MONITORING MULFORD'S MILKVETCH (*ASTRAGALUS MULFORDIAE*) ON THE OWYHEE FRONT: 2004 RESULTS

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Challenge Cost-Share Project
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ABSTRACT

Mulford's milkvetch (*Astragalus mulfordiae*) is a low, slender forb endemic to the western Snake River Plain in southwestern Idaho and adjacent eastern Oregon. It is on the Bureau of Land Management's (BLM) special status plant list for Idaho. In 2003, the BLM and Idaho Conservation Data Center initiated a program to monitor the long-term conservation of Mulford's milkvetch and its habitat in Owyhee County, Idaho. The monitoring protocol is designed to collect Mulford's milkvetch census, ground disturbance, and plant community trend information. Baseline monitoring information was collected at five Mulford's milkvetch occurrences in 2003. In 2004, these occurrences were resampled, and five additional occurrences were added to the monitoring program. In 2004, four of the occurrences with two years of census data showed a decline in reproductive individuals. The number of non-reproductive plants declined at all five occurrences. Seedling numbers were variable. In both 2003 and 2004, the most frequently recorded weed species was cheatgrass (*Bromus tectorum*). Another weed species, Russian thistle (*Salsola kali*) was not recorded in 2003, but was relatively common at several occurrences in 2004. Divots/compressions of uncertain origin were recorded more often than all other ground disturbance factors combined. Many were likely old animal (livestock or wildlife) tracks, but they lacked sufficient definition to confidently determine their origin. Motorcycle tracks were encountered only at the Noble Island occurrence. For the five occurrences with two years of data, 58% of the microplots had some level of ground disturbance in 2004, compared to 45% in 2003. The occurrences at Con Shea Basin and Noble Island had the most ground disturbance. This report provides a review of the monitoring methods, and a summary and discussion of our 2004 results.

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INTRODUCTION

Mulford's milkvetch (*Astragalus mulfordiae*) is a slender, spring-flowering perennial forb in the legume family endemic to southwestern Idaho and adjacent eastern Oregon. The Owyhee Front (an area bordered by the Snake River to the north and the Owyhee Plateau at higher elevations to the south) in northern Owyhee County represents one of three population centers for Mulford's milkvetch in Idaho. The other two are the Boise foothills and the Weiser areas. Mulford's milkvetch occurs on dry, sandy slopes, typically with a southerly or westerly aspect. In Owyhee County, it is usually associated with an open mix of desert shrubs and a suite of grass and forb species indicative of sandy habitats. Detailed information concerning the distribution, habitat, and ecology of Mulford's milkvetch is contained in other reports (e.g., Mancuso 1999a, Moseley 1989).

Most extant occurrences of Mulford's milkvetch in Idaho have <500 plants (Idaho Conservation Data Center 2005). Several occurrences in the Boise Foothills and Owyhee Front have been extirpated or reduced in size (Moseley 1989, U.S. Fish and Wildlife Service 1995). Mulford's milkvetch's limited distribution, tendency to occur in low numbers, and habitat loss and degradation problems have made it a conservation target for the Bureau of Land Management (BLM) in both Oregon and Idaho for many years. It is currently a Type 2 special status plant species for the Idaho BLM. The Type 2 category is reserved for species that are imperiled rangewide and have a high likelihood of being federally listed in the foreseeable future due to their global rarity and significant endangerment factors (Bureau of Land Management 2003).

Mulford's milkvetch is known from 14 widely scattered occurrences along the Owyhee Front, extending from near the town of Bruneau, westward for approximately 40 miles to near the town of Murphy. The majority of occurrences in the Owyhee Front are located on BLM property. In contrast, most occurrences elsewhere in Idaho are on private land. Conservation of the Owyhee Front population are center critical to ensure the species' long-term persistence in Idaho. BLM biologists and others have documented anthropogenic disturbances associated with reductions in population size and/or habitat quality at several Mulford's milkvetch occurrences in the Owyhee Front (Idaho Conservation Data Center 2005). The main conservation threat facing Mulford's milkvetch in Owyhee County is habitat degradation, especially weed invasion associated with wildfire, off-road motorized vehicles (ORVs), and livestock grazing disturbances (Moseley 1989; U.S. Fish and Wildlife Service 1995). Outright habitat loss tends to be more localized and mostly associated with user-created ORV trails and mining activities. All occurrences along the Owyhee Front are vulnerable to one or more of these threat factors.

Monitoring information is needed to help BLM resource managers be pro-active in their conservation efforts for Mulford's milkvetch, and meet their stewardship objective of maintaining viable populations of special status plant species on lands they administer within a multiple-use management framework. In 2003, the BLM Lower Snake River District contracted the Idaho Conservation Data Center (IDCDC) to begin a monitoring program for Mulford's milkvetch in northern Owyhee County. Six transects were established at five Mulford's milkvetch occurrences in 2003 (Mancuso and Miller 2004). This represented an initial step towards the goal of a comprehensive program to monitor all Mulford's milkvetch occurrences located on BLM property in Owyhee County and the Weiser area. The objective of the monitoring program is to provide long-term population and habitat trend information for Mulford's milkvetch occurrences. This report provides a review of the monitoring methods, and a summary and discussion of our 2004 results.

METHODS

In 2003, we established six monitoring transects at five Mulford's milkvetch occurrences located on BLM property in northern Owyhee County (Mancuso and Miller 2004). In 2004, six transects were established at five additional occurrences. The monitoring protocol we used was modified from methods initially developed to monitor Mulford's milkvetch in the lower Boise foothills (Mancuso 1999b, Mancuso 2001). At each occurrence, we conducted a reconnaissance to determine the distribution of Mulford's milkvetch in the area. To ensure adequate sampling, we subjectively located monitoring transects in areas with a relatively high abundance of Mulford's milkvetch plants. Table 1 lists the 10 occurrences and corresponding 12 transects presently established and included in the monitoring program.

Table 1. Mulford's milkvetch occurrences monitored in 2004.

Occurrence #	Occurrence name	USGS quadrangle	Legal description
4	Horse Hill	Sugar Valley	T8S R5E Sec 3
9	Mud Flat Road**	Purjue Canyon	T7S R3E Sec 6
10*	Vinson Wash**	Vinson Wash	T5S R3E Sec 30
11	Twentymile Gulch	Grand View	T6S R3E Sec 28
13*	Con Shea Basin	Initial Point	T2S R1W Sec 5
14*	Noble Island	Walters Butte	T1S R2W Sec 28
22*	SE of Guffey Butte	Walters Butte	T2S R2W Sec 12
23	West of Shoofly Creek	Chalk Hills	T6S R3E Sec 33
25*	Lower Vinson Wash	Vinson Wash	T5S R2E Sec 23
26	Sandhill Point	Vinson Wash	T5S R2E Sec 21

* = Occurrences monitored in both 2003 and 2004.
** = Occurrences with two monitoring transects.

Mulford's milkvetch census and ground disturbance monitoring information is collected along a variable length belt transect. A red-painted rebar stake hammered into the ground "permanently" marks the location and starting point for each transect. A large metal spike references the transect end point. Transects range in length from 10 to 30 m long. To sample, a metric tape is stretched between the start and end points. Beginning at the 1-m mark, a 1-m square quadrat (microplot) is aligned flush against the tape. Sampling occurs at each meter mark along the transect tape. Mulford's milkvetch census and disturbance factor information is recorded on monitoring forms developed for this project. Transect length and azimuth, side of tape sampled, and other sampling information for each transect is summarized in Appendix 1.

The map location for each transect is in Appendix 2. UTM coordinates obtained with a navigation grade (Garmin 12XL) GPS unit at each transect marker stake are listed in Appendix 3. To further help relocate monitoring plots in the future, Appendix 3 also includes a "Monitoring Site Location Form" completed for each transect. It provides directions, a sketch map with landmarks, and other relocation information. The Element Occurrence (EO) number (a numerical identifier for each occurrence in the IDCDC database) was used to label and identify each transect.

The monitoring protocol is designed to collect Mulford's milkvetch census information; ground disturbance information; plant community information; and photo point photographs. Protocols for each component of the monitoring program are outlined below.

Mulford's milkvetch census monitoring

Census and density information is collected by counting every Mulford's milkvetch plant rooted within the quadrat microplot and assigning each individual to one of three life stage class categories: (1) Reproductive stage class (R) - individuals with flowers and/or fruits; (2) Non-reproductive stage class (N) - non-flowering/fruiting individuals that are not seedlings; or (3) Seedlings (S) - tiny germinants, usually <2 cm tall; cotyledons are sometimes present, along with one or occasionally two pair of leaves. In addition to stage class, the location of each Mulford's milkvetch plant is recorded by referencing the appropriate microplot frame cell in which the plant occurs. The microplot plot frame is divided into nine equal segments or cells referenced by the letters A through I (see below). As an example: a microplot contains one reproductive plant in cell A, and a cluster of five seedlings in cell F. This is recorded on the data sheet as A/R and F/S5, respectively.

A	B	C
D	E	F
G	H	I

One-square meter microplot frame and microplot reference cells. Cell "A" is positioned so it is at the top, left corner, similar to reading a page of newsprint.

Disturbance factor monitoring

Information regarding a series of disturbance attributes is recorded for each microplot along the transect, including:

(1) Weed species – cover of non-native weed species rooted within the microplot is estimated and assigned to one of the following five cover class values: 1 = <1% (trace); 2 = 1 - 10%; 3 = 11 - 25%; 4 = 26 - 50%; 5 = >50%. Cover class represents the percentage of the microplot area occupied by the weed species. A total weed cover class is also assigned to each microplot.

(2) Ground disturbances – cover of surface disturbances such as ORV tracks, wildlife or cattle prints, or other disturbances occurring within each microplot. The cover of each disturbance factor is estimated and assigned to one of the five cover classes described above. The assigned value represents the percentage of ground surface within the microplot clearly broken, crushed, or sloughed for each type of ground disturbance. A total ground disturbance cover class is also assigned to each microplot.

(3) Insect damage and disease – each plant is inspected for evidence of insect and/or disease damage. Individual plants and associated damage are referenced on the field data sheet.

(4) Herbivory and trampling - each plant is inspected for evidence of non-insect herbivory or trampling damage. Individual plants and their associated damage are referenced on the field data sheet.

Plant community monitoring

At each transect, plant community and other ecological data are collected for Mulford's milkvetch habitat using the methods of Bourgeron et al. (1992). Plant community information is based on visual estimates of cover class values for all vascular plant species occurring in a 0.03-ha (0.1-ac) circular plot (11.3-m; 37-ft radius). Estimates are also made for ground cover

categories such as bare ground, litter, and microbiotic crust. Two forms are used to collect the plot information, a “Community Survey Form”, and an “Ocular Plant Species Data Form”. Plant community cover class values are as follows:

1 = <1%	30 = 25 – 34.9%	70 = 65 – 74.9%
3 = 1 – 4.9%	40 = 35 – 44.9%	80 = 75 – 84.9%
10 = 5 – 14.9%	50 = 45 – 54.9%	90 = 85 – 94.9%
20 = 15 – 24.9%	60 = 55 – 64.9%	98 = 95 – 100%

Cover class midpoints are used for discussing results. Plant community changes are monitored by comparing the plant species and cover class values recorded one year against another year. This method has an acceptable accuracy standard of +/- one cover class and requires an increase or decrease of two or more classes to indicate measurable change.

The plant community plot center is determined by measuring 11.3 m from the transect rebar marker stake using an azimuth perpendicular to the transect azimuth (transect azimuth + 90^0). This positions the rebar stake at the edge of the plot and minimizes trampling along the transect while collecting plant community information. Deviations from this layout are explained in the transect sampling notes (Appendix 3).

Photo points

Photo point photographs provide a visual, time-lapse record of the vegetation and other habitat characteristics for each monitoring site. Repeat photo monitoring is useful to document site-specific change or lack of change to landscape features of interest (Hall 2001). In 2003, all photographs were taken using a wide-angle setting and 35 mm print film. In 2004, photographs were taken using a 35 mm camera at some transects, and a digital camera at others. A complete switch to digital images is being considered for future monitoring years. The rebar stake marking the location of the transect serves as the reference point (the photo point) from which the photos are taken. A minimum of six photos are taken at each monitoring site. Four photos, at 0^0, 90^0, 180^0, and 270^0 bearing are taken at each photo point. They provide a panoramic overview of the monitoring site area. Two additional photos are taken; one from 3 m behind the rebar stake along the transect azimuth, the other from 3 m behind the end stake along the back azimuth. Additional photos to show the rebar marker stake, the vegetation plot, disturbances, or some other landscape feature are optional.

RESULTS

Monitoring was conducted between May 4 and June 18, 2004. Monitoring stations are now established at 10 of the 13 known occurrences located on BLM property in Owyhee County. Despite thorough surveys, we were unable to find any Mulford’s milkvetch at the South of Sugar Valley (EO 2) and East of Little Valley (EO 5) occurrences. Transects were not established at these two occurrences because plants were not found. No attempt was made to relocate Mulford’s milkvetch at the North of Twentymile Gulch (EO 24) occurrence.

Mulford’s milkvetch census monitoring

A total of 279 Mulford’s milkvetch plants were tallied at the 12 transects monitored in 2004. The number of plants/transect ranged from 3 to 90. Overall, non-reproductive plants were the most common life stage, and reproductive plants the least common. Non-reproductive plants were the only life stage class represented on every transect. Four transects had no reproductive plants, and all had <10 reproductive individuals. Census information for 2004 is summarized in Table 2. Copies of the 2004 census information field data sheets are in Appendix 4.

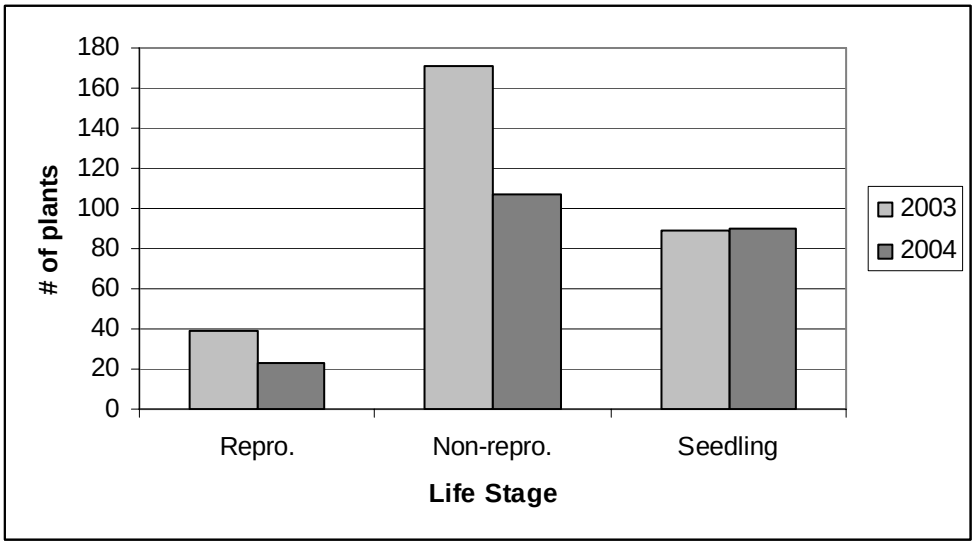
Two years of census information for the six transects established in 2003 is included in Table 2. Five of the transects with two years of census data showed a decline in reproductive individuals compared to 2003. The number of non-reproductive plants declined at all six transects. Seedling numbers had variable results. Two transects (10-1 and 10-2) had no reproductive plants in either 2003 or 2004. Figure 1 summarizes the two year census dataset for the six transects.

Table 2. Mulford's milkvetch census monitoring information, 2003 and 2004. Life stage percentages for each transect are in parentheses.

Transect	Transect length (m)	# plants		Reproductive		Non-reproductive		Seedling	
		2003	2004	2003	2004	2003	2004	2003	2004
04-1	15	-	3	-	2 (67)	-	1 (33)	-	0
09-1	20	-	13	-	0	-	11 (85)	-	2 (15)
09-2	15	-	18	-	0	-	13 (72)	-	5 (28)
10-1	20	50	30	0	0	47 (94)	20 (67)	3 (6)	10 (33)
10-2	25	84	90	0	0	70 (83)	66 (73)	14 (17)	24 (27)
11-1	10	-	5	-	2 (40)	-	3 (60)	-	0
13-1	20	51	37	7 (14)	5 (14)	22 (43)	6 (16)	22 (43)	26 (70)
14-1	25	27	9	5 (19)	5 (56)	17 (62)	4 (44)	5 (19)	0
22-1*	30	30	23	18 (60)	7 (30)	8 (27)	6 (26)	4 (13)	10 (44)
23-1	15	-	8	-	1 (13)	-	6 (75)	-	1 (13)
25-1	30	57	31	9 (16)	6 (19)	7 (12)	5 (16)	41 (72)	20 (65)
26-1	30	-	12	-	1 (8)	-	6 (50)	-	5 (42)
Sum		299	279	39 (13)	29 (10)	171 (57)	147 (53)	89 (30)	103 (37)

* sampling method not the same both years
- not sampled in 2003

Figure 1. Mulford's milkvetch census information, 2003 and 2004. N = 6 transects.



Mulford's milkvetch demographic information

Life stage census data can be used to generate demographic information for Mulford's milkvetch. The annual fate of individual plants can be categorized using the three census life class stages as follows:

Reproductive to reproductive (R – R)
Reproductive to Non-reproductive (R – N)
Reproductive to absent (R – 0)
Non-reproductive to Non-reproductive (N – N)
Non-reproductive to Reproductive (N – R)
Non-reproductive to absent (N – 0)
Seedling to Seedling (S – S)
Seedling to Non-reproductive (S – N)
Seedling to absent (S – 0)

Life stage class information collected for 269 Mulford's milkvetch plants at five transects in 2003 was compared to the corresponding 2004 census dataset. The fate of most 2003 plants was to either remain in the same life stage or to be absent in 2004. Very few changed life state class. The majority (57%) of reproductive plants in 2003, continued to be reproductive in 2004. However, one-third (33%) of the reproductive plants were absent the second year. Most non-reproductive plants (71%) and seedlings (85%) tallied in 2003 were absent in 2004. Demographic details for the two-year dataset are summarized in Table 3.

Table 3. Fate of Mulford's milkvetch plants between 2003 and 2004. N = 269 individuals.

Transect	**Life stage transition changes**								
	R - R	**R - N**	**R - 0**	**N - N**	**N - R**	**N - 0**	**S - S**	**S - N**	**S - 0**
10-1				15		32			3
10-2				26		44	3	3	8
13-1	4	1	2	1	1	20	3		19
14-1	4		1	1	1	15			5
25-1	4	1	4	1	2	4	4		37
Sum (%)	12 (57)	2 (10)	7 (33)	44 (27)	4 (2)	115 (71)	10 (12)	3 (3)	72 (85)

Disturbance factor monitoring

Weed species

Five weed species were observed along the 12 monitoring transects in 2004. Three of the species, halogeton (*Halogeton glomeratus*), tall tumblemustard (*Sisybrium altissimum*), and prickly lettuce (*Lactuca serriola*) were restricted to one or two transects. The most frequently recorded weed species was cheatgrass (*Bromus tectorum*). It occurred in 187 (73%) of the 255 transect microplots sampled in 2004. It was the only weed species found at every transect, including every microplot for six transects. Russian thistle (*Salsola kali*) was another weed species frequently recorded. It occurred in 113 (44%) of all the microplots sampled, including every microplot at three transects. Copies of the weed/ground disturbance field data sheets are in Appendix 5. Appendix 6 contains a spreadsheet of the 2004 weed dataset. Weed species data are summarized in Tables 4 and 5.

For the six transects with two years of comparative data, the most frequently recorded total weed cover class changed from 1 (<1% cover) in 2003, to 2 (1-10% cover) in 2004. However, the number of microplots with total weed cover class 3 (11-25% cover) and 4 (26-50% cover) decreased in 2004 compared to 2003. Cheatgrass was the most common weed species recorded at the six transects in 2003. It was also common along the majority of these transects in 2004. The exceptions being the two Vinson Wash transects (10-1 and 10-2), which had cheatgrass in nearly all microplots in 2003, but only a few in 2004. Russian thistle was not recorded in 2003, but was regularly encountered at three transects monitored both years. Figure 2 provides a comparison of the two year weed abundance dataset for the six transects with two years of monitoring information.

Table 4. Weed species recorded at each transect, 2004.

Transect	**# micro-plots**	**Percentage of transect microplots with each weed species**				
		Cheatgrass	Russian thistle	Halogeton	Tall tumblemustard	Prickly lettuce
04-1	15	100	100	0	20	0
09-1	20	85	0	10	0	0
09-2	15	67	0	20	0	0
10-1	20	10	0	0	0	0
10-2	25	8	0	0	0	0
11-1	10	100	0	0	0	0
13-1	20	100	65	0	0	0
14-1	25	100	0	0	0	0
22-1	30	100	83	0	0	3
23-1	15	53	0	0	0	0
25-1	30	60	100	0	0	0
26-1	30	100	100	0	0	0

Table 5. Weed cover class summary, 2003 and 2004.

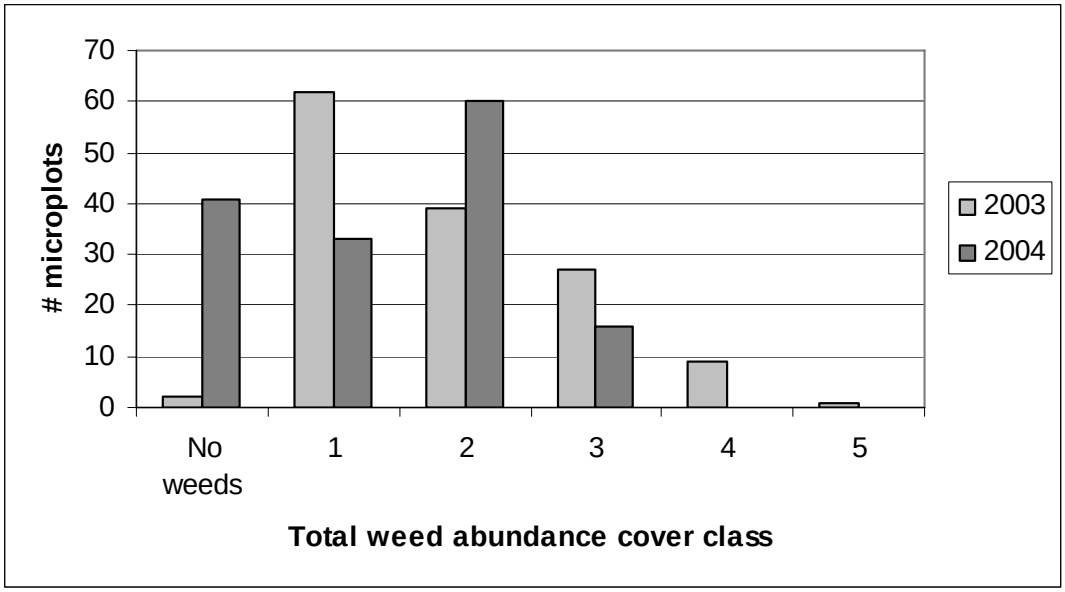
Transect	**# micro-plots**	**Percentage of transect microplots for each total weed cover class**											
		No weeds		**cover class 1**		**cover class 2**		**cover class 3**		**cover class 4**		**cover class 5**	
		2003	**2004**	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**
010-1	20	10	90	85	10	5	0	0	0	0	0	0	0
010-2	25	0	92	96	8	4	0	0	0	0	0	0	0
013-1	20	0	0	0	0	15	80	70	20	15	0	0	0
014-1	25	0	0	0	40	36	48	40	12	20	0	4	0
022-1	30*	0	0	50	30	35	53	10	17	5	0	0	0
025-1	30	0	0	37	33	60	53	3	13	0	0	0	0

*20 microplots in 2003

Ground disturbance

The loose, sandy soil characterizing Mulford's milkvetch habitat readily leaves evidence of sloughing, compression, churning, and other disturbances. Ground disturbances identified at the transects included divots/compressions of uncertain origin, motorcycle tracks, road edges, cow feces, small burrows, and human footprints. Ground disturbances were recorded at all transects

Figure 2. Microplot total weed cover class summary, 2003 and 2004. N = 6 transects.



except one (transect 09-2). Slightly less than one-half (48%) of the 255 transect microplots sampled in 2004 had evidence of ground disturbance. Most (77%) microplots with evidence of disturbance had total ground disturbance cover <10% (cover class 1 or 2). No microplots had >50% (cover class 5) total ground disturbance cover.

Divots/compressions of uncertain origin were recorded at nine (75%) of the transects, more than any other type of ground disturbance. Overall, divots/compressions of uncertain origin were recorded in 28% of the 255 microplots sampled, more often than all the other ground disturbance types combined. The divots/compressions varied in size, but were usually round in outline, with either smooth or irregular edges. Many were likely old animal (livestock or wildlife) prints, but they lacked sufficient definition to confidently determine their origin. Low cover class values of old cattle feces were recorded at seven (53%) of the transects. Small holes or burrows were also recorded at the majority (53%) of transects. Species responsible for creating the holes were unknown, although it was thought to be lizards in some cases. Motorcycle tracks were encountered only at the Noble Island transect. A few microplots at one of the Vinson Wash transects (10-1) accounts for all of the road edge disturbance recorded.

For the six transects with two years of data, 58% of the microplots sampled had some level of ground disturbance in 2004, compared to 45% in 2003. In both 2003 and 2004, the transects at Con Shea Basin and Noble Island had the most ground disturbance. Ground disturbance data collected in 2004 are outlined in Table 6. Table 7 and Figure 3 summarizes microplot ground disturbance results for the six transects with two years of monitoring information. Appendix 7 contains spreadsheets summarizing ground disturbance data in more detail.

Table 6. Ground disturbances recorded at each transect, 2004.

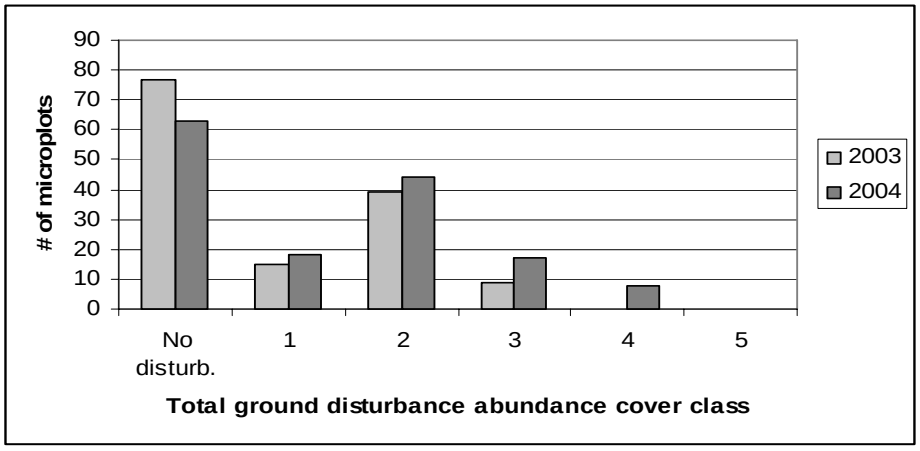
Transect	#microplots	Percentage of transect microplots with each ground disturbance					
		Unknown divots	Cattle feces	Small burrow	Motor tracks	Road edge	Footprint
04-1	15	53	0	20	0	0	0
09-1	20	0	0	5	0	0	0
09-2	15	0	0	0	0	0	0
10-1	20	5	5	0	0	20	0
10-2	25	4	12	0	0	0	0
11-1	10	40	20	30	0	0	0
13-1	20	100	20	0	0	0	0
14-1	25	36	0	8	68	0	0
22-1	30	43	3	0	0	0	7
23-1	15	13	0	40	0	0	0
25-1	30	47	13	10	0	0	0
26-1	30	0	23	10	0	0	0

Table 7. Total ground disturbance summary, 2003 and 2004. Cover classes are defined in the methods.

Trans.	#micro-plots	Percentage of microplots for each total ground disturbance cover class											
		no disturb.		cover class 1		cover class 2		cover class 3		cover class 4		cover class 5	
		2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
10-1	20	85	70	5	10	10	20	0	0	0	0	0	0
10-2	25	76	84	16	16	8	0	0	0	0	0	0	0
13-1	20	5	0	5	0	80	5	10	60	0	35	0	0
14-1	25	20	8	8	12	52	60	20	16	0	4	0	0
22-1	30*	45	50	20	10	25	40	10	0	0	0	0	0
25-1	30	87	37	10	20	3	40	0	3	0	0	0	0
Total (%)	150**	77 (55)	63 (42)	15 (11)	18 (12)	39 (29)	44 (29)	9 (6)	16 (11)	0	8 (5)	0	0

*20 microplots in 2003; ** 140 microplots in 2003

Figure 3. Microplot total ground disturbance cover class summary, 2003 and 2004. N =6 transects.



Insect damage and disease

Evidence of insect damage or disease on Mulford's milkvetch plants was not observed at any of the monitoring transects in 2004. Owen et al. (1994) reported a rust that infects Mulford's milkvetch throughout its range. Plants with lesions indicative of infection were not observed at any of the transects.

Herbivory and trampling

Herbivory was recorded on three Mulford's milkvetch plants at SE of Guffey Butte. In all cases one or more branches were obviously nipped off. Some of the branches likely had flowers and/or fruits as all of the nipped plants were larger, reproductive individuals. It was unclear which animal species was responsible for the herbivory. In 2003, four Mulford's milkvetch plants at the same transect had branches nipped off, most likely by deer or rabbits. Herbivory was noted on several plants at the Lower Vinson Wash transect in 2003, but not in 2004. Trampling of Mulford's milkvetch plants was not observed at any of the transects.

Plant community monitoring

Plant community information was collected at each circular plot. The vegetation at most sites is characterized by an open mix of desert shrub species, low grass species diversity, and a relatively diverse suite of forbs, all with low cover. Bare ground (sand) comprises most of the ground surface at all plots. Biological crust cover is sparse when present. A total of 59 vascular plant species were tallied for the 11 plots in 2004, including 12 shrub, 7 grass, and 40 forb taxa. Twenty-two of the forb species are perennial, and 18 are desert annuals. The number of vascular plant species in the plant community plots ranged from 15 to 28.

In 2004, total shrub cover within the plots ranged from 3 – 20%. No shrub species had cover >10% in any of the plots. Green rabbitbrush (*Chrysothamnus viscidiflorus*) and fourwing saltbush (*Atriplex canescens*) had the highest constancy among shrub species. Total graminoid cover ranged from 3 – 30%, with most plots having values of either 3% or 10%. Cheatgrass, Indian ricegrass (*Oryzopsis hymenoides*), and needle-and-thread (*Stipa comata*) all had high constancy. Individual grass species rarely had cover >3%. Total forb cover never had cover >10%. In addition to Mulford's milkvetch, three annual forbs, white-stemmed mentzelia (*Mentzelia albicaulis*), purple nama (*Nama aretiodes*), and rusty lupine (*Lupinus pusillus*) had high constancy in the plots. Six other forb species, all annuals, were found in at least one-half of the plots. Fifteen forb species were recorded in one plot, but none of the others. Forb species cover was consistently low, and none were >3%.

One introduced grass and four introduced forb species were recorded in 2004. The most prevalent weedy species were cheatgrass, present in 90% of the plant community plots, and Russian thistle, found in 63% of the plots. In 2003, a species of wheatgrass (*Agropyron* spp). common at Vinson Wash (transect 10-2) was recorded as an introduced cultivar. It may actually be western wheatgrass (*A. smithii*), a native species, but no flowering material was observed in 2004 to confirm its identification. Noxious or aggressive perennial weedy forb species such as rush skeletonweed (*Chondrilla juncea*) were not recorded within any of the Mulford's milkvetch occurrences.

Cheatgrass decreased two or more cover classes at two of the six plots with two years of monitoring information. At Noble Island, cheatgrass had a 30% cover in 2003, but only 3% in 2004. At SE of Guffey Butte, the cheatgrass cover declined from 10% in 2003, to <1% in 2004. Total graminoid cover was reduced by comparative amounts for each plot. No other plant community changes were detected for the six plots based on the two cover class requirement used for the monitoring protocol. All plots with two years of plant community data had one of

more forb species recorded in 2003 that were absent in 2004. These were almost all annual species found at <1% cover in 2003.

All transects occur in mix desert shrub community types. Transects 04-1, and 10-1 have Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and may represent the Wyoming sagebrush/needle-and-thread grass habitat type (Hironaka et al. 1983). Transects 14-1, 23-1, and 26-1 occur in an undescribed mix desert shrub/needle-and-thread community type; transects 09-1, 10-2, 11-1, 22-1, and 25-1 in an undescribed mix desert shrub/Indian ricegrass community type; and transect 13-1 in an undescribed mix desert shrub/cheatgrass community type. Copies of our plant community field data sheets are in Appendix 8. The complete plant community dataset for 2003 and 2004 in spreadsheet format is in Appendix 9.

Photo points
All photographs were labeled, organized in a three-ring binder, and submitted to the Lower Snake River District BLM. A duplicate set is on file at the IDCDC in Boise.

GENERAL OBSERVATIONS

Horse Hill (transect 04-1): A total of four Mulford's milkvetch plants were found during a thorough survey of the subpopulation area. The area was less weedy than most of the surrounding landscape. A few dry feces were present, but no recent cattle sign were observed near the transect. No ORV tracks were observed in the general transect area, although a dry drainage bottom west of the transect probably receives some level of use.

Mud Flat Road (transects 09-1 and 09-2): An estimated 150 Mulford's milkvetch plants were observed in the subpopulation. None of the plants were reproductive. Over 90% of the plants were <5 cm tall and <10 cm wide. Many individuals appeared to be seedlings at first glance, but were simply very small "adult" plants. Dry feces were scattered, but no recent cattle sign was observed in the transect area. Evidence of recent ORV use was not seen. The general transect area appeared largely undisturbed except for the old ORV trail running along the Poison triangulation point ridgeline.

Vinson Wash (transect 10-1): The subpopulation was estimated to have 50-100 Mulford's milkvetch plants. The majority were <3 cm tall; the largest roughly 5 cm tall. No reproductive plants were observed. Cheatgrass was rare in the general subpopulation area. Dry feces were scattered, but no recent evidence of cattle use was observed in the area. A two-track dirt road bisects the Mulford's milkvetch subpopulation, but appears to receive little use. Evidence of motorized use in the transect area was restricted to this road. In 2003, an estimated 100 -150 Mulford's milkvetch plants were observed within the subpopulation. Nearly all (>90%) individuals were non-reproductive. The majority were only 5 cm tall or less and had relatively few leaves

Vinson Wash (transect 10-2): An estimated 100+ Mulford's milkvetch plants were counted in the subpopulation area. The majority were <3 cm tall, and none >5 cm tall. No reproductive plants were observed. Dry feces were scattered and fairly common, but no evidence of recent cattle use was observed in the area. No evidence of ORV disturbance was observed in the immediate transect area, although a well-worn single-track motorcycle trail followed the small gully that separates transects 10-1 and 10-2. In addition, there were a few single-use motorcycle tracks located approximately 50 m southeast of the transect zone. In 2003, 100 -150 Mulford's milkvetch plants were observed over an approximately 0.2 ha (0.5 ac) subpopulation area. Most individuals were ca 5 cm tall, and none exceeded 10 cm in height. None of the plants were reproductive.

Twentymile Gulch (transect 11-1): A total of approximately 20 Mulford's milkvetch plants were counted in the subpopulation area. Only a few were reproductive. A few dry feces were present in the area, but no recent cattle sign was observed. No ORV tracks were observed in the immediate transect area. However, an occasionally used track cut diagonally upslope from the wash bottom and passes downslope of the transect zone.

Con Shea Basin (transect 13-1): Fewer than 50 Mulford's milkvetch plants were seen in the general transect area. Small (seedling) Mulford's milkvetch plants were less common compared to 2003. Numerous divots were present on the sandy slope above the transect. Although definition of the divots had degraded enough to preclude positive identification, the depth of the depressions and numerous feces in the area strongly suggested they were from cattle prints. Cheatgrass was commonly rooted in the divots. No evidence of ORV use was observed in the immediate transect area. In 2003, the transect area supported Mulford's milkvetch plants of various size, including several large individuals up to 30 cm tall with >100 fruit pods. Mulford's milkvetch occurred uphill and downslope of the transect. Including seedlings, >100 genets were observed at the subpopulation.

Noble Island (transect 14-1): The subpopulation area appeared quite dry, with short-stature cheatgrass plants and low native forb abundance and diversity. Only relatively large Mulford's milkvetch plants were observed and seedlings appeared to be absent. No evidence of livestock use was observed in the general area. ORV tracks (all motorcycle?), including several recent treads occurred along and near the transect. In addition, several well-used, main ORV trails occurred within 50 – 100 m of the transect. In 2003, most Mulford's milkvetch plants were small, approximately 5 cm in height.

SE of Guffey Butte (transect 22-1): Sixty "adult" Mulford's milkvetch plants of various size were tallied in the general transect area. An unknown number of seedlings also occurred. A few dry feces were present, but no recent cattle use was observed in the general transect area. Off-road motorcycle tracks occurred on nearby ridges, but none were seen in the transect area. In 2003, an estimated 50 –100 Mulford's milkvetch plants were scattered over roughly 0.2 acre in the general transect area. Only a few additional plants were observed outside this limited zone. Reproductive plants varied in size from 7 to 20 cm tall.

West of Shoofly Creek (transect 23-1): A total of approximately 15 Mulford's milkvetch plants were found during a thorough survey of the subpopulation area. Most plants were non-reproductive. A few dry feces were present, but no evidence of recent cattle use was observed in the general transect area. No ORV tracks were observed in the immediate transect area. However, a substantial off-road trail traverses the sandy ridgecrest located approximately 30 m uphill from the transect.

Lower Vinson Wash (transect 25-1): At least 30 Mulford's milkvetch plants were counted during a cursory survey of the subpopulation area. All size classes were represented, but reproductive plants had only a few fruits each. Dry feces were scattered, but no recent cattle sign was observed near the transect. ORV tracks were absent from the general transect area. In 2003, approximately 50 Mulford's milkvetch plants were observed within the subpopulation. All were <15 cm in height, mostly <10 cm. Reproductive plants contained relatively few flowers.

Sandhill Point (transect 26-1): A thorough survey of 0.2 ha (0.5 ac) in the occurrence area located only 10 Mulford's milkvetch plants. All were <10 cm tall, and their small, wispy habit made them hard to see. Scattered dry feces were present, but no evidence of recent cattle use

was observed in the general transect area. No ORV tracks were observed in the general transect zone, but they could be seen on slopes to the north and east.

DISCUSSION

The monitoring program is designed to document long-term trends in Mulford's milkvetch population, weed species, ORV use, livestock trampling, and other measured attributes. Research in Oregon has shown Mulford's milkvetch population numbers can fluctuate substantially over time (Bureau of Land Management 1998, Pyke 1996, J. Findley, BLM botanist, pers. comm.). For this reason, two years of monitoring information is insufficient to assess Mulford's milkvetch population trends for occurrences being monitored in Owyhee County. It will be several more years until we can evaluate population trends. Preliminary evidence from transects with two years of census information substantiate the pattern observed in Oregon that plant numbers can be dynamic one year to the next.

With only one, or in some cases two years of monitoring data, it is also premature to evaluate trends in habitat condition. Cheatgrass is established within all the monitoring sites, but its abundance may fluctuate annually. Cheatgrass cover decreased at the Noble Island and SE of Guffey Butte monitoring sites in 2004. In 2004, microplot cover class values for cheatgrass were lower at most transects with two years of monitoring information. It is unclear if reductions in cheatgrass abundance were influenced more by annual environmental factors or disturbance patterns. Russian thistle, which was not recorded in 2003, was prevalent at three transects in 2004. The monitoring program will serve as an early warning detection system for new weed invasions and allow timely control measures to be implemented.

Most transects with two years of monitoring information had similar ground disturbance values in 2003 and 2004. The primary exception was at Con Shea Basin which had higher cover of 'divots of uncertain origin' in 2004. Although definition of the divots had degraded enough to preclude positive identification, the depth of the depressions and numerous feces in the area strongly suggested they were from cattle prints. Motorcycles tracks continued to be the main ground disturbance at Noble Island, and were slightly more abundant than in 2003. Monitoring results indicate the Con Shea Basin and Noble Island occurrences may need closer management scrutiny if a management goal is to minimize ground disturbing activities at these Mulford's milkvetch sites.

SE of Guffey Butte

In 2003, census and ground disturbance information was collected differently than the other transects at SE of Guffey Butte (Mancuso and Miller 2004). In 2004, the transect was re-established to collect monitoring information in the same manner as all the other plots. Because of this change, a direct comparison between the first and second year monitoring data is not possible for this site. However, results from the two year dataset can be compared to obtain an overall pattern of similarities or differences. Plant community information was collected the same as at other plots both years.

Monitoring protocol recommendation

The most subjective component of the census monitoring protocol is consistently distinguishing Mulford's milkvetch seedlings from small non-reproductive plants that look similar to, but are not recent germinants. Seedlings can be readily distinguished if cotyledons are present, but these initial leaves are deciduous at some point. To minimize uncertainty and inconsistent interpretation in the field, we recommend adding a life stage class intermediate between the seedling and non-reproductive classes as follows:

Seedling (S) = seedlings; tiny plants <2 cm tall, or larger plants if cotyledons present
Small plants (P) = plants >2 cm tall, but < 4 cm in height with no cotyledons present
Non-reproductive (N) = non-flowering/fruiting individuals >4 cm tall
Reproductive (R) = individuals with flowers or fruits

The new “small plants” class may in reality represent seedlings (especially if observed later in the spring or early summer), or individuals that are probably young, but still at least one-year old (especially if observed early in the season, or perhaps during a dry period). With this modification, the “seedling” class will represent current year germinants, as well as possibly very small non-reproductive plants that are at least one year old.

We plan to expand the program to include Mulford’s milkvetch occurrences located on BLM property in the Weiser area in 2005. We would also like to again try and relocate and establish monitoring stations at the Mulford’s milkvetch occurrences at South of Sugar Valley and East of Little Valley, south of Bruneau. It is clear that Mulford’s milkvetch is one of the rarest and most vulnerable BLM special status plant species in southwestern Idaho. The Mulford’s milkvetch monitoring program is intended to assist the BLM in their efforts to ensure the long-term conservation of Mulford’s milkvetch on lands they manage.

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Appendix 1

Transect sampling information.

All compass readings taken with declination set at 16°.

Horse Hill (04) – Transect 04-1

Transect length = 15 m
Transect bearing = 20°
Transect sampled on the west (left-hand) side of tape

Plant community circular plot: plot center is located 11.3 m (37 ft) @ 110° from the transect rebar marker stake. This positions the stake at the downhill edge of the 0.1 ac plot.

The red rebar marker stake is at ground level atop a very slightly raised sand mound (not a unique feature in the area). The end stake (red-painted, 12 inch nail) is located at the 15.5-m mark of the transect tape, on a slightly raised sandy spot.

Mud Flat Road (09) – Transect 09-1

Transect length = 20 m
Transect bearing = 55°
Transect sampled on the north (left-hand) side of tape

Plant community circular plot: plot center is located 11.3 m (37 ft) @ 145° from the transect rebar marker stake. This positions the stake at the edge of the 0.1 ac plot.

The red rebar marker stake is at ground level near the base of a small, approximately 0.3 m tall fourwing saltbrush shrub, and about 1.5 m east of the center of a ridgecrest “trail”. The end stake (red-painted, 12 inch nail) is located at the 21-m mark of the transect tape at the base of a dead, broken shrub skeleton, approximately 1 m from the center of the ridgecrest trail.

Mud Flat Road (09) – Transect 09-2

Transect length = 15 m
Transect bearing = 295°
Transect sampled on the north (right-hand) side of tape

Transect 09-2 is adjacent to 09-1, and the same plant community plot serves for both transects.

The rebar marker stake for 09-1 also serves as the start point for transect 09-2. The end stake (red-painted, 12 inch nail) is located at the 16-m mark of the transect tape at the base a sulphur buckwheat (*Eriogonum umbellatum*) plant.

Vinson Wash (10) – Transect 10-1

Transect length = 20 m
Transect bearing = 170^{o}
Transect sampled on the east side of tape

Plant community circular plot: plot center is located 11.3 m (37 ft) @ 270^{o} from the transect rebar marker stake. This positions the stake at the edge of the 0.1 ac plot.

The red rebar marker stake is at ground level and located near the base of a fourwing saltbush shrub. This shrub was ca 40 cm tall in 2003. The transect end spike is located at the 20.5-m mark of the transect tape. It is hidden beneath a small green rabbitbrush shrub and a mounded cushion buckwheat (*Eriogonum ovalifolium*) subshrub.

Vinson Wash (10) – Transect 10-2

Transect length = 25 m
Transect bearing = 77^{o}
Transect sampled on the south (right hand) side of tape

Plant community circular plot: plot center is located 11.3 m @ 90^{o} from the transect rebar marker stake. This positions the stake at the edge of the 0.1 ac plot.

The red rebar marker stake is at ground level and located between two low green rabbitbrush shrubs. The dead stem of another rabbitbrush shrub occurs adjacent to the stake, so that together, the three stems form sort of a triangle around the stake. The transect end spike is located at the 28.2-m mark of the transect tape. This location provides some protection by nearby shrubs.

Twentymile Gulch (11) – Transect 11-1

Transect length = 10 m
Transect bearing = 78^{o}
Transect sampled on the uphill (north) side of tape

Plant community circular plot: plot center is located 11.3 m @ 168^{o} from the transect rebar marker stake. This positions the stake at the uphill edge of the 0.1 ac plot.

The red rebar marker stake is at ground level and located just downslope of an approximately 0.5 m tall green rabbitbrush shrub and the dead skeleton of another shrub. The transect end spike is located at the 10.1-m mark of the transect tape near the base of a mostly dead fourwing saltbrush shrub.

Con Shea Basin (13) – Transect 13-1

Transect length = 20 m
Transect bearing = 342^{o}
Transect sampled on the west (downhill) side of tape. Due to the location of the transect, the 1m^{2} m microplot is positioned close to the edge of the foot/horse trail that bisects the subpopulation.

Plant community circular plot: plot center is located 11.3 m @ 90^{o} from the transect rebar marker stake. This positions the stake at the downhill edge of the 0.1 ac plot. To minimize disturbance on the moderately steep, sandy, west–facing slope, just one pass was made through the plot area to assemble the plant list and make cover class estimates.

The red rebar marker stake is at ground level and located at the base of a gray rabbitbrush shrub. The transect end spike is positioned at the base of a nearly dead rabbitbrush shrub.

Noble Island (14) – Transect 14-1

Transect length = 25 m
Transect bearing = 355^{o}
Transect sampled on the east (uphill) side of tape

Plant community circular plot: plot center is located 11.3 m @ 90^{o} from the transect rebar marker stake. This positions the stake at the downhill edge of the 0.1 ac plot.

The red rebar marker stake is at ground level and located at the base of a green rabbitbrush shrub (mostly dead and ca 40 cm tall in 2003). It is embedded in a thatch of cheatgrass. The transect end spike is at the 23-m mark of the transect tape and partially hidden by a shrub.

SE of Guffey Butte (22) –Transect 22-1

Transect length = 30 m
Transect bearing = 260^{o}
No information was recorded concerning which side of the transect tape was sampled in 2004. A vague recollection says sampling took place on the south (right-hand) side of the tape.

Plant community circular plot: the rebar marker stake is the center of the 0.1 acre plot.

The red rebar marker stake is at ground level and located atop a small, raised, crusty mound near the center of the small “bowl” delineating the general transect area. The end stake is located at the 30 m mark of the transect tape.

West of Shoofly Creek (23) – Transect 23-1

Transect length = 15 m
Transect bearing = 152°
Transect sampled on the north (left-hand) side of tape

Plant community circular plot: plot center is located 11.3 m @ 242° from the transect rebar marker stake. This positions the stake at the uphill edge of the 0.1 ac plot.

The red rebar marker stake is at ground level positioned at the base of dead shrub with prostrate branches. This affords some protection to the stake. The end stake is located at the 14.7-m mark of the transect tape. The 15-m mark was not used because the presence of a dead shrub skeleton would make it difficult to see the spike.

Lower Vinson Wash (25) – Transect 025-1

Transect length = 30 m
Transect bearing = 344°
Transect sampled on the east (right hand) side of tape

Plant community circular plot: plot center is located 11.3 m @ 254° from the transect rebar marker stake. This positions the stake at the edge of the 0.1 ac plot. Note that this plot location differs from when originally sampled in 2003 (plot center in 2003 was 11.3 m @ 76° from rebar stake) The revised plot location is preferred to minimize researcher trampling in the transect area.

The red rebar marker stake is at ground level and located near the base of a little-leaved horsebrush (*Tetradymia glabrata*). The transect end spike is 30-m mark of the transect tape.

Sandhill Point (26) – Transect 26-1

Transect length = 30 m
Transect bearing = 235°
Transect sampled on the northwest (uphill) side of tape

Plant community circular plot: plot center is located 11.3 m @ 90° from the transect's rebar marker stake. This positions the stake at the edge of the 0.1 ac plot.

The red rebar marker stake is located on the uphill side of dead shrub with graying, nearly prostrate stems. Several other similar-looking dead shrubs also occur in the vicinity. A fourwing saltbrush shrub approximately 0.4 m tall is located roughly 1 m due north of the stake. The end spike is at the 29-m mark. The end spike protrudes about 5 cm above the ground adjacent to a Franklin's sandwort cushion.

Appendix 2

Map locations for Mulford’s milkvetch monitoring transects in the Owyhee Front.

Appendix 3

Mulford’s milkvetch monitoring transect location forms and GPS coordinates.

GPS coordinates

GPS coordinates: based on Universal Transverse Mercator grid - zone 11 (UTM 11T), and Map Datum NAD 27.

Occurrence Name (#)	Transect	Stake	Coordinates
Horse Hill (04)	04-1	start	4734724 N 594526 E
		end	4734739 N 594532 E
Mud Flat Road (09)	09-1	start	4743498 N 571029 E
		end	no coordinates
	09-2	start	same as for 09-1
		end	no coordinates
Vinson Wash (10)	10-1	start	4755990 N 569263 E
		end	4755967 N 569267 E
	10-2	start	4756147 N 569419 E
		end	4756154 N 569448 E
Twentymile Gulch (11)	11-1	start	4747481 N 572391 E
		end	no coordinates
Con Shea Basin (13)	13-1	start	4792159 N 541164 E
		end	4792182 N 541151 E
Noble Island (14)	14-1	start	4794352 N 533641 E
		end	4794375 N 533637 E
SE of Guffey Butte (22)	22-1	start	4790766 N 539221 E
		end	4790761 N 539190 E
West of Shoofly Creek (23)	23-1	start	4744813 N 573103 E
		end	no coordinates
Lower Vinson Wash (25)	25-1	start	4748292 N 567153 E
		end	no coordinates
Sandhill Point (26)	26-1	start	4758074 N 563803 E
		end	4758063 N 563787

Appendix 4

Mulford's milkvetch census monitoring data sheets, 2004.

Appendix 5

Disturbance factor monitoring data sheets, 2004.

Appendix 6

Weed species monitoring data, 2004.

Astragalus mulfordiae monitoring project, 2004																											
Weed disturbance data																											
		Bromus tectorum					**Halogeton glomerata**					**Lactuca serriola**					**Salsola tragus**					**Sisymbrium altissimum**					**no weeds**
	#microplots	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	
04-1	15		13	2													5	6	3	1		2	1				0
09-1	20	17					1	1																			2
09-2	15	9	1				3																				4
10-1	20	2																									18
10-2	25	2																									23
11-1	10	10																									0
13-1	20		16	4													13										0
14-1	25	10	12	3																							0
22-1	30	10	16	4								1					16	9									0
23-1	15	8																									7
25-1	30	18															10	16	4								0
26-1	30	22	8														7	20	3								0
sum	255	108	66	13			4	1				1					51	51	10	1		2	1				54
	Total (%)																										
Brotec	187 (73)																										
Halglo	5 (2)																										
Lacser	1 (<1)																										
Saltra	113 (44)																										
Sisalt	3 (1)																										
No weeds	54 (21)																										

Appendix 7

Ground disturbance attribute monitoring data, 2004

Astragalus mulfordiae monitoring, 2004

Ground disturbance information

			unknown divot					motor tracks					small burrow					cattle feces					road edge					footprint				
	# microplots	# disturbed	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
04-1	15	10	2	5	1								1	2																		
09-1	20	1											1																			
09-2	15	0																														
10-1	20	6	1															1						4							
10-2	25	4	1															3														
11-1	10	6	1	3										2	1			2														
13-1	20	20		1	12	7												4														
14-1	25	23	5	4				3	9	4	1		1	1																		
22-1	30	15	3	10														1											2			
23-1	15	8		1	1								3	3																		
25-1	30	19	4	9	1								2	1				2	2													
26-1	30	10											3					5	2													
sum	255	123	17	33	15	7		3	9	4	1		11	9	1			18	4					4					2			
Class1	**49**																															
Class2	**62**																															
Class3	**20**																															
Class4	**8**																															
Class5	**0**																															
divot	**72**																															
motor	**17**																															
burrow	**21**																															
cattle	**22**																															
road	**4**																															
foot	**2**																															

Appendix 8

Plant community sampling data sheets, 2004.

Appendix 9

Plant community plot data, 2003 and 2004.

Intermountain Flora (1977-1997) is the primary reference for plant nomenclature used in this report, including the following table. Flora of the Pacific Northwest (Hitchcock and Cronquist 1973) is used for those species not covered in the Intermountain Flora series.

		Transect											
		4-1	9-1	10-1	10-2	11-1	13-1	14-1	22-1	23-1	25-1	26-1	Constancy (%)
SHRUBS													
Artemisia spinescens	2003			1	1						1		50
	2004												0
Artemisia tridentata	2003			10									17
	2004	10		10						1			27
Atriplex canescens	2003			3	3		3	3			10		83
	2004		3	3	3	3	3	3		3	3	3	81
Atriplex confertifolia	2003												0
	2004					1							9
Chrysothamnus nauseosus	2003							1	1				33
	2004	3	1			1		1		3	1		54
Chrysothamnus viscidiflorus	2003			3	3		3	3	1		10		100
	2004		1	3	3	3	3	3	1	1	10	3	90
Eriogonum microthecum	2003							1	1				33
	2004		1		1				1		1		36
Eurotia lanata	2003				1								17
	2004			1	1								18
Grayia spinosa	2003												0
	2004			3	1		1			1	1	1	54
Leptodactylon pungens	2003			1	1				1		3		67
	2004	1	1	1	1				3	10	3	1	72
Purshia tridentata	2003							1					17
	2004		1					1					18
Salvia dorrii	2003								1				17
	2004		1						3				18
Tetradymia glabrata	2003			3	10						20		50
	2004			10	10	3	1			1	3	1	63
Total shrub cover	2003			20	20		3	10	10		40		
	2004	10	3	20	20	10	3	10	10	20	20	10	
GRAMINOIDS													
Agropyron spp.	2003				10								17
	2004				3								9
Bromus tectorum	2003			1	1		30	30	10		3		100
	2004	10	1	1		1	30	3	1	1	1	3	90
Oryzopsis hymenoides	2003			3	3		3	1	3		3		100
	2004	3	3	3	3	3	1	1	3	1	3	1	100
Sitanion hystrix	2003												0
	2004	1								1			18
Stipa comata	2003			3	3			20	1				67
	2004	10	1	3	1	1		10		1	1	3	90

		4-1	9-1	10-1	10-2	11-1	13-1	14-1	22-1	23-1	25-1	26-1	Constancy (%)
Vulpia microstachys	2003												0
	2004	1										1	18
Vulpia octoflora	2003			1	1				1		3		67
	2004			1	1				1				27
Total graminoid cover	2003			10	10		30	40	20		3		
	2004	20	3	10	3	3	30	10	3	3	3	10	
FORBS													
Abronia mellifera	2003						1				1		33
	2004						1					1	18
Ambrosia artemisiifolia	2003							1					17
	2004		1					1					18
Arabis spp.	2003				1								17
	2004												0
Arenaria franklinii	2003			1	1				3				50
	2004		1	1	1				3			1	45
Astragalus camptopus	2003						1	1	1				50
	2004		1			1		1		1			36
Astragalus geyeri	2003			1	1						1		50
	2004		1		1	1				1	1	1	54
Astragalus lentigenosus	2003						1						17
	2004												0
Astragalus mulfordiae	2003			1	1		1	1	1		1		100
	2004	1	1	1	1	1	1	1	1	1	1		90
Astragalus purshii	2003				1								17
	2004				1		1						18
Balsamorhiza sagittata	2003			1							1		33
	2004		1	1							1		27
Camelina microcarpa	2003							1					17
	2004												0
Camissonia boothii	2003												0
	2004					1							9
Camissonia pusilla	2003			1									17
	2004												0
Chaenactis douglasii	2003						1	1					33
	2004		1				1	1		1			36
Chaenactis macrantha	2003												0
	2004									1			9
Chenopodium leptophyllum	2003			1	1						1		50
	2004	1				1						1	27
Coldenia nuttallii	2003			1							1		33
	2004	1		1		1	1			1	1	1	63
Comandra umbellata	2003							1	1				33
	2004								1				9

		4-1	9-1	10-1	10-2	11-1	13-1	14-1	22-1	23-1	25-1	26-1	Constancy
Cryptantha circumscissa	2003			1	1		1		1				67
	2004	1	1	1	1	1			1	1			63
Cymopterus acaulis	2003				1								17
	2004			1									9
Eriastrum sparsiflorum	2003			1	1			1	1				67
	2004	1	1		1	1				1	1	1	63
Eriogonum cernum	2003												0
	2004		1										9
Eriogonum maculatum	2003												0
	2004		1										9
Eriogonum ovalifolium	2003				1								17
	2004		1		1							1	27
Erodium cicutarium	2003												0
	2004					1	1						18
Gilia inconspicua	2003			3	1			1					50
	2004			1						1			18
Gilia sinuata	2003										3		17
	2004												0
Halogeton glomerata	2003												0
	2004		1			1				1			27
Hymenopappus filifolius	2003								3				17
	2004								3				9
Kochia spp.	2003						1						17
	2004												0
Langlosia ramosissma	2003												0
	2004		1										9
Leucocrinum montanum	2003										1		17
	2004	1											9
Lupinus pusillus	2003			1	1		1		1		1		83
	2004			1	1	1	1		1	1	1	1	72
Macaeranthera canescens	2003						1	1	1				50
	2004						1	1	1			1	36
Malacothrix glabrata	2003			1				1			3		50
	2004			1		1	1	1		1		1	54
Mentzelia albicaulis	2003			3	1		3	3	1		3		100
	2004	1	*3*	3	1	3	1	1	1	1	1	3	100
Nama aretioides	2003			1	1			1			1		67
	2004	1	1	1	1	1		1	1	1		1	81
Oenothera claviformis	2003												0
	2004		1			1	1			1		1	45
Oenothera pallida	2003								3				17
	2004								3			1	18

		4-1	9-1	10-1	10-2	11-1	13-1	14-1	22-1	23-1	25-1	26-1	Constancy
Opuntia polyacantha	2003			1									17
	2004			1									9
Penstemon acuminatus	2003								1				17
	2004								1				9
Phacelia glandulifera	2003			1	1						1		50
	2004	1			1								18
Psoralea lanceolata	2003												0
	2004									1			9
Salsola kali	2003												0
	2004	3				1	1		1	1	3	3	63
Sisymbrium altissimum	2003							1					17
	2004	3											9
Sphaeralcea grossulariifolia	2003												0
	2004			1							1	1	27
Strepanthella longirostris	2003			1									17
	2004												0
Unknown	2003				1						1		33
	2004	1										1	18
Total forb cover	2003			10	10		3	3	10		10		
	2004	10	10	10	3	3	1	3	10	3	3	10	
GROUND COVER*													
Bare ground/soil	2003			80	80		80	60	80		80		
	2004	80				90			80		80	90	
Gravel	2003			1	1		3		3		1		
	2004					3			3		3		
Rock	2003							3	3				
	2004								3				
Litter	2003			10	3		3	30	1		10		
	2004	10				3			1		3	1	
Wood	2003			1	1			1	1				
	2004	1				1			1		1	1	
Moss/lichen	2003			3	3			3	3		3		
	2004	1							3		3	1	
Basal vegetation	2003								3		3		
	2004	10				3			3		3	3	

* 2004 ground cover information not collected for plots 09-1, 10-1, 10-2, 13-1, 14-1, 23-1