

**MONITORING MULFORD'S MILKVETCH (*ASTRAGALUS MULFORDIAE*)  
IN THE BOISE FOOTHILLS: 2019 RESULTS**

By

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## **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 was becoming clear that monitoring information was needed to help Boise City and Ada County 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. Towards this end, 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. In 2019, Boise City and the Idaho Native Plant Society collaborated to resample Mulford's milkvetch monitoring plots located in the Boise Foothills. A total of 37 Mulford's milkvetch plants were tallied on transects in 2019, with most having fewer plants compared to previous monitoring years. Eight transects had no Mulford's milkvetch. The 37-plant tally for 2019 represents a 83% decrease compared to 2008. All plots had one or more ground disturbance factors in 2019, with total ground disturbance in plots ranging from <1% to 15.1 %. Mean total ground disturbance for all plots in 2019 was 6.2%, a value lower than all previous monitoring years except 2006. Primary ground disturbance factors in 2019 included animal digging at 7 plots, deer tracks at 2 plots, animal tracks (likely deer and/or dog) at 1 plot, and a walking trail at 1 plot. Plant community data collected in 2019 showed Mulford's milkvetch plots in the Boise Foothills to be characterized by a sparse to open shrub layer, high grass cover dominated by non-native weedy species, mainly cheatgrass, and low to moderate cover of a mix of native and introduced forb species. Overall, the 2019 monitoring data indicates the conservation status of Mulford's milkvetch in the Boise Foothills is in jeopardy. The conservation for Mulford's milkvetch and other Boise Foothill rare plant species will likely become more challenging as the human population in the Boise metropolitan area continues to grow. Monitoring provides documentation upon which land managers can base conservation priorities and actions that benefit rare plant species in the Boise Foothills.

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## 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. 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. Several Mulford's milkvetch occurrences in the Boise Foothills have been extirpated or reduced in size in recent decades (Moseley 1989; U.S. Fish and Wildlife Service 1995). 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*).

The Idaho Natural Heritage Program rare plant database includes 4 occurrences of Mulford's milkvetch in the Boise Foothills, all consisting of multiple groupings separated by unoccupied habitat (Idaho Department of Fish and Game 2019). The majority of Boise Foothills occurrences are located on private property, but several occur at least partly on Boise City, Ada County, and Bureau of Land Management (BLM) land. This includes occurrences located in 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 was becoming clear that monitoring information was needed to help Boise City and Ada County 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.

In 1999, a pilot Mulford's milkvetch monitoring program consisting of three plots was established at Camel's Back Reserve in Boise 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 5 in Military Reserve and 1 in Lower Halls Gulch Reserve on Boise City property, 1 in Seaman Gulch on Ada County land, and 2 in Middle Stewart Gulch on BLM land. All 12 of the 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 all Boise Foothill area plots by the IDCDC in 2005, 2006, 2007, and 2008 was again funded by the USFWS (Mancuso 2006, Idaho Conservation Data Center 2007, Idaho Conservation Data Center 2008, Idaho Natural Heritage Program 2009). The monitoring dataset compiled during this 1999 – 2008 time period provides a good baseline for population sizes, habitat conditions, and disturbance factors at the Mulford's milkvetch occurrences in the Boise Foothills.

The monitoring protocol consists of collecting Mulford's milkvetch census, plant community, weed species, and ground disturbance information at "permanently" marked plots. Photo-point photos are also taken at each plot. 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 (Mancuso 2000). 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 also be used to help prioritize conservation measures and evaluate resource protection or other activities occurring in areas supporting Mulford's milkvetch. In 2019, Boise City and the Idaho Native Plant Society collaborated to resample the 12 Mulford's milkvetch monitoring plots located in the Boise Foothills. This effort ended an 11-year gap since the last time monitoring information was collected in 2008. This report summarizes monitoring information collected in 2019 and provides some comparisons to data collected during previous monitoring years.

## METHODS

Mulford's milkvetch monitoring in the Boise Foothills includes 12 monitoring plots, all originally established in 1999 or 2000 (Table 1). The plots represented 8 separate Mulford's milkvetch occurrences when initially established. However, due to subsequent changes in the way the Idaho Natural Heritage Program (formerly IDCDC) delineates an occurrence, the monitoring program now entails 3 Mulford's milkvetch occurrences in the Boise Foothills. This database-related change did not change the three-digit code used to identify each plot.

In response to lessons learned during the monitoring program history, most Mulford's milkvetch monitoring protocols have undergone slight modifications over the years, generally to increase efficiency and consistency in data collection. Data collection in 2019 included all original monitoring protocols except for weed species sampling on the monitoring transects. Collecting weed species canopy cover data on the transects is a relatively time-consuming procedure that requires practice to sample consistently and accurately. The decision to omit this protocol reflects trying to find the balance between the amount and vigor of data collected to the time and resources available. The protocols outlined below represent those used in 2019.

Table 1. Mulford's milkvetch monitoring plots in the Boise Foothills. Plots in Camels Back Reserve established in 1999, all others in 2000.

<b>Plot identifier</b>	<b>Site name</b>	<b>Land ownership</b>
015-1	Seaman Gulch	Ada County
018-1	Middle Stewart Gulch	BLM
018-2	Middle Stewart Gulch	BLM
700-1	Military Reserve-Powderhouse Gulch	Boise City
701-1	Military Reserve-Veterans Ridge	Boise City
701-2	Military Reserve-Veterans Ridge	Boise City
705-1	Military Reserve-Cemetery Ridge East	Boise City
706-1	Military Reserve-Cemetery Ridge West	Boise City
708-1	Lower Hulls Gulch	Boise City
715-1	Camels Back Reserve	Boise City
715-2	Camels Back Reserve	Boise City
715-3	Camels Back Reserve	Boise City

### Monitoring protocol

Red-painted rebar stakes hammered into the ground mark the location of most transects. Two transects at Camel's Back Reserve use existing wood fence posts to reference the location of

the transect. 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. A metric tape stretched between the start and end points delineates the transect. Mulford's milkvetch census and ground disturbance data collection occurs along one, pre-determined side of the transect tape. One-meter square quadrats aligned flush with the transect tape are sampled at each meter mark starting at the 1-m mark - a total of 25 quadrats/transect. Plant community information is collected in the 0.1 acre circular plot. Photo-points provide a photographic record of each monitoring area. Trail width measurements are made at one plot (715-1) in Camels Back Reserve. One plot (705) in Military Reserve is not conducive to using a transect for data collection due to the small number of scattered Mulford's milkvetch plants at this site (based on when the plot was originally established in 2000). For this reason, the 0.1 acre plant community plot is also used as the sample area to collect Mulford's milkvetch census data. Transect azimuth and other sampling information for each plot has been summarized, along with general 2019 plot observations (Appendix 3).

#### Mulford's milkvetch census and plant damage monitoring

Census information is collected by counting every Mulford's milkvetch rooted within quadrats sampled along the transect and assigning each plant to one of three life stage class categories: (1) Reproductive stage class - individuals with flowers and/or fruits; (2) Non-reproductive stage class – individuals >4 cm tall without flowers or fruits; (3) Seedling stage class – non-reproductive individuals <4 cm tall (or taller if cotyledons present). It can sometimes be difficult to distinguish very small non-reproductive plants from seedlings. Applying the height standard makes life stage classification of small plants more consistent but may occasionally result in small plants >1-year old being recorded as seedlings. If two Mulford's milkvetch stems are <3 cm apart, they are considered one plant. After assigning each Mulford's milkvetch to a life stage class, the plant is inspected for evidence of disease, insect damage, non-insect herbivory, and trampling damage. Damages are recorded as a "yes" on the data sheet if observed. The cause of the damage is also recorded if known. Census data are collected differently for Plot 705 because it lacks a transect. At this plot, census data are collected for all Mulford's milkvetch plants found in the 0.1-acre circular plot.

#### Ground disturbance monitoring

The amount of ground disturbance within each quadrat is estimated and reflects the percentage of ground surface within the quadrat clearly broken, compressed, churned, or sloughed due to animal tracks, animal digging, trails, footprints, or other causes. Identifying the cause of a disturbance is sometimes not an issue and can be assigned with high confidence. Some disturbance factors such as deer track, dog track, footprint, motorcycle track, and wildlife trail are self-explanatory. However, unless the disturbance is fresh, it can be difficult or impossible to confidently determine the cause. Common ground disturbance factors that take this ambiguity into account include:

Animal track – used when the animal track is too ill-defined to allow confident identification of the species that caused it. In the Boise Foothills these are most often probably old deer or dog tracks.

Animal digging – applies to mounds/piles of soil deposited by a digging animal. In many cases the digging is likely from pocket gopher activity, but smaller piles may be from a smaller mammal or a lizard or insect. A burrow hole sometimes accompanies the dirt pile.

Burrow – used in cases where there is no dirt pile, only a hole dug by an unknown animal.

Divot – usually an irregularly-shaped soil depression or gouge of uncertain origin, although often probably related to old animal tracks.

Sloughing – soil displacement from churning, detachment, or other erosive action, typically from an uncertain cause.

Trail – a pathway used by people, whether maintained or not.

Ground disturbance cover classes for 2019 are based on the eight categories used in 2008 data collection and include: 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%.

A special “ground disturbance” monitoring transect was established in 2000 near Plot 700-1 in Military Reserve to monitor changes in the size of an erosion gully bisecting the Mulford’s milkvetch occurrence in this area. Some Mulford’s milkvetch habitat was destroyed when the gully was deeply cut during a storm – probably in the 1980s. Enlargement of the gully threatens additional habitat along the small draw bottom. Monitoring at this location consists of taking photographs and measuring the width of the gully measured at a set of intervals along the transect. Photos and measurements were not taken at this transect in 2019. The Mulford’s milkvetch occurrence at monitoring Plot 715-1 in Camels Back Reserve is bisected by a walking trail. Monitoring at this location includes measuring the width of the trail at the transect start point.

#### Vegetation monitoring

Plant community information is based on visual estimates of canopy cover class values for all vascular plant species occurring within a 0.1-acre circular plot. Cover class estimates are also made for bare ground, litter, and moss/lichen ground cover attributes. Previous monitoring years collected ground cover estimates for several additional ground surface features, including rock, gravel, wood, and basal vegetation. Estimates were not made for these features in 2019 because they tend to be minor contributors to the ground surface in the Boise Foothills. Instead, rock and gravel were considered part of the bare ground category and wood part of the litter category. Basal vegetation cover was estimated to be approximately 10% in plots in previous monitoring years but can be difficult to estimate consistently in communities dominated by weedy annual species.

Plant community changes are monitored by comparing the plant species and cover values recorded one year, against the species and cover values recorded another year. Because this method has an acceptable accuracy standard of +/- one cover class, an increase or decrease of two or more classes is required to indicate measurable change. Canopy cover classes for 2019 are based on the eight categories used in 2008 data collection and include: 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%.

#### Photo points

Repeat photo monitoring is useful to document site-specific change or lack of change to landscape features of interest (Hall 2001). The plot marker stakes serve as the photo-point reference marker from which the photos are taken. Photographs are taken using a digital camera set at wide-angle. A minimum of six photos are taken at each monitoring site. Four photos, taken at bearings of 0°, 90°, 180°, and 270° while standing at the transect start stake marker provide a panoramic overview of the area. The remaining photos are for the immediate transect area. One is taken standing 3 m behind the transect start stake along the transect azimuth; the other while standing 3 m behind the end stake along the back azimuth. Additional photos to show the plant community plot, disturbances, or other landscape features are optional.

## RESULTS

Mulford's milkvetch monitoring data were collected May 9 – June 13, 2019. Data collection included all 12 plots located in the Boise Foothills.

### Mulford's milkvetch census

A total of 37 Mulford's milkvetch plants were tallied at the 12 Boise Foothill plots, with transects having fewer plants compared to previous monitoring years in most cases (Table 2). The only exceptions were for 2 transects which had counts of 0 and 1 for both 2008 and 2019. Plot 715-1 was the only transect with >10 plants and accounted for 78% of all plants recorded in 2019. Eight transects had no Mulford's milkvetch. The 37-plant tally for 2019 represents a 83% decrease compared to 2008, the last year transects were previously sampled. Sixty percent of Mulford's milkvetch plants recorded in 2019 were reproductive, with 8% in the non-reproductive and 32% in the seedling life stage classes (Table 2). Past monitoring has shown large fluctuations in the abundance of seedlings from year to year. Discounting seedlings, the total Mulford's milkvetch count for 2019 was still the lowest of any monitoring year (Figure 1). Discounting seedlings, the 25-plant total for 2019 represents a 86% decrease compared to the average number recorded during the 2000 to 2008 monitoring years. Plot 715-1 was the only location with a greater number of non-seedlings plants in 2019 compared to one or more previous monitoring years. Evidence of disease, insect damage, non-insect herbivory, or trampling damage was not observed on any Mulford's milkvetch plants sampled on the monitoring transects in 2019.

In addition to transect sampling, we also searched for and tallied Mulford's milkvetch plants located within the 0.1-acre plant community plot and in the immediately surrounding area at each monitoring location. A total of an additional 128 Mulford's milkvetch were counted on these off-transect searches (Table 3).

### Ground disturbance

The loose, sandy soil characterizing Mulford's milkvetch habitat readily leaves evidence of compression, digging, sloughing, and other disturbances. All plots had one or more ground disturbance factors in 2019. Transect sampling recorded ground disturbance in 73% of all quadrats, an increase compared to monitoring years 2000 (57%), 2001 (69%), and 2005 (66%). Total ground disturbance in plots ranged from <1% to 15.1 % (Table 4). 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 plots in 2019 was 6.2%, a value lower than all previous monitoring years except 2006 (Figure 2). Primary ground disturbance factors in 2019 included animal digging at 7 plots, deer tracks at 2 plots, animal tracks (likely deer and/or dog) at 1 plot, and a trail at 1 plot (Table 5). Monitoring has shown the amount of ground disturbance can vary substantially from one year to another year at a plot (Table 4), but that disturbance factors have remained largely consistent within a plot (Table 5).

### Plant community

Plant community data collected in 2019 showed Mulford's milkvetch plots in the Boise Foothills to be characterized by a sparse to open shrub layer, high grass cover dominated by non-native weedy species, and low to moderate cover of a mix of native and introduced forb species. The shrub component was dominated by either antelope bitterbrush or gray rabbitbrush (*Ericameria nauseosa*) or a combination of the two species, with green rabbitbrush (*Chrysothamnus viscidiflorus*) contributing low cover at a few plots as well. The grass layer was typically strongly dominated by cheatgrass (*Bromus tectorum*), with relatively low cover of native bunchgrass species. Individual forb species cover rarely exceeded 5% and was <1% in many cases. A total



of 54 plant species were recorded in the 10 plant community plots, including 3 shrub, 12 grass, and 39 forb species (Table 6). This total includes 17 (31%) introduced species. One of them, rush skeletonweed (*Chondrilla juncea*) is on the Idaho noxious weed list (Idaho State Department of Agriculture 2019). The number of species tallied in a plot ranged from 11 to 32, with an average of 18 species for all plots. Gray rabbitbrush, cheatgrass, rush skeletonweed, and storksbill (*Erodium cicutarium*) were the only species recorded in all plots. Species recorded for the first time in 2019 included Japanese brome (*Bromus japonicus*), flixweed (*Descurainia sophia*), and garden burnet (*Sanguisorba minor*). These introduced species were recorded at trace cover (<1%) in 1 plot each.

The plant community methodology requires an increase or decrease of 2 cover classes between sampling periods to mark a change in abundance for a species. A non-statistical trend assessment was made for selected species based on comparing 2019 cover values to values from previous monitoring years (Table 7). The assessment found that each selected species had a stable trend or in some cases a fluctuating trend at the majority of plots. However, the assessment also found trends of increased or decreased abundance for several species in one or more plots. Regarding introduced grass species, the assessment found a trend of increased abundance for cheatgrass at 1 plot, for bulbous bluegrass (*Poa bulbosa*) at 2 plots, and for cereal rye (*Secale cereale*) at 3 plots. For native species the assessment found a trend of decreased abundance for gray rabbitbrush at 2 plots, for needle-and-thread grass (*Hesperostipa comata*) at 3 plots, and for red threeawn (*Aristida purpurea*) at 1 plot.

Bare ground was the most abundant ground cover attribute in 3 plots and litter the most abundant at 7 plots, in 2019 (Table 6). Moss/lichen cover was <5% in all plots.

## **DISCUSSION**

Monitoring in 2019 documents the decline in Mulford's milkvetch abundance at plots in the Boise Foothills compared to earlier 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, it is not known if the decrease in Mulford's milkvetch abundance has been a slow and steady process, or if the loss has accelerated the last few years. Monitoring in 2019 also documented a mean total ground disturbance lower than nearly all previous monitoring years. Animal digging and deer tracks were the primary ground disturbance factors at all plots outside Camels Back Reserve. These are disturbances not directly related to human activity. Disturbances at plots in Camels Back Reserve in 2019 included animal tracks likely dog-related, digging, footprints, and a walking trail, disturbances related to human activity except for the animal digging. A comparison of plant community monitoring data from 2019 and previous years suggests notable changes to the vegetation at several plots. These include decreases in needle-and-grass abundance at 3 plots and increases in cereal rye at 3 plots and bulbous bluegrass at 2 plots. Cover values for the invasive forbs blue bachelor buttons (*Centaurea cyanus*) and rush skeletonweed have remained relatively stable over the years. Rush skeletonweed occurs in all Mulford's milkvetch plots in the Boise Foothills, including in Middle Stewart Gulch where it was recorded for the first time in 2019.

Monitoring data collected in 2019 indicates the conservation status of Mulford's milkvetch in the Boise Foothills is in jeopardy. We recommend resampling Mulford's milkvetch monitoring plots on a more regular basis than done in the recent past – if not annually, then every other year. Consideration should also be given to expanding the monitoring program to include additional locations on Boise City, Ada County, BLM, and perhaps private (with landowner cooperation) lands in the Boise Foothills that support Mulford's milkvetch. Any expansion of the monitoring

program may want to consider a more comprehensive approach that takes other rare plant species known from the Boise Foothills into account, including Aase's onion (*Allium aaseae*), Boise sand-verbena (*Abronia mellifera* var. *pahoveorum*), and slickspot peppergrass (*Lepidium papilliferum*). The occurrence of multiple rare plant species points to the inherent biodiversity value of the Boise Foothills. The conservation of Mulford's milkvetch and these other Boise Foothill rare plant species will likely become more challenging as human population in the Boise metropolitan area continues to grow. Monitoring is one important tool that can help land managers meet these challenges with timely and relevant population, habitat condition, and disturbance information. Monitoring provides documentation upon which land managers can base conservation priorities and actions that benefit rare plant species in the Boise Foothills.

### Potential Conservation Actions

The Open Space Matters Reserve Management plan, 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). Soil disturbance and invasive species are likely two major factors associated with the overall decline of Mulford's Milkvetch populations in the Lower Boise Foothills. Potential management actions to reduce and mitigate these factors include fencing plant populations adjacent to highly-utilized recreational areas like Camel's Back, as well as habitat restoration in and around existing populations of Mulford's milkvetch. Research indicates that native plants can compete with invasive species like cheatgrass (*Bromus tectorum*) 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. Efforts will also be made to weed around existing plants, starting in 2020, to facilitate natural regeneration within populations. Few observations of Mulford's seedlings were recorded in 2019, and weeding around mature individuals may improve reproductive capacity, as the plants will have reduced weed competition and create open areas for seeds to naturally disperse and germinate when conditions are appropriate. There is also an opportunity to pursue Mulford's milkvetch propagation to supplement native populations and support genetic diversity of the species. Seed collection and nursery procedures will follow protocols outlined by the [Center of Plant Conservation](#) and the [Seeds of Success](#) programs and be conducted in partnership with plant professionals like the Idaho Botanic Garden.

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Figure 1. Number of reproductive and non-reproductive Mulford's milkvetch plants at monitoring plots in the Boise Foothills, 2000 – 2019. Values do not include seedling plants. Values from 2002 not shown because only on subset of plots sampled.

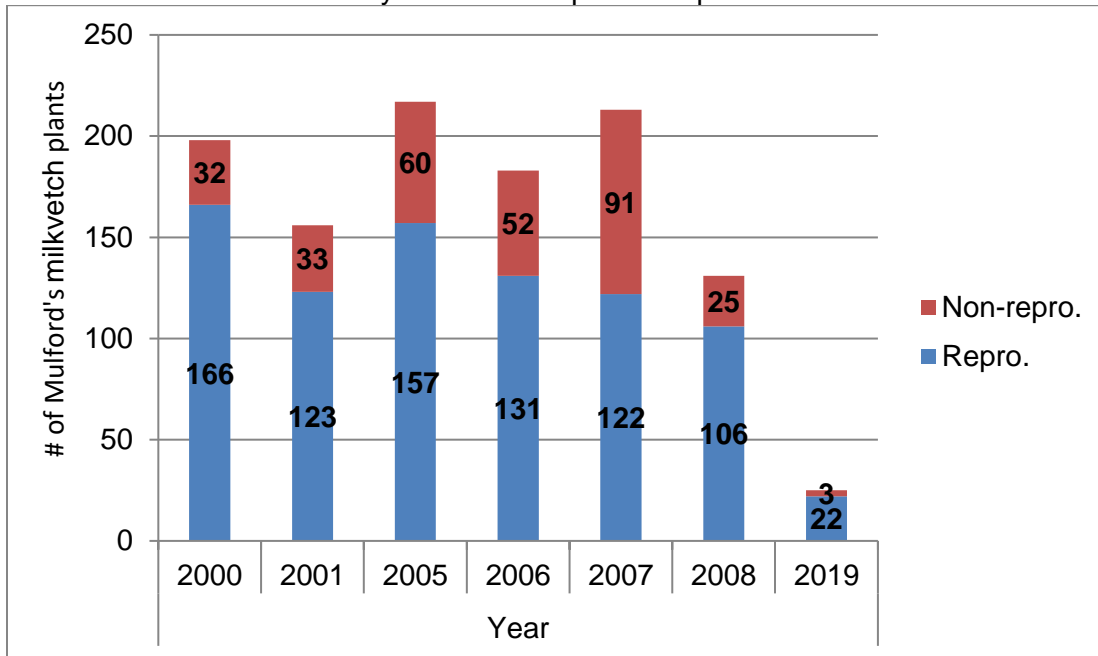


Figure 2. Overall mean total ground disturbance abundance at Mulford's milkvetch monitoring plots in the Boise Foothills, 2000 – 2019.

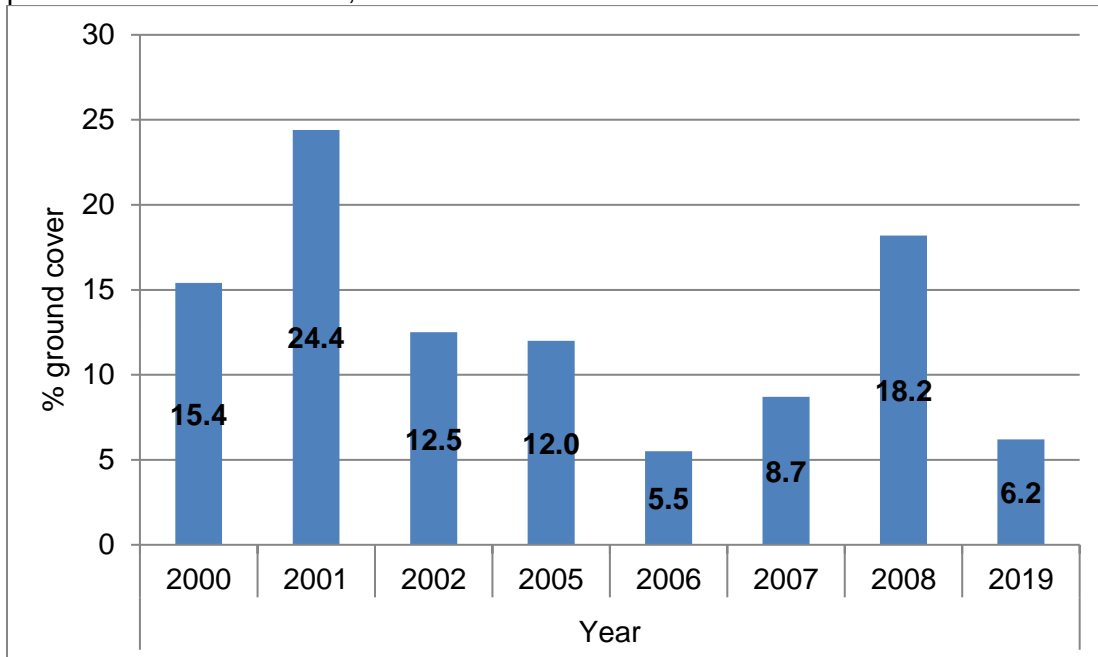


Table 2. Mulford's milkvetch census data for monitoring plots in the Boise Foothills, 1999 – 2019.

xx = no data collection (only a subset of plots sampled in 2002 and Plot 705 not sampled 2002 - 2008).

	# of reproductive plants by year									# of non-reproductive plants by year								
	99	00	01	02	05	06	07	08	19	99	00	01	02	05	06	07	08	19
15-1	no	6	7	8	9	5	7	1	1	no	1	0	1	0	4	1	0	0
18-1	no	7	13	xx	21	25	18	12	3	no	4	3	xx	12	5	13	4	0
18-2	no	33	13	xx	12	6	6	6	0	no	4	5	xx	0	11	0	0	0
700-1	no	6	2	1	0	0	1	0	0	no	0	0	0	2	0	0	0	0
701-1	no	18	15	6	5	1	1	1	0	no	1	0	1	0	0	0	0	0
701-2	no	41	26	29	29	44	32	27	0	no	7	13	13	11	6	23	6	0
705	no	9	10	xx	xx	xx	xx	xx	0	no	0	0	xx	xx	xx	xx	xx	0
706-1	no	6	6	3	1	0	0	0	0	no	1	0	0	0	0	0	0	0
708-1	no	5	6	4	10	4	0	1	0	no	1	0	0	1	3	1	1	0
715-1	12	13	5	xx	29	6	7	6	16	7	3	6	xx	20	5	39	7	3
715-2	6	8	5	xx	7	7	10	13	2	1	4	2	xx	0	3	3	1	0
715-3	11	14	15	16	32	33	40	39	0	12	6	4	13	14	15	11	6	0
<b>Total</b>	<b>29</b>	<b>166</b>	<b>123</b>	<b>68</b>	<b>155</b>	<b>131</b>	<b>122</b>	<b>106</b>	<b>22</b>	<b>20</b>	<b>32</b>	<b>33</b>	<b>28</b>	<b>60</b>	<b>52</b>	<b>91</b>	<b>25</b>	<b>3</b>
	# of seedling plants by year									Total # plants (all life stages) by year								
	99	00	01	02	05	06	07	08	19	99	00	01	02	05	06	07	08	19
15-1	no	0	0	3	0	0	0	0	0	no	7	7	12	9	9	8	1	1
18-1	no	16	18	xx	9	7	33	28	0	no	27	31	xx	42	37	64	44	3
18-2	no	43	13	xx	3	0	2	0	0	no	80	31	xx	15	17	8	6	0
700-1	no	0	0	0	0	0	0	0	0	no	6	2	1	2	0	1	0	0
701-1	no	1	0	0	0	0	1	2	0	no	20	15	7	5	1	2	3	0
701-2	no	9	8	3	2	3	37	3	0	no	57	47	45	42	53	92	36	0
705	no	0	0	xx	xx	xx	xx	xx	0	no	9	10	xx	xx	xx	xx	xx	0
706-1	no	3	0	1	0	0	3	0	0	no	10	6	4	1	0	3	0	0
708-1	no	9	0	0	0	0	6	0	0	no	15	6	5	11	7	7	2	0
715-1	20	55	141	xx	27	10	59	35	10	39	71	152	xx	76	21	105	48	29
715-2	3	15	4	xx	2	11	7	6	2	10	27	11	xx	9	21	20	20	4
715-3	0	5	9	6	7	0	38	10	0	23	25	28	35	53	48	89	55	0
<b>Total</b>	<b>23</b>	<b>156</b>	<b>190</b>	<b>13</b>	<b>50</b>	<b>31</b>	<b>186</b>	<b>84</b>	<b>12</b>	<b>72</b>	<b>354</b>	<b>346</b>	<b>109</b>	<b>265</b>	<b>214</b>	<b>399</b>	<b>215</b>	<b>37</b>

Table 3. Mulford's milkvetch tallies for off-transect areas at each monitoring plot, 2019.  
 --- = plant count did not differentiate between in and outside the 0.1 acre plant community plot.

Plot	# plants in 0.1 acre plant community plot	# plants outside plot zone	Total # plants off-transect
15-1	6	0	6
18-1 & 2	---	---	30
700-1	0	0	0
701-1 & 2	23	21	44
705	0	0	0
706-1	0	0	0
708-1	0	0	0
715-1	---	---	39
715-2	0	9	9
715-3	0	0	0
<b>Total</b>	29	30	128

Table 4. Total ground disturbance percent cover values at Mulford's milkvetch monitoring plots in the Boise Foothills, 2000 – 2019.

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

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

Table 5. Main ground disturbance factors at Mulford's milkvetch monitoring plots in the Boise Foothills, 2000 – 2019. Disturbance factors listed in order of 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
15-1	deer	deer	not specific	divot	deer	divot deer	divot	digging
18-1	divot	deer	xx	deer	deer divot	deer track	divot deer	deer
18-2	deer	deer	xx	divot deer	divot deer	deer divot tracks	divot wi trail deer	deer
700-1	not specific	not specific	not specific	digging	digging	digging	digging divot	digging
701-1	none	not specific	not specific	digging	divot	tracks	divot slough	digging tracks
701-2	not specific	not specific	not specific	footprint	divot deer	tracks	divot digging slough	digging tracks
706-1	not specific	divot	not specific	deer	digging	digging tracks	divot	digging
708-1	not specific	divot	not specific	digging divot	digging	digging divot	digging divot	digging
715-1	not specific	not specific	xx	slough	slough digging	slough digging divot	slough	trail tracks digging
715-2	not specific	not specific	xx	slough divot	slough	divot	deer divot	digging tracks
715-3	footprint	not specific	not specific	footprint digging	divot	divot digging	divot digging deer	tracks footprint

Descriptions for each disturbance factor are either self-explanatory or defined in the Ground Disturbance Methods section. Deer = deer tracks; Track = animal track; Digging = animal digging; Divot = divot; Slough = sloughing; Trail = trail used by people; Wi trail = wildlife trail; Footprint = human footprint; Not specific = disturbance factor(s) not specified on data sheet

Table 6. Percent canopy cover values for plant species recorded in Mulford's milkvetch plant community plots, 2019. Nomenclature follows Hitchcock and Cronquist (2018).

Species	Plot									
	700-1	701-1	705	706-1	708-1	715-1	715-2	715-3	15-1	18-1
<b>Shrubs</b>										
<i>Chrysothamnus viscidiflorus</i>				3		0.5	0.5		0.5	
<i>Ericameria nauseosa</i>	0.5	3	0.5	17.5	17.5	3	3	17.5	7.5	3
<i>Purshia tridentata</i>	7.5	3	7.5	17.5	0.5				0.5	17.5
<b>Total Shrubs</b>	7.5	7.5	7.5	37.5	17.5	3	7.5	17.5	7.5	17.5
<b>Graminoids</b>										
<i>Achnatherum hymenoides</i>				0.5						3
<i>Aristida purpurea</i>	0.5	17.5		3		0.5	0.5	3	3	
<i>Bromus japonicus</i>								0.5		
<i>Bromus tectorum</i>	62.5	17.5	62.5	62.5	85	7.5	62.5	62.5	85	7.5
<i>Hesperostipa comata</i>	0.5	7.5	0.5	3		3	3	0.5		
<i>Poa bulbosa</i>	0.5	17.5	0.5	0.5		37.5	0.5	0.5		3
<i>Poa secunda</i>		0.5		0.5		0.5	0.5		0.5	3
<i>Pseudoroegneria spicata</i>		0.5								3
<i>Secale cereale</i>	3	7.5	0.5	0.5	0.5	37.5	3	7.5		
<i>Vulpia myuros</i>			0.5							
<i>Vulpia octoflora</i>									0.5	
<i>Vulpia sp.</i>	0.5	0.5								
<b>Total Graminoids</b>	85	37.5	62.5	62.5	85	62.5	62.5	85	85	37.5
<b>Forbs</b>										
<i>Abronia mellifera</i>				0.5						
<i>Achillea millefolium</i>	0.5	0.5	0.5	0.5	0.5					
<i>Alyssum desertorum</i>					0.5	3	7.5	3		0.5
<i>Ambrosia artemisiifolia</i>						0.5				
<i>Amsinckia retrorsa</i>	0.5			0.5				0.5		
<i>Antennaria dimorpha</i>		0.5								
<i>Astragalus mulfordiae</i>		0.5				0.5				0.5
<i>Astragalus purshii</i>		0.5								
<i>Balsamorhiza sagittata</i>		3				0.5				
<i>Centaurea cyanus</i>	3	0.5			0.5		0.5	0.5		
<i>Chondrilla juncea</i>	3	3	0.5	0.5	0.5	0.5	3	3	3	0.5
<i>Commandra umbellata</i>				0.5						
<i>Crepis occidentalis</i>		0.5								
<i>Cryptantha sp. (annual)</i>	0.5	0.5	0.5					0.5		
<i>Delphinium sp.</i>										0.5
<i>Descurainia incana</i>										0.5



Species	Plot									
	700-1	701-1	705	706-1	708-1	715-1	715-2	715-3	15-1	18-1
<i>Descurainia sophia</i>					0.5					
<i>Draba verna</i>		0.5								
<i>Epilobium brachycarpum</i>	0.5									
<i>Eriogonum microthecum</i>										0.5
<i>Eriogonum ovalifolium</i>			0.5							0.5
<i>Erodium cicutarium</i>	7.5	0.5	0.5	0.5	0.5	3	3	3	0.5	3
<i>Grindelia squarrosa</i>		0.5								
<i>Holosteum umbellatum</i>								0.5		
<i>Lactuca serriola</i>		0.5								
<i>Lomatium simplex</i>		0.5								
<i>Machaeranthera canescens</i>		0.5				0.5				
<i>Mentzelia albicaulis</i>										0.5
<i>Oenothera pallida</i>		0.5				0.5	0.5			
<i>Oenothera contorta</i>								0.5	0.5	
<i>Phacelia hastata</i>	0.5		0.5	0.5			0.5			0.5
<i>Phacelia linearis</i>									0.5	0.5
<i>Phlox longifolia</i>		0.5								
<i>Plantago patagonica</i>		0.5						0.5	0.5	
<i>Salsola tragus</i>							0.5			
<i>Sanguisorba minor</i>		0.5								
<i>Sisymbrium altissimum</i>	3	0.5	0.5		0.5	3	0.5	0.5		
<i>Tragopogon dubius</i>		0.5							0.5	
<i>Triteleia grandiflora</i>	0.5	0.5				0.5	0.5			
<b>Total Forb</b>	17.5	7.5	3	0.5	0.5	7.5	17.5	7.5	3	3
<b>Ground cover</b>										
Bare ground	37.5	62.5	37.5	37.5	62.5	37.5	17.5	17.5	37.5	85
Litter	62.5	37.5	62.5	62.5	37.5	62.5	85	85	62.5	7.5
Moss/lichen	0	3	3	0.5	0.5	0.5	0	3	0.5	3

Table 7. Non-statistical trend assessment for selected plant species in Mulford's milkvetch plant community plots.

= = 2019 percent cover value similar (within 1 cover class) to one or more previous monitoring years (more or less stable or a fluctuating abundance trend).

+ = 2019 percent cover value 2 cover classes or more greater than any previous monitoring year (increase abundance trend).

- = 2019 percent cover value 2 cover classes or more less than any previous monitoring year (decrease abundance trend).

0 = species absent in plot for first time in 2019; 1 = species recorded in plot for the first time in 2019; 00 = species never recorded in the plot.

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>	=	=	=	=	=	=	1	00	00	00
<i>Ericameria nauseosa</i>	-	=	=	=	=	=	=	=	-	=
<i>Aristida purpurea</i>	-	=	=	=	0	=	0	1	=	=
<i>Bromus tectorum</i>	+	=	=	=	=	=	=	-	=	=
<i>Poa bulbosa</i>	=	=	=	+	=	=	=	+	=	=
<i>Poa secunda</i>	=	=	0	=	0	=	=	=	=	0
<i>Hesperostipa comata</i>	=	=	-	=	=	=	=	=	-	-
<i>Secale cereale</i>	00	00	=	+	=	=	1	+	=	+
<i>Centaurea cyanus</i>	00	00	=	=	00	=	=	00	=	=
<i>Chondrilla juncea</i>	=	1	=	=	=	=	=	=	=	=