Plots

Mulford's milkvetch typically occurs in small, scattered patches in the Boise Foothills. A new Site Monitoring protocol implemented in 2020 provides a rapid monitoring method to collect Mulford's milkvetch abundance and habitat information at selected locations. Site Monitoring does not use a transect, quadrat sampling, or delineation of a standard plot size. Although data collection is less intensive compared to the 12 original monitoring plots, it still provides information required by land managers to assess the conservation trajectory and needs of

Mulford's milkvetch at a scale relevant to pro-active conservation measures. Site Monitoring was developed to allow more Mulford's milkvetch locations to be included in the monitoring program without straining the limited resources available to collect the data. Site Monitoring targets Mulford's milkvetch locations considered vulnerable to recreation-related or other disturbance impacts. These locations may be priorities for conservation management actions.

Site Monitoring consists of:

- (1) counting or estimating the abundance of Mulford's milkvetch, including estimates by life stage category (reproductive, non-reproductive, and seedling).
- (2) providing a habitat description (e.g., slope, aspect, plant community information).
- (3) compiling a list of exotic weed species and assigning each of them to one of five abundance categories: Trace = only a few individuals, easy to overlook, Sparse = spotty and perhaps not seen at first glance, but unlikely to overlook in careful observation; Scattered = widespread and perhaps not seen at first glance, but cannot be overlooked in careful observation; Common = frequent and widespread, obvious at first glance; Dominant = very abundant, a community dominant.
- (4) compiling a list of ground disturbance factors and disturbance details such as magnitude, imminence, and extent.
- (5) conservation recommendations and other comments, such as native plant species present at the site.

Information about the plot's location and plot photographs are also recorded. All of this information is recorded on a Site Monitoring form. Ten Site Monitoring plots have been established as of 2023, including five in City of Boise Reserves, three adjacent to Hillside to Hollow Reserve on Land Trust of the Treasure Valley property, and two on private property adjacent to Military Reserve (Table 1). Sites on private property were sampled with landowner permission. All are located adjacent to, or near popular recreation trails. Eight monitoring sites were established in 2020 and two in 2023. Their locations have been mapped and are documented by GPS coordinates (Appendix 1).

RESULTS

Original Monitoring Plots

Mulford's milkvetch monitoring data at the 12 original Boise Foothills plots were collected May 31 – June 29, 2023. Copies of the completed data sheets are in Appendix 2.

Mulford's milkvetch census

A total of 66 Mulford's milkvetch plants were tallied at the 12 original transects in 2023, including 13 (20%) reproductive, 7 (10%) non-reproductive, and 46 (70%) seedling plants (Table 2). Discounting seedlings, the 20-plant total for 2023 is the lowest ever recorded on the transects and represents an 89% decline compared to the 2000-2008 baseline average of 183 reproductive and non-reproductive plants (Figure 1). Past monitoring has shown large fluctuations in the abundance of seedlings from year to year. The total of 46 seedlings for 2023 represents a 60% decline compared to the 2000-2008 baseline average of 116 seedlings. Seven transects had no Mulford's milkvetch regardless of life stage. One plot (715-1) accounted for 60% of all plants recorded in 2023, including 55% of all reproductive/non-reproductive individuals and 63% of all seedlings (Table 3). Fruit pods on one plant had evidence of insect seed predation. Evidence of disease, insect damage, non-insect herbivory, or trampling damage was not observed on any other Mulford's milkvetch plants.

In addition to transect sampling, we also searched for, and tallied Mulford's milkvetch plants located adjacent to the transect, within the 0.1-acre plant community sample zone, and

elsewhere in the immediate plot vicinity. A total of 109 Mulford's milkvetch were counted on these off-transect searches, including 81 reproductive/non-reproductive plants and 28 seedlings (Table 4).

Ground disturbance

The loose, sandy soil characterizing Mulford's milkvetch habitat readily leaves evidence of tracks, gouges, digging, and other disturbances. All plots had one or more ground disturbance factors in 2023 (Table 5). Transect sampling recorded ground disturbance in 66% of all quadrats, a decrease from 69% in 2020 and 73% in 2019, and like the 64% for the 2000-2005 average. Total ground cover disturbance was <10% for most transects but ranged from <1% to 28% (Table 5). Three plots had a lower total ground disturbance value compared to all previous monitoring years. In contrast, 2 plots had a higher ground disturbance value compared to all previous monitoring years. Mean total ground disturbance for all transects was 6.8% in 2023, a value lower than all previous monitoring years except 2006 and 2019 (Figure 2), and approximately 50% of the 2000-2008 average of 13.8%. Animal digging and divots (likely deer, dog, or perhaps occasionally other animal tracks no longer able to confidently distinguish) were the only ground disturbances recorded in ≥50% of the transects. One or the other of them was the most common disturbance in all plots except Plot 706 that had <1% ground disturbance (Table 5). Animal burrow/hole, deer tracks, animal trail, anthill, footprints, recreation trail, and erosion (water rills or sloughing) were other ground disturbances recorded in at least one transect in 2023 (Table 5). Footprints in three transects and part of a recreation trail along the edge of one transect were the only ground disturbances directly related to human activity. Monitoring has shown the amount of ground disturbance can vary substantially from year to year (Table 6), but that the primary disturbance factors at a location remain largely consistent (Table 7).

Plant community

Plant community data collected in 2023 showed Mulford's milkvetch plots in the Boise Foothills tend to be characterized by a sparse to open shrub layer, moderate to high grass cover dominated by non-native weedy species, and low to moderate cover of a mix of native and introduced forb species (Table 8). Antelope bitterbrush or gray rabbitbrush (*Ericameria nauseosa*), or a combination of the two species dominate the shrub component, with green rabbitbrush (*Chrysothamnus viscidiflorus*) also contributing low cover at a few plots. The grass layer was typically strongly dominated by cheatgrass (*Bromus tectorum*) or cereal rye (*Secale cereale*), with relatively low cover of native bunchgrass species. Total graminoid canopy cover exceeded 35% in all but one plot. Total forb canopy cover was <10% in all but one plot, usually with one or more exotics being the most abundant forbs in a plot. Canopy cover for individual native forb species was <1% except for arrowleaf balsamroot (*Balsamorhiza sagittata*) in two plots and pale evening-primrose (*Oenothera pallida*) in one plot.

A total of 48 plant species were recorded in the plant community plots in 2023, including 3 shrub, 13 grass, and 32 forb taxa (Table 8). This total includes 16 (33%) exotic, weedy species. The number of species tallied in a plot ranged between 11 and 30. Cheatgrass, bulbous bluegrass (*Poa bulbosa*), and rush skeletonweed (*Chondrilla juncea*) were the only species recorded in all plots. Rush skeletonweed is on the Idaho noxious weed list (Idaho State Department of Agriculture 2023).

The plant community methodology requires an increase or decrease of 2 cover classes between sampling periods to mark a change in species abundance. A non-statistical trend assessment was made for selected species based on comparing canopy cover values for 2023 to values from the initial 2000-2006 monitoring years (Table 9). The assessment found an increase in

cereal rye canopy cover and decreased cover for cheatgrass and needle-and-thread grass (*Hesperostipa comata*) cover at the three plots in Camel's Back Reserve (715-1, 715-2, 715-3). Increased cereal rye cover and decreased needle-and-thread grass cover also occurred at two plots in Military Reserve (700-1, 701-1). Cheatgrass cover may be decreasing at a plot in Military Reserve (700-1) where in addition to cereal rye, cover for medusahead rye (*Taeniatherum caput-medusae*) and blue bachelor button (*Centaurea cyanus*) have also increased. Rush skeletonweed occurs in all plots and its abundance appears to fluctuate slightly or be relatively stable at most plots. The exception is a plot in Military Reserve (700-1) where this species appears to be increasing. A slightly fluctuating or stable trends applies to nearly all other species recorded in the plots. Bare ground and/or litter dominated the ground surface in all plots in 2023. Most plots had at least minor amounts of moss/lichen cover on the ground surface.

Photo points

A total of 82 photographs were taken at the 12 monitoring plots, including 70 photo point and 12 supplemental images (Appendix 3).

Site Monitoring Plots

Mulford's milkvetch census

A total of 301 Mulford's milkvetch plants were tallied at the 10 Site Monitoring locations in 2023 (Table 10). Eight of these plots were originally sampled in 2020, with one of them (West of Fence) showing a substantial increase in Mulford's milkvetch abundance mostly attributed to the large number of seedlings present in 2023. Another plot (Powerline Corridor) had approximately the same number of plants in 2023 as in 2020. The other six plots had fewer Mulford's milkvetch plants in 2023, with plot declines ranging from 33 – 96%. The two new Site Monitoring plots established in 2023 totaled 49 Mulford's milkvetch plants. Copies of the completed data sheets are in Appendix 2.

Weed species

A total of 15 exotic, weedy species were recorded in the Site Monitoring locations in 2023 (Table 11). Cheatgrass was recorded at all locations. Cereal rye, rush skeletonweed, and storksbi (*Erodium cicutarium*) were recorded at all but one location, and bulbous bluegrass at all but two locations. Annual ragweed (*Ambrosia artemisiifolia*) was the only other weed species recorded at ≥50% of locations. Cheatgrass abundance was rated "common" or "scattered" at five sites and "sparse" or "trace" at the other five sites. Abundance for cereal rye was rated "common" or "scattered" at six of the nine site where it occurred. Rush skeletonweed was the only other weed species to be rated "common". This was at the two sites located on private land immediately adjacent to Military Reserve.

Ground disturbance

One or more ground disturbances occurred at all Site Monitoring locations in 2023 (Table 12). A total of 12 different disturbances were recorded. Animal digging, recreation trail, and weed invasion were recorded at >50% of locations. Dog tracks were present at three locations, with all other ground disturbances limited to one or two locations.

Photo points

A total of 46 photos were taken at the 10 monitoring plots (Appendix 4).

DISCUSSION

Monitoring in 2023 documents the continued decline in Mulford's milkvetch abundance in the Boise Foothills compared to earlier, baseline monitoring years. The decline includes plot

locations in popular Boise City Reserves as well as locations on Ada County and BLM land with minimal human visitation. Because no monitoring occurred between 2008 and 2019, we do not know if the decrease in Mulford's milkvetch abundance has been a slow and steady process, or something that has accelerated the past 5 years or so. Mean total ground disturbance across all plots was lower in 2023 compared to most previous monitoring years. Animal digging (pocket gophers) and divots ground disturbances were present at most plots. Animal digging was the predominant disturbance at five plots. Divots almost certainly representing old deer track were the main disturbance at the two plots on BLM land in Stewart Gulch. Divots, likely originating as dog tracks, were a main disturbance at each of the three plots in Camel's Back Reserve. One plot at Camel's Back Reserve was the only location where footprint cover exceeded 1%. Plant community monitoring shows that most plots continue to be impacted by weed species canopy cover exceeding 30%. Cheatgrass and/or cereal rye have higher cover than any other species in all plots. Monitoring has detected increased cereal rye abundance accompanied by decreased needle-and-thread grass abundance at two plots in Military Reserve and at all three plots in Camel's Back Reserve. Cheatgrass abundance has also apparently decreased at the plots in Camel's Back Reserve. Abundance for nearly all other species show a fluctuating or stable trend when comparing 2023 to previous monitoring years. Rush skeletonweed was present in all Mulford's milkvetch plots in 2023, although at <1% cover in some plots.

The 10 Site Monitoring locations sampled in 2023 included eight sites originally established in 2020 and two new sites established in 2023. For the eight sites originally sampled in 2020, Mulford's milkvetch counts in 2023 were less at six sites, higher at one site, and approximately the same at one site. Cheatgrass, cereal rye, and rush skeletonweed were the only weed species rated as "common" at any sites. Between one and four ground disturbance factors were recorded at each site. Animal digging, recreation trail, and weed invasion were the only factors recorded at >50% of locations.

In 2019, we raised the alarm that monitoring data indicated a precarious conservation status for Mulford's milkvetch in the Boise Foothills (Mancuso and Brabec 2019). Monitoring results from 2023 provide further evidence Boise Foothill populations of Mulford's milkvetch are in jeopardy. It is clear that conserving these populations will remain a long-term challenge. Monitoring information provides documentation that land managers can use to formulate conservation priorities and actions that benefit Mulford's milkvetch and the habitat it depends upon in the Boise Foothills. For this reason, we recommend the monitoring program continue with data collection every three years.

The cause for alarm about the long-term conservation of Mulford's milkvetch extends beyond the Boise Foothills. The species has also shown an overall decrease in population size over time in both the Owyhee County, Idaho, and eastern Oregon (Malheur County) portions of its distribution range (Pyramid Botanical Consultants 2019, Diaz and Harris 2022). A modelling study projects that the rangewide decline can lead to a collapse of the species in the future (Diaz et al. 2022). Aase's onion (*Allium aaseae*), Boise sand-verbena (*Abronia mellifera* var. *pahoveorum*), and slickspot peppergrass (*Lepidium papilliferum*) are additional rare plant species found in the Boise Foothills. The presence of multiple rare plant species points to the inherent biodiversity value of the Boise Foothills. The City of Boise and the Idaho Native Plant Society are both committed to work towards their long-term conservation.

Potential Conservation Actions

The Open Space Matters Reserve Management plan (Open Space Matters 2015), implemented in 2015, provides management framework for City-owned open spaces and outlines a need for protection and enhancement of natural resources like rare plants (Focus Area 3). Habitat

degradation due to invasive species and long-term disturbance from recreation are likely the major factors associated with overall decline of Mulford's milkvetch populations in the Lower Boise Foothills.

One Mulford's milkvetch population in Military Reserve (transects 701-1 and 701-2) was fenced in 2021 to protect the sensitive area, but unfortunately the species continues to decline at this location. Research indicates that native plants can compete with invasive species like cheatgrass and medusahead rye (*Taeniatherum caput-medusae*) and increasing abundance in native plants may result in less weeds and thus more available soil and water resources for Mulford's milkvetch (Chambers, et al. 2007). Efforts will be made in 2024 to weed around existing plants to facilitate native plant regeneration within populations. Mulford's milkvetch seeds and potentially seedlings will be transplanted in fall 2024 to support recovery of the species at this protected location. Seedlings will be grown in partnership with Idaho Botanic Garden. Mulford's milkvetch seeds will be collected from the Polecat/Powerline population as this population is slated for disturbance due to power pole replacement in summer 2024. Seed collection and nursery procedures will follow protocols outlined by the Center of Plant Conservation and the Seeds of Success programs.

Transects 700-1 and 706-1 in Military Reserve had zero reproductive/non-reproductive Mulford's milkvetch individuals in 2023. Mulford's milkvetch seeds and potentially seedlings will be transplanted in fall 2024 to reintroduce the species to these locations. Habitat management to reduce invasive annual grasses will begin in spring 2024 in these areas too. We hope these conservation actions will begin to improve the long-term viability of Mulford's milkvetch at Military Reserve.

REFERENCES

Boise Parks and Recreation Department. 1996. Conservation Agreement for *Allium aaseae* (Aase's onion), *Astragalus mulfordiae* (Mulford's milkvetch), and *Lepidium papilliferum* (slick-spot peppergrass). Hulls Gulch Reserve, Boise, Idaho. Resolution 14145. Approved by the Council of the City of Boise City and by the Mayor of the City of Boise City on October 22, 1996.

Chambers, J.C., Roundy, B.A., Blank, R.R., Meyer, S.E. and Whittaker, A., 2007. What makes sagebrush ecosystems invasible by *Bromus tectorum*?. *Ecological Monographs*, 77: 117-145. <https://doi.org/10.1890/05-1991>

Diaz, S., and S. Harris. 2022. *Astragalus mulfordiae* (Mulford's milkvetch): population dynamics and the effects of cattle grazing in the Vale District, BLM. Institute for Applied Ecology, Corvallis, Oregon.

Diaz S, S. Harris, and T. Kaye. 2022. *Astragalus mulfordiae* (Mulford's milkvetch): modeling population growth rates and the effects of climate. Unpublished report for USDI Bureau of Land Management, Vale District. Institute for Applied Ecology, Corvallis, Oregon.

Hitchcock, C.L., and A. Cronquist. 2018. *Flora of the Pacific Northwest, An Illustrated Manual*, Second Edition. Edited by D.E. Giblin, B.S. Legler, P.F. Zika, and R.G. Olmstead. University of Washington Press, Seattle, in association with Burke Museum of Natural History and Culture, Seattle.

Idaho Natural Heritage Program. 2009. Mulford's milkvetch (*Astragalus mulfordiae*) monitoring in southwestern Idaho: 2008 results. Idaho Department of Fish and Game, Boise, ID. Draft.

Idaho Department of Fish and Game. 2023. Idaho Fish and Wildlife Information System Species Diversity database. Idaho Department of Fish and Game, Boise, ID.

Idaho Conservation Data Center. 2007. Mulford's milkvetch (*Astragalus mulfordiae*) monitoring in southwestern Idaho: 2006 results. Idaho Department of Fish and Game, Boise, Idaho. 29 pp. plus appendices.

Idaho Conservation Data Center. 2008. Mulford's milkvetch (*Astragalus mulfordiae*) monitoring in southwestern Idaho: 2007 results. Idaho Department of Fish and Game, Boise, ID. 40 pp. plus appendices.

Idaho State Department of Agriculture. 2023. Idaho noxious weed list. Available on-line: <http://www.idahoweedawareness.net/vfg/weedlist/weedlist.html>.

Mancuso, M. 1999. Monitoring Mulford's milkvetch at Camel's Back Reserve, Boise, Idaho. Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 4 pp. plus appendices.

Mancuso, M. 2001. Monitoring Mulford's milkvetch (*Astragalus mulfordiae*) in the Boise Foothills: 2000 results. Idaho Department of Fish and Game, Idaho Conservation Data Center, Boise, ID. 12 pp. plus appendices.

Mancuso, M. 2002. Monitoring Mulford's milkvetch (*Astragalus mulfordiae*) in the Boise Foothills: 2001 results. Idaho Department of Fish and Game, Idaho Conservation Data Center, Boise, ID. 12 pp. plus appendices.

Mancuso, M. 2006. Monitoring Mulford's milkvetch (*Astragalus mulfordiae*) in southwestern Idaho: 2005 results. Idaho Conservation Data Center, Idaho Department of Fish and Game, Boise, ID. 25 pp. plus appendices.

Mancuso, M. and Brabec, M. 2019. Monitoring Mulford's Milkvetch (*Astragalus mulfordiae*) in the Boise Foothills: 2019 results. Prepared for Boise City Department of Parks and Recreation, Boise, ID. 15 pp. plus appendices.

Moseley, R.K. 1989. Report on the conservation status of *Astragalus mulfordiae* in Idaho. Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 31 pp. plus appendices.

Open Space Matters. 2015. City of Boise Reserve Management Plan.

Pyramid Botanical Consultants. 2019. Mulford's milkvetch (*Astragalus mulfordiae*) monitoring, 2019. Bruneau Field Office, Boise District BLM. Boise, ID.

U.S. Fish and Wildlife Service. 1995. Habitat conservation assessment for Mulford's milkvetch (*Astragalus mulfordiae*). Unpublished report prepared for the U.S. Fish and Wildlife Service, Boise, ID. 13 pp. plus appendices.

Figure 1. Number of reproductive and non-reproductive Mulford's milkvetch plants for the 12 original monitoring plots in the Boise Foothills, 2000 – 2023. Values do not include seedling plants. Values from 2002 not shown because only a subset of plots sampled that year.

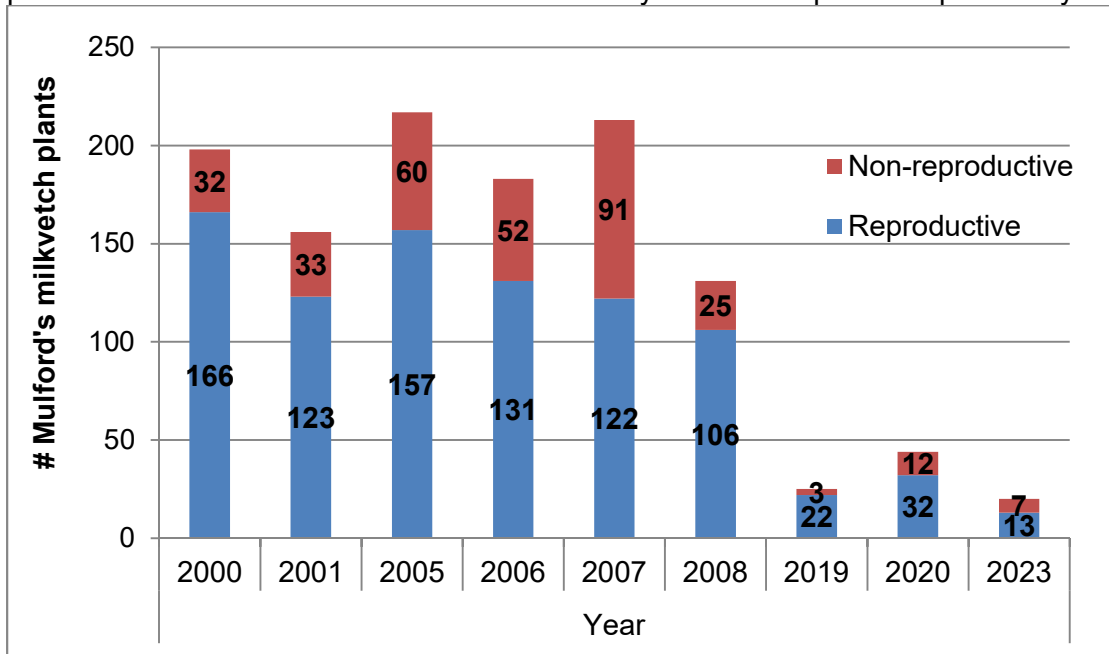
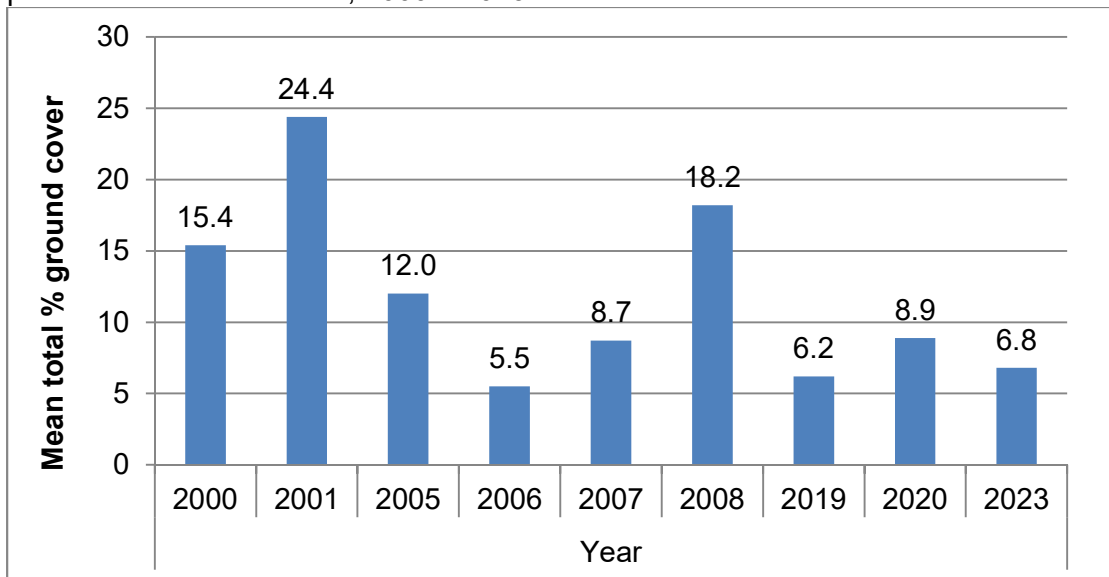


Figure 2. Overall mean total ground disturbance abundance at Mulford's milkvetch monitoring plots in the Boise Foothills, 2000 – 2023.



715-1	3	6	xx	20	5	39	7	3	6	5
715-2	4	2	xx	0	3	3	1	0	0	0
715-3	6	4	13	14	15	11	6	0	0	0
Total	32	33	28	60	52	91	25	3	12	7
	# of seedling plants									
15-1	0	0	3	0	0	0	0	0	0	0
18-1	16	18	xx	9	7	33	28	0	8	4
18-2	43	13	xx	3	0	2	0	0	0	0
700-1	0	0	0	0	0	0	0	0	0	2
701-1	1	0	0	0	0	1	2	0	0	0
701-2	9	8	3	2	3	37	3	0	0	9
705	0	0	xx	xx	xx	xx	xx	0	0	0
706-1	3	0	1	0	0	3	0	0	0	0
708-1	9	0	0	0	0	6	0	0	0	0
715-1	55	141	xx	27	10	59	35	10	17	29
715-2	15	4	xx	2	11	7	6	2	0	2
715-3	5	9	6	7	0	38	10	0	0	0
Total	156	190	13	50	31	186	84	12	25	46
	# of plants - all life stages									
15-1	7	7	12	9	9	8	1	1	3	0
18-1	27	31	xx	42	37	64	44	3	13	6
18-2	80	31	xx	15	17	8	6	0	0	0
700-1	6	2	1	2	0	1	0	0	0	2
701-1	20	15	7	5	1	2	3	0	0	0
701-2	57	47	45	42	53	92	36	0	14	15
705	9	10	xx	xx	xx	xx	xx	0	0	0
706-1	10	6	4	1	0	3	0	0	0	0
708-1	15	6	5	11	7	7	2	0	1	0
715-1	71	152	xx	76	21	105	48	29	38	40
715-2	27	11	xx	9	21	20	20	4	0	3
715-3	25	28	35	53	48	89	55	0	0	0
Total	354	346	109	265	214	399	215	37	69	66

Table 4. Mulford's milkvetch off-transect counts in vicinity of monitoring plots, 2019 - 2023. Counts do not differentiate between in and outside the 0.1 acre plant community plot. R= reproductive, NR = non-reproductive, S = seedling. xx = not sampled.

Plot	2019	2020	2023
15-1	6	4 (all R)	5 near transect (no seedlings)
18-1 & 2	30	no data	56 (30 R & NR + 26 S)
700-1	0	2 (1R, 1NR)	4 near transect
701-1 & 2	44	63 (includes 3 S)	35 (all R or NR)
705	0	xx	0
706-1	0	0	0
708-1	0	0	0
715-1	39	18 + (13R, 5NR, & many seedlings along trail edge)	3 down trail of transect and several upslope of transect
715-2	9	15 (11R, 3NR, & 1S)	6 (4 R + 2S) close to transect
715-3	0	0	0
Total	128	~102	~109

2023, Plots 18-1 & 2: all plants associated with 18-1 except for 7 non-seedling plants in area between 18-1 and 18-2

2023, Plots 701-1 & 2: 1 large plant adjacent to transect 701-1 and 5 plants within 40 cm of 701-2; then 29 plants in general plot zone, including several large individuals with numerous pods

Table 5. Ground disturbance percent cover values at Mulford's milkvetch monitoring plots, 2023. Erosion for Plot 15-1 = water erosion, for Plot 715-1 = sloughing.

	Animal dig pile	Burrow/hole	Divot	Deer tracks	Animal trail	Anthill	Foot print	Rec. trail	Erosion	Total
15-1	1.3	-	0.3		-	-	-	-	0.4	2.0
18-1	1.0	0.1	3.9		-	-	-	-	-	5.1
18-2	-	1.5	2.6		-	-	-	-	-	4.1
700-1	6.5	-	-		-	3.7	0.04	-	-	10.4
701-1	28.3	-	0.1		-	-	-	-	-	28.3
701-2	1.8	-	1.2		-	-	-	-	-	2.9
706-1	-	-	-	0.02	0.02	-	0.02	-	-	0.1
708-1	-	0.1	-	0.9	-	-	-	-	-	1.1
715-1	2.2	0.5	4.2	-	-	-	-	0.1	3.2	10.9
715-2	0.3	-	1.2	-	-	-	-	-	-	1.5
715-3	2.9	-	2.0	-	-	-	2.5	-	-	8.0

Table 6. Total ground disturbance percent cover values at Mulford's milkvetch monitoring plots, 2000 – 2023. xx = no data collection.

Plot	Year									
	2000	2001	2002	2005	2006	2007	2008	2019	2020	2023
15-1	1.7	2.5	3.0	1.5	1.7	17.6	6.2	0.5	4.8	2.0
18-1	9.1	38.9	xx	4.4	6.2	4.8	32.1	5.0	5.5	5.1
18-2	3.7	41.0	xx	4.9	4.1	7.1	25.6	3.6	5.7	4.1
700-1	3.0	1.6	6.9	1.1	9.1	7.6	7.9	15.1	6.1	10.4
701-1	0	0.2	5.2	3.3	1.5	2.1	9.2	10.5	4.8	28.3
701-2	9.6	3.5	11.9	5.2	3.4	6.2	16.8	6.9	3.8	2.9
706-1	1.2	1.2	5.9	0.2	2.1	5.1	5.4	0.3	0.3	0.1
708-1	3.5	9.1	13.2	14.2	22.6	11.7	22.8	2.9	3.7	1.1
715-1	73.5	73.5	xx	73.5	4.3	26.4	46.3	9.1	9.5	10.9
715-2	56.1	75.0	xx	15.1	3.1	1.2	13.5	6.9	17.9	1.5
715-3	8.3	22.4	41.7	8.2	3.0	6.6	14.7	7.8	35.8	8.0
Mean	15.4	24.4	12.5	12.0	5.5	8.7	18.2	6.2	8.9	6.8

Table 7. Main ground disturbance factors at Mulford's milkvetch monitoring plots in the Boise Foothills, 2000 – 2023. Disturbance factors listed in order or abundance in the plot. In most cases, only disturbance factors with >1% ground cover listed.

xx = no data collection (only a subset of plots sampled in 2002).

Plot	2000	2001	2002	2005	2006	2007	2008	2019	2020	2023
15-1	deer	deer	NS	divots	deer	divots deer	divots	digging	deer digging	digging
18-1	divot	deer	xx	deer	deer divots	deer	divots deer	deer	digging	divots digging
18-2	deer	deer	xx	divots deer	divots deer	deer divots	deer divots	deer	digging deer	divots digging
700-1	NS	NS	NS	digging	digging	digging	digging divots	digging	digging anthills	digging anthills
701-1	none	NS	NS	digging	divots	divots	divots	digging divots	digging	digging
701-2	NS	NS	NS	footprint	divots deer	divots	divots digging	digging divots	deer	digging divots
706-1	NS	divots	NS	deer	digging	digging divots	divots	digging	deer anthills	deer
708-1	NS	divots	NS	digging divots	digging	digging divots	digging divots	digging	digging	deer
715-1	NS	NS	xx	slough divot	slough	divot	deer divot	digging divots	dog trail	slough divot
715-2	NS	NS	xx	slough divot	slough	divot	deer divots	digging divots	digging dog	divot
715-3	footprint	NS	NS	footprint digging	divot	divots digging	divots digging	divots footprint	deer digging	digging footprint

Deer = deer tracks; Digging = animal digging/dirt piles/burrows/holes; Dog = dog tracks; Divots = variously-shaped soil depressions or gouges lacking clear definition, likely related to old deer tracks in most cases, but sometimes probably dog or other animal tracks. Slough = soil movement erosion due to disturbance, typically footprints or dog tracks; Other categories are self-explanatory. NS = not specified (disturbance category not consistently recorded for most plots 2000-2002).

Table 8. Percent canopy cover values for plant species recorded in Mulford's milkvetch monitoring plant community plots, 2023. Nomenclature follows Hitchcock and Cronquist (2018).

	15-1	18-1	700-1	701-1	705	706-1	708-1	715-1	715-2	715-3
Shrubs										
<i>Chrysothamnus viscidiflorus</i>	3		0.5			7.5		0.5	0.5	
<i>Ericameria nauseosa</i>	17.5				3	7.5	37.5	3	7.5	17.5
<i>Purshia tridentata</i>	3	17.5	7.5	3	18	37.5	0.5			
Total Shrub Cover	17.5	17.5	7.5	3.0	17.5	37.5	37.5	3	7.5	17.5
Graminoids										
<i>Achnatherum hymenoides</i>						0.5				
<i>Aristida purpurea longiseta</i>	3		0.5	7.5	3	8		0.5	3	3
<i>Bromus japonicus</i>			0.5	0.5						
<i>Bromus tectorum</i>	37.5	7.5	37.5	37.5	37.5	17.5	63	7.5	17.5	17.5
<i>Elymus elymoides</i>	0.5									
<i>Hesperostipa comata</i>			0.5	0.5	0.5	3.0		0.5	0.5	
<i>Poa bulbosa</i>	3	3	0.5	3	0.5	0.5	0.5	7.5	7.5	3
<i>Poa secunda</i>	3	0.5						0.5		
<i>Pseudoroegneria spicata</i>		3		3	0.5	0.5				
<i>Secale cereale</i>			17.5	37.5	0.5	3.0	0.5	62.5	37.5	62.5
<i>Sporobolus cryptandrus</i>			1		0.5	0.5		0.5	0.5	
<i>Taeniatherum caput-medusae</i>			8	0.5	0.5					
<i>Vulpia myuros</i>	0.5									
Total Graminoid Cover	62.5	7.5	62.5	62.5	37.5	37.5	62.5	85	85	85
Forbs										
<i>Abronia mellifera</i>						0.5				
<i>Achillea millefolium</i>			0.5	0.5		0.5	0.5			
<i>Allium acuminatum</i>			0.5							
<i>Alyssum desertorum</i>		3	0.5		0.5		0.5	3	3	1
<i>Ambrosia artemisiifolia</i>			0.5	0.5				0.5	0.5	
<i>Antennaria dimorpha</i>	0.5				0.5		0.5			
<i>Astragalus mulfordiae</i>	0.5	0.5	0.5	0.5			0.5	0.5	0.5	
<i>Astragalus purshii</i>	0.5			0.5	0.5					
<i>Balsamorhiza sagittata</i>			3.0	3						0.5
<i>Centaurea cyanus</i>			17.5	0.5	0.5	0.5	0.5	0.5	3	3
<i>Chondrilla juncea</i>	3	0.5	7.5	3	3	0.5	0.5	0.5	3	3
<i>Commandra umbellata</i>						0.5				
<i>Crepis occidentalis</i>				0.5	0.5					
<i>Cryptantha</i> sp. (annual)				0.5						
<i>Descurainia sophia</i>			0.5				0.5			
<i>Epilobium brachycarpum</i>	0.5		0.5	0.5	0.5		0.5	0.5		
<i>Eriogonum microthecum</i>		0.5								
<i>Eriogonum ovalifolium</i>		0.5			0.5					
<i>Erodium cicutarium</i>	0.5		0.5	0.5	0.5		0.5	0.5	3	0.5

	15-1	18-1	700-1	701-1	705	706-1	708-1	715-1	715-2	715-3
<i>Grindelia squarrosa</i>				0.5						
<i>Lactuca serriola</i>				0.5						
<i>Lomatium simplex</i>				0.5						
<i>Machaeranthera canescens</i>			0.5	0.5	0.5	0.5		0.5	0.5	
<i>Oenothera pallida</i>				0.5				3		
<i>Oenothera contorta</i>							0.5			
<i>Phacelia hastata</i>					0.5	0.5	0.5		0.5	
<i>Phlox longifolia</i>	0.5			0.5						
<i>Plagiobothrys tenellus</i>	0.5		0.5		0.5					
<i>Plantago patagonica</i>				0.5						0.5
<i>Salsola tragus</i>			0.5	0.5			0.5	0.5	0.5	0.5
<i>Sisymbrium altissimum</i>			0.5	0.5				0.5		
<i>Tragopogon dubius</i>	0.5		0.5				0.5			
Total Forb Cover	3	3	3	7.5	3	0.5	0.5	7.5	3	3

Table 9. Non-statistical trend assessment for selected plant species in Mulford's milkvetch plant community plots, 2023.

Species	Plot										
	15-1	18-1	700-1	701-1	705	706-1	708-1	715-1	715-2	715-3	
<i>Purshia tridentata</i>	=	=	=	=	=	=	=	=	00	00	00
<i>Ericameria nauseosa</i>	=	=	=	0	=	=	=	=	=	=	=
<i>Aristida purpurea</i>	-	00	=	=	=	+	-	=	=	=	=
<i>Bromus tectorum</i>	=	=	=	=	=	-	=	-	-	-	-
<i>Poa bulbosa</i>	1	=	=	=	=	=	1	=	=	=	=
<i>Poa secunda</i>	=	=	=	=	=	=	=	=	=	0	=
<i>Hesperostipa comata</i>	00	=	-	-	=	=	=	-	-	-	-
<i>Secale cereale</i>	00	00	+	+	=	=	=	+	+	+	+
<i>Centaurea cyanus</i>	00	00	+	=	1	=	=	1	=	=	=
<i>Chondrilla juncea</i>	=	=	=	=	=	=	=	=	=	=	=

= = 2023 percent cover value similar (within 1 cover class) to all monitoring years prior to 2019 (more or less stable or fluctuating abundance trend); note that species recorded at trace (<1% cover) in 2023, but not recorded prior to 2019 scored as = (because within 1 cover class of 0)

+ = 2023 percent cover value 2 cover classes or more greater than all monitoring years prior to 2019 (increase abundance trend)

- = 2023 percent cover value 2 cover classes or more less than all monitoring years prior to 2019 (decrease abundance trend)

0 = species absent in plot for first time in 2023; 00 = species never recorded in the plot

1 = species recorded in plot for the first time in 2023

Table 10. Mulford's milkvetch census for Site Monitoring plots, 2020 and 2023.
 West of Fence in 2023: non-repro. and seedlings not differentiated, at least 74, most being seedlings. xx = plot not established until 2023.

Plot Name	# Mulford's milkvetch plants							
	2020				2023			
	Total	Repro.	Non-repro.	Seed.	Total	Repro.	Non-repro.	Seed.
15 th Street Trail - 1	45	34	21	few	10	10	0	0
15 th Street Trail - 2	26	~21	~5	0	9	9	0	0
Red Fox Trail	25	~20	~5	0	1	1	0	0
Red Fox Trail - upslope	xx	xx	xx	xx	40	~30	~10	0
Powerline Corridor	32				29	22	7	few
Healthwise Trail	37				23	17	6	0
East of Fence	75				50	32	18	few
West of Fence	6				92	18	?	many
Promontory - East	65				30	~27	~3	0
Promontory - West	xx	xx	xx	xx	9	5	4	0
Total	311				301			

Table 11. Weed species abundance for Site Monitoring plots, 2023.
 T = trace, P = sparse, S = scattered, C = common, D = dominant

	<i>Bromus tectorum</i>	<i>Poa bulbosa</i>	<i>Secale cereale</i>	<i>Aegilops cylindrica</i>	<i>Chondrilla juncea</i>	<i>Centaura cyanus</i>	<i>Erodium cicutarium</i>	<i>Alyssum desertorum</i>	<i>Lactuca serriola</i>	<i>Tragopogon dubius</i>	<i>Ambrosia artemisiifolia</i>	<i>Sisymbrium altissimum</i>	<i>Salsola tragus</i>	<i>Melilotus officinalis</i>	<i>Medicago sativa</i>
15 th Street Trail - 1	S	P	C				S				S		T		
15 th Street Trail - 2	C	P	C	T	P	T	T				T	T	T	P	T
Red Fox Trail	P	P	P		S	P	T								
Red Fox Trail - upslope	P	P	P		P	P				T				T	
Powerline Corridor	C	P			S		S	T							
Healthwise Trail	T	S	C		P		P	T					T		
East of Fence	P	P	S		P		P								
West of Fence	P	P	C		P		P				T			P	
Promontory - East	C		S		C		P				S				
Promontory - West	C		P		C	S	P				S				

Table 12. Ground disturbances at Site Monitoring plots, 2023.

West of Fence: non-motorized recreation = footprints

Other (water erosion) = probably related to several 2023 heavy spring rainfall events

	Animal digging	Deer/wildlife tracks	Dog tracks	Livestock tracks	Trail	Road	Motorized recreation	Non-motor recreation	Weed invasion	Wildfire	Other (antill)	Other (water erosion)
15 th Street Trail - 1	x								x			
15 th Street Trail - 2	x				x				x			
Red Fox Trail	x											
Red Fox Trail - upslope	x										x	x
Powerline Corridor						x						
Healthwise Trail	x		x		x				x			
East of Fence			x		x				x			
West of Fence		x	x		x			x	x			
Promontory - East					x				x			x
Promontory - West	x				x				x			

Appendix 1

Map locations for Mulford's milkvetch monitoring plots.

Appendix 2

Copies of 2023 monitoring data collection forms.

Appendix 3

Photographs for the original Mulford's milkvetch monitoring plots, 2023.

Appendix 4:

Photographs for Mulford's milkvetch site monitoring locations, 2023.