



Idaho Conservation Data Center
Idaho Department of Fish and Game
PO Box 25
Boise, Idaho
83707



**MONITORING WHITE CLOUD MILKVETCH
(*ASTRAGALUS VEXILLIFLEXUS* VAR. *NUBILUS*)
ON THE
SAWTOOTH NATIONAL RECREATION AREA:
BASELINE RESULTS, 2005**



Michael Mancuso

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**Sawtooth National Forest
and
Idaho Department of Fish and Game**

ABSTRACT

White Cloud milkvetch (*Astragalus vexilliflexus* var. *nubilus*) is a U.S. Forest Service, Region 4 sensitive plant species known from ten occurrences, all located within the Sawtooth National Recreation Area. It is endemic to an approximately 21 km x 10 km area on the eastern slope of the White Cloud Peaks and western slope of the adjacent Boulder Mountains in Custer County, Idaho. In 2005, the Sawtooth National Forest contracted the Idaho Department of Fish and Game's Idaho Conservation Data Center to establish a monitoring program for this species. White Cloud milkvetch census, plant community, and ground disturbance information was collected along permanently marked transects at eight of the ten known occurrences. Photo point photographs and the collection of additional occurrence area disturbance and threat information were also part of the monitoring protocol. Baseline results showed occurrences had variable White Cloud milkvetch density and habitat characterized by low vegetation cover. The majority had minimal or no disturbance. The landscape surrounding all occurrences was dominated by native vegetation and unfragmented except for occasional secondary roads. Bowery Ridge is the occurrence requiring the most immediate management attention. Recent off-trail motorcycle and heavy cattle use were observed within and near the occurrence. Imminent, serious threats were not observed within the other occurrences visited. Periodic monitoring is recommended to ensure managers are kept apprised of population and habitat trends, the status of any threats, and to evaluate whether directed management actions such as grazing allotment boundary adjustments, are having the intended effect. The 2005 monitoring dataset serves as a baseline to compare and evaluate future monitoring results.

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INTRODUCTION

White Cloud milkvetch (*Astragalus vexilliflexus* var. *nubilus*) is a prostrate, cushion-like perennial plant covered with short, sinuous hairs that give the foliage a silvery-green color. Its small, yellowish, pea-like flowers are on stems not raised above the foliage, and can be almost hidden within the leaves (Figure 1). White Cloud milkvetch is restricted to the eastern slope of the White Cloud Peaks and across the valley of the East Fork Salmon River on the western slope of the Boulder Mountains in Custer County, Idaho (Moseley and Mancuso 1994). Its known global distribution measures approximately 21 km (13 mi) x 10 km (6.2 mi). It occurs along ridge crests and associated slopes in the subalpine zone between approximately 2650 - 2895 m (8,700 - 9,500 ft) elevation. Sites are dry, rocky, open, relatively sparsely vegetated, and usually underlain by substrates of the Challis Volcanic Group. White Cloud milkvetch is a U.S. Forest Service (USFS) Region 4 sensitive species known from only ten occurrences, all at least partially located within the Sawtooth National Recreation Area (NRA).

Most White Cloud milkvetch occurrences were discovered prior to 1991 (Moseley and Mancuso 1994). The more accessible occurrences have been periodically visited by Sawtooth National Forest (NF) personnel over the years, but others are more remote and have no recent information. Range monitoring has documented ground disturbance associated with cattle trampling, trailing, and loafing at four of the known White Cloud milkvetch occurrences in the past (S. Phelan, Sawtooth NF Range Conservationist in a personal communication to Kim Pierson, botanist for the Sawtooth NF, 2003). In 2003, the Sawtooth NF completed an environmental impact statement for the Upper and Lower East Fork allotment management plans (USDA Forest Service 2003). This decision adjusted allotment boundaries to reduce cattle grazing and associated resource damage within fragile plant communities above 2590 m (8500 ft) elevation. The boundary adjustment reduced the number of White Cloud milkvetch occurrences within the allotment from ten, to four.

In addition to livestock disturbance, multiple occurrences were known or suspected to be vulnerable to recreation-related impacts and weed invasion. The White Cloud Peaks are a popular recreation destination with trails and access roads located immediately adjacent or in close proximity to several White Cloud milkvetch occurrences. Several aggressive weed species, including spotted knapweed (*Centaurea maculosa*), Dalmatian toadflax (*Linaria dalmatica*), common toadflax (*Linaria vulgaris*), and musk thistle (*Cardus nutans*) have become established in the East Fork Salmon River valley. Cattle have the potential to be direct vectors for weed introduction, or may indirectly contribute to introductions by their ground disturbance activity (Fleischner 1994, Hobbs and Huenneke 1992).

In 2005, the Sawtooth NF contracted the Idaho Department of Fish and Game's Idaho Conservation Data Center (IDCDC) to establish a monitoring program for White Cloud milkvetch. Monitoring is an essential component of an effective species management program (Owen and Rosentreter 1992) and provides a way to measure the effects of management actions and assess whether the response of target species and communities are consistent with conservation objectives (Menges and Gordon 1996). The objective of the White Cloud milkvetch monitoring program is to collect occurrence-level habitat, population, and disturbance factor trend information. This information will be used by Sawtooth NF managers to evaluate the effectiveness of the Upper and Lower East Fork allotment boundary changes to reduce or eliminate livestock-related disturbances at White Cloud milkvetch sites. Monitoring will also help managers assess and address recreation, weed invasion, wildlife, and other possible threats and disturbances, and help guide management efforts that may be necessary to ensure the long-term conservation of White Cloud milkvetch and its habitat. Baseline monitoring data were

collected in the summer of 2005 in a collaborative effort between the IDCDC and Sawtooth NF. This report provides an outline of our monitoring methods and a summary and discussion of the results.

Figure 1. Close-up photo of White Cloud milkvetch.



STUDY AREA

The White Cloud Peaks and adjacent western Boulder Mountains are located in central Idaho. The geology of the area is a mix of Paleozoic sedimentary, mostly calcareous rock; Cretaceous-age granitics of the Idaho batholith; Eocene-age Challis Volcanics and related rock, and Quaternary glacial deposits and alluvium (Fisher et al. 1983). In general, the area has a montane climate subject to both continental and maritime influences resulting in cold, wet winters and warm, dry summers. Most precipitation falls during the winter months as snow, with lesser amounts from high-altitude convective storms during the late spring and summer (Ross and Savage 1967). Except for the valley bottoms, much of the area is USFS land, including a large portion contained within the Sawtooth NRA (Figure 2).

METHODS

The monitoring protocol was modified from methods used to monitor Tobias' saxifrage (*Saxifraga bryophora* var. *tobiasae*), a high elevation sensitive plant species on the Payette NF (Mancuso 2001), and Mulford's milkvetch (*Astragalus mulfordiae*), a Bureau of Land

Figure 2. Location of the Sawtooth National Recreation Area in central Idaho.



Management special status plant species in southwestern Idaho (Mancuso and Miller 2004). Information and maps contained in the IDCDC Element Occurrence Record (EO Record) database (Idaho Conservation Data Center 2005) were used to help relocate occurrences in the field. At each occurrence we conducted a reconnaissance to determine the distribution of White Cloud milkvetch in the area. We subjectively located monitoring transects where White Cloud milkvetch plants were relatively abundant to ensure adequate sampling.

White Cloud milkvetch census, plant community, and ground disturbance monitoring information was collected along a 25 m long belt transect. A red-painted rebar stake “permanently” marks the location and starting point for each transect, and a large metal spike references the transect end point. To sample, a metric tape was stretched between the start and end points. Census and ground disturbance data were collected using a 1-m square microplot (quadrat) aligned flush against the tape. Each meter of the transect was sampled beginning at the 1 m mark for a total of 25 microplots/transect. Plant community information was collected along the same side of the transect tape using separate methods for shrub and herbaceous species. Cover for all shrub species was measured using the line intercept method (Bonham 1989). The distance (cm) each shrub intercepts above or below the transect line was recorded. Shrub sampling covered 25 m of the transect, beginning at the 1 m and ending at the 26 m mark. Using a plumb improves sampling consistency and accuracy. Herbaceous species cover was measured using a 20 x 50 cm Daubenmire microplot, with the 20 cm side aligned flush against the tape. Ten microplots were sampled, starting at the 2 m mark and including all even-numbered meters up to the 20 m mark. The collection of additional occurrence area disturbance information and photo point photographs were included in the monitoring protocol.

Transect azimuth, side of tape sampled, and other sampling information is summarized in Appendix 1. UTM coordinates obtained using a navigation grade (Garmin 12XL) GPS unit at each transect marker stake are also in Appendix 1. The map location for each transect is in Appendix 2. Appendix 3 includes directions, sketch map, landmarks, and other information to help relocate transects in the future. The EO Record number was used to label and identify each transect. A declination of 16° was used for all monitoring protocol azimuths. Specific protocols for each component of the monitoring program are outlined below. Plant nomenclature follows Hitchcock and Cronquist (1973) in most cases.

White Cloud milkvetch census - Census and density information was collected by counting every White Clouds milkvetch plant rooted in the microplot and assigning each individual to one of three life stage class categories: (1) Reproductive stage class (R) - individuals with flowers or fruits; (2) Non-reproductive stage class (N) - non-flowering/fruitlet individuals that are not seedlings; or (3) Seedlings (S) - tiny germinants, usually <2 cm tall. Cotyledons may be present, along with one or two pair of leaves. Individuals without cotyledons recorded as seedlings may actually be small plants > 1 year old. It can be difficult to distinguish individual White Cloud milkvetch genets from one another because cushions may be comprised of multiple branches emanating from a common caudex. For sampling purposes, plants were considered to be distinct individuals if rooted >5 cm apart (approximately the width of three fingers), unless there was clear evidence the plants were connected to a common underground caudex.

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

- 1) Weed species – the cover of each introduced weed species rooted within the microplot was estimated and assigned to one of eight modified Daubenmire method cover classes: 1 = <1% cover; 2 = 1 - 4.9% cover; 3 = 5 - 9.9% cover; 4 = 10 – 24.9% cover; 5 = 25 – 49.9% cover; 6 = 50 – 74.9%; 7 = 75 – 94.9%; 8 = 95 – 100%. A total weed cover class was also assigned to each microplot.
- 2) Ground disturbances – the cover of each surface disturbance, such as off-road vehicle (ORV) tracks, recreation trails, livestock or wildlife hoof prints, animal burrows, or other ground disturbing activities was estimated and assigned to one of the eight modified Daubenmire method cover classes. A total ground disturbance cover class was also assigned to each microplot.
- 3) Insect damage and disease – each plant was inspected for evidence of insect and disease damage. Associated damage was recorded on the field data sheet.
- 4) Herbivory and trampling - each plant was inspected for evidence of non-insect herbivory or trampling damage. Associated damage was recorded on the field data sheet.

General disturbance and threat information - Disturbance and threat information for the transect area was assessed after a reconnaissance of the occurrence or subpopulation area. Information was summarized by completing the “White Clouds milkvetch general disturbance information” data sheet, with fields for ORV, livestock, fire, recreation, and other potential management concerns.

Plant community - The identification of all shrubs and herbs, preferably to species, is needed to complete the plant community part of the protocol. Each shrub that intercepts the side of the tape being sampled was measured. Individual shrub measurements can be aggregated to

provide a total shrub intercept or a species by species accounting. Herbaceous plant community information was collected by assigning every forb or graminoid species rooted in the microplot one of the Daubenmire method cover class values. Cover class values were also assigned for bare ground, rock/gravel, wood, litter, and microbotic crust within the microplot.

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). Photographs were taken using a digital camera set to wide angle. The rebar stake marking the location of the transect served as the reference point (the photo point) from which the photos were taken. The photo point series is comprised of a minimum of six photographs, including two photos of the transect and four others providing a general panorama of the surrounding landscape. One transect photo was taken along the transect azimuth while standing 3 m behind the rebar marker stake. The other transect photo was taken along the back azimuth standing 3 m behind the end stake. Photos taken at 0⁰, 90⁰, 180⁰, and 270⁰ bearings provide a panoramic overview of the surrounding landscape. Including the skyline makes it easier to compare photos taken in different years. Additional photos to show the rebar marker stake, disturbances, or landmark landscape features are optional.

RESULTS

Monitoring was conducted August 8 – 11, 2005, with transects established at eight of the ten known element occurrences (EO) for White Cloud milkvetch. Table 1 lists the occurrences included in the monitoring program and their general location. The Wickiup Creek Ridge occurrence (EO 5) was not included in the monitoring program due to trail access across private land being posted and blocked. Omitting the Germania Ridge (EO 6) occurrence was the result of a recent change in the IDCDC database. The Mountain Meadow Creek occurrence (EO 10) was formerly considered a subpopulation of Germania Ridge. After the 2005 field season, the IDCDC determined the subpopulation to be a distinct EO because of its nearly 3.2 km (2 mi) separation distance east of the other Germania Ridge subpopulation. This separation distance is more consistent with other White Cloud milkvetch occurrences in the IDCDC database.

The monitoring program allowed us to verify, or in several cases adjust and improve the accuracy of the map location for each occurrence we visited. The reconnaissance portion of the monitoring protocol provided an opportunity to collect White Cloud milkvetch abundance, habitat, and other general information used to update the EO Record for each occurrence. White Cloud milkvetch EO records are in Appendix 4 and maps showing the location of each occurrence in Appendix 5.

Table 1. White Cloud milkvetch occurrences included in monitoring program, 2005.

EO #	Occurrence name	USGS quadrangle	General location
1	Railroad Ridge	Livingston Creek	ca 2.1 km NW of Livingston Mill
2	South of Bowery Creek	Bowery Creek	ca 4.6 km NE of Bowery Guard Sta
3	Jim Creek	Livingston Creek	ca 4 km W of Livingston Mill
4	SW of Frog Lake	Boulder Chain Lakes	ca 0.4 km SW of Frog Lake
7	Red Ridge	Bowery Creek	ca 5.2 km NE of Frog Lake
8	Bowery Ridge	Boulder Chain Lakes Bowery Creek, Galena Pk	ca 2.2 km W of Bowery Guard Sta
9	Upper Big Lake Creek	Livingston Creek	ca 4.4 km NW of Livingston Mill
10	Mountain Meadow Creek	Bowery Creek	ca 8.5 km N of Bowery Guard Sta

White Cloud milkvetch census - A total of 736 White Cloud milkvetch plants were tallied at the eight monitoring transects. The number of plants/transect ranged from 13 to 258. Three transects had >150 White Cloud milkvetch plants and accounted for 79% of the total tally. Reproductive plants were the most common stage class at five transects, non-reproductive at two transects, and seedlings at one transect. Overall, reproductive plants were the most common stage class. The three stage classes were represented at all transects except Upper Big Lake Creek, which did not have seedlings. Two transects accounted for most (87%) of the seedlings. Census information for 2005 is summarized in Table 2. Copies of the 2005 census information field data sheets are in Appendix 6.

Table 2. White Cloud milkvetch census monitoring data, 2005. Percentages are in parentheses.

Occurrence	Transect #	# of plants	Stage class		
			Reproductive	Non-reproductive	Seedling
Railroad Ridge	1-1	156	113 (72)	34 (22)	9 (6)
S of Bowery Creek	2-1	39	26 (67)	10 (26)	3 (7)
Jim Creek	3-1	39	8 (20)	24 (62)	7 (18)
SW of Frog Lake	4-1	30	12 (40)	14 (47)	4 (13)
Red Ridge	7-1	170	48 (28)	48 (28)	74 (44)
Bowery Ridge	8-1	258	110 (43)	58 (22)	90 (35)
Upper Big Lake Cr	9-1	13	7 (54)	6 (46)	0
Mountain Meadow Cr	10-1	31	16 (52)	14 (45)	1 (3)
		736	340 (46)	208 (28)	188 (26)

Disturbance factors – Three of the eight transects had no ground disturbance. Minor amounts (<1% or 1-4.9% cover classes) of old cattle or horse feces were recorded at four transects. A few divots that may have been old cattle prints were recorded at the Jim Creek transect, but sufficient detail was lacking to positively assign the divots to cattle or another source. Recreation trail disturbance was recorded at Southwest of Frog Lake and Bowery Ridge, and represents the only factor disturbing >1% of the ground surface at any of the transects. The only non-native weedy species encountered was common dandelion (*Taraxacum officinale*) at the Upper Big Lake Creek transect. Evidence of insect damage, disease, herbivory, or trampling of White Cloud milkvetch plants was not observed at any of the transects. Table 3 summarizes baseline disturbance factor information collected in 2005. Copies of the field data sheets containing disturbance factor information are included in Appendix 6.

General disturbance and threat information – Jim Creek and Upper Big Lake Creek are the only White Cloud milkvetch occurrences within 2 km (1.2 mi) of a road. Monitoring transects at Railroad Ridge and Bowery Ridge have pioneer ORV trails in close proximity. ORV use was not observed in the vicinity of any other occurrence. Popular recreation trails occur within 100 m of the Southwest of Frog Lake and Bowery Ridge transects. Recent cattle use was observed only at Bowery Ridge. Older cattle feces were present within or near five other transects, with Southwest of Frog Lake and Mountain Meadow Creek the only occurrences without cattle sign of any age. Most occurrences are located <1 km (0.6 mi) from a water source that could be used by livestock. Salt blocks for cattle use were not observed near any of the occurrences. Low cover of cheatgrass (*Bromus tectorum*) was observed along the road immediately adjacent to the White Cloud milkvetch occurrence at Jim Creek, and it is approximately 2 air km (1.2 mi)

Table 3. Ground cover percentage for disturbance factors at White Cloud milkvetch monitoring transect, 2005. Ground cover percentage for each disturbance factor is calculated by summing the cover class mid-points recorded at all 25 transect microplots, divided by the number of microplots (25).

Occurrence	Transect #	Disturbance factor					
		Cattle feces	Horse feces	Trail	Unknown divot	Animal burrow	Weeds
Railroad Ridge	1-1	0	0	0	0	0	0
S of Bowery Creek	2-1	0.04	0	0	0	0	0
Jim Creek	3-1	0.02	0	0	0.04	0	0
SW of Frog Lake	4-1	0	0.8	40	0	0	0
Red Ridge	7-1	0	0	0	0	0	0
Bowery Ridge	8-1	0	0	6.4	0	0	0
Upper Big Lake Cr.	9-1	0.3	0	0	0	0.3	0.5
Germania Ridge	10-1	0	0	0	0	0	0

from the Railroad Ridge occurrence to an introduced weed population in the Livingston Mill area. Low cover of common dandelion occurs within the Upper Big Lake Creek occurrence. Introduced weed species were not observed within any of the other occurrences, nor are they located close to known infestations. Copies of field sheets with general disturbance and threat information are included in Appendix 7.

Plant community – Vegetation is characterized at most transects by an open, low cover mix of low-growing shrub, graminoid and forb species. Individual or patches of whitebark pine (*Pinus albicaulis*) occur in close proximity to several transects. Rock/gravel or bare soil dominate the ground cover and bedrock is consistently at or near the surface. These high elevation communities have not been classified. A vegetation reconnaissance of the White Cloud Peaks by Taylor (1980) named the kind of habitats supporting White Cloud milkvetch subalpine fellfields. Alpine plant communities described for Railroad Ridge in the White Cloud Peaks (Richardson and Henderson 1999) are only minimally similar to the subalpine ridge vegetation supporting White Cloud milkvetch. Mountain big sagebrush/ bluebunch wheatgrass (*Artemisia tridentata* var. *vaseyana*/ *Agropyron spicatum*), mountain big sagebrush/Idaho fescue (*Festuca idahoensis*) or whitebark pine communities (Hironaka et al. 1983, Steele et al. 1981) usually dominate the surrounding vegetation on more fully developed soils.

A total of 49 vascular plant species were recorded at the eight transects, including 6 shrubs, 32 forbs, and 11 graminoids. Shrub intercept cover was <20% at all but one transect and ranged from 44% to zero. The number of shrub species/transect varied from four to none. Mountain big sagebrush and green rabbitbrush (*Chrysothamnus viscidiflorus*) were the only shrubs recorded on >50% of the transects. Shrub cover information is summarized in Table 4. Copies of field sheets with shrub line intercept data are in Appendix 8. The data are presented in spreadsheet form in Appendix 9.

The number of herbaceous species ranged from 7 – 19 species/transect, with an average of 11. Forbs outnumbered graminoid species on all transects and also had higher cover in most cases. Nearly three-fourths (72%) of all herbaceous species occurred at <1% cover. Bluebunch wheatgrass was recorded at 7 transects, the most of any species. Only 7 other herbaceous species occurred on at least 50% of the transects. The only introduced weedy species encountered was common dandelion at Upper Big Lake Creek. Table 5 summarizes floristic

data by listing the percent cover for herbaceous species at each transect. Copies of vegetation transect field data sheets are included in Appendix 8. The data are presented in spreadsheet form in Appendix 9. Nomenclature for most plant names follows Hitchcock and Cronquist (1973). Common plant names for species encountered on the transects are in Appendix 10.

Table 4. Percent line intercept for shrub species at White Cloud milkvetch monitoring transects, 2005. Based on line intercept method (# of cm intercepted/2500 cm).

Species name	Transect							
	1-1	2-1	3-1	4-1	7-1	8-1	9-1	10-1
<i>Artemisia arbuscula</i>							8	
<i>Artemisia tridentata vaseyana</i>	4	3	42	13	6			
<i>Chrysothamnus nauseosus</i>				4				
<i>Chrysothamnus viscidiflorus</i>			<1	1		2	1	
<i>Leptodactylon pungens</i>			2	1	1			
<i>Tetradymia canescens</i>					5	3		
Total shrub	4	3	44	19	12	5	9	0

Photo points – Photo point photographs were taken for all transects. Digital images were put onto a CD and submitted to the Sawtooth NF as part of this report. Reproductions of the 55 digital images are in Appendix 11. In general, photographs show the open, rocky, relatively sparsely vegetated subalpine habitat occupied by White Cloud milkvetch and the intact appearance of the surrounding landscape.

GENERAL OCCURRENCE INFORMATION

Railroad Ridge (EO 1) – This occurrence is comprised of a series of five subpopulations scattered along approximately 2.1 km (1.3 mi) of ridgeline. The occurrence was estimated to have 700 White Cloud milkvetch plants in 1990, including 200-400 individuals at subpopulation 2. The other subpopulations were estimated to contain from 1 to >200 plants (Mancuso and Moseley 1990). In 2005, a monitoring transect was established at subpopulation 2, and a thorough reconnaissance of the roughly 0.2 ha (0.5 ac) subpopulation area tallied approximately 570 plants. The subpopulation occurs along an open, flat section of ridgecrest along the edge of a whitebark pine-dominated woodland patch. The fine-textured soil is different than the stony-rocky substrate characterizing other subpopulations of this occurrence. The immediate subpopulation area was undisturbed in 2005; however, a pioneer ORV trail was observed immediately to its west. Some cattle feces were also noted nearby, although they may have been from past years. Subpopulation 1 was not relocated in 2005, with no attempt made to revisit subpopulations 3-5.

South of Bowery Creek (EO 2) – This approximately 0.4 ha (1 ac) occurrence is located along an open, relatively sparsely vegetated, rocky ridgecrest and associated very upper slope. An estimate of 300-500 White Cloud milkvetch plants was made in 1990. In 2005, 248 plants were counted during a reconnaissance of the occurrence, with an estimated total of at least 300 individuals. Cattle disturbance was the only threat reported in 1990 (Mancuso and Moseley 1990). In 2005, cattle feces were observed within the occurrence, including a few pies atop some White Cloud milkvetch plants (Appendix 11, photo 14). A cattle/wildlife trail passed through the southern end of the occurrence, but no recreation-related impacts were observed.

Table 5. Percent cover class average for herbaceous species on White Cloud milkvetch monitoring transects, 2005. Averages calculated by summing the cover class mid-points recorded for each of the 10 transect microplots, divided by the number of microplots (10).

Species name	Transect							
	1-1	2-1	3-1	4-1	7-1	8-1	9-1	10-1
<i>Agropyron spicatum</i>		0.7	1.4	0.8	1.1	2.6	3.1	2.2
<i>Antennaria lanata</i>						0.45		
<i>Antennaria microphylla</i>			0.4	0.3	0.8		3.5	
<i>Arabis</i> sp.			0.1					
<i>Arenaria aculeata</i>	0.05							
* <i>Astragalus purshii</i>		0.05						
<i>Astragalus vex. nubilus</i>	0.7	3.8		0.2	0.9	5.8		0.1
* <i>Astragalus whitneyi</i>		0.7						0.05
<i>Bupleurum americanum</i>			0.6				0.1	
<i>Carex elynoides</i>		13.6						
<i>Carex</i> sp.			0.4	1.8				
<i>Castilleja</i> spp.				0.7			0.05	
<i>Collinsia parviflora</i>			0.2					
<i>Cymopterus bipinnatus</i>	0.5							2.4
<i>Draba</i> sp.							0.3	0.6
<i>Erigeron compositus</i>	0.3	0.3					1.3	0.4
<i>Eriogonum caespitosum</i>							0.1	
<i>Eriogonum microthecum</i>					0.3			
<i>Eriogonum ovalifolium</i>			0.3	0.3				0.05
<i>Festuca ovina</i>							0.5	
<i>Festuca</i> sp.					1.1			
<i>Haplopappus acaulis</i>							3.6	0.3
<i>Ipomopsis aggregata</i>			0.5	0.3				
<i>Koeleria cristata</i>			0.8	0.7				
<i>Linum perenne</i>							0.2	
<i>Lithospermum ruderale</i>				0.3				
<i>Lupinus argenteus</i>				1.5			8.8	
<i>Microseris</i> sp.	0.2							
<i>Oenothera caespitosa</i>						0.5		
<i>Oryzopsis exigua</i>			1.2					
<i>Oryzopsis hymenoides</i>						0.3		
<i>Penstemon humilus</i>			0.5	0.1	1		0.1	
<i>Phacelia incana</i>			0.05					
<i>Phlox hoodii</i>					1.4	2.5		
<i>Phlox</i> sp.	1.2	0.3		2.6			1.6	
<i>Physaria</i> sp.							0.05	
<i>Poa secunda</i>		0.6				4.4	1.2	0.05
<i>Poa</i> sp.	0.3	0.6	0.5				0.3	0.7
<i>Potentilla</i> sp.							0.05	
<i>Sedum lanceolatum</i>			0.3	0.05				
<i>Senecio canus</i>								0.6
<i>Sitanion hystrix</i>	1.8						0.15	
<i>Taraxacum officinale</i>							0.1	

Species name	1-1	2-1	3-1	4-1	7-1	8-1	9-1	10-1
Bare soil	75.8	14.8	27.5	32.3	5.2	43.1	10	3.5
Litter	0.5	6.3	6.5	22.2		0.05	11.9	1.5
Microbiotic crust		0.05	0.05			0.3		
Rock/gravel	14.5	71.5	38.4	31.6	60.8	32.8	67.4	92.5
Wood	0.8	0.05	2.6	0.05				

* = based on late-season, tentative identification

Jim Creek (EO 3) – This occurrence consists of two subpopulations separated by approximately 0.5 km (0.3 mi). The transect was established in the larger subpopulation, estimated to have 500 White Cloud milkvetch plants in 1990. In 2005, 420 plants were counted during a thorough reconnaissance of the approximately 30 x 50 m subpopulation area. The other subpopulation was discovered in 2005 and had 20 plants in a 10 x 10 m area. Both subpopulations occur on southerly-facing, convex-shaped spur ridges within mountain big sagebrush/bluebunch wheatgrass communities. Cattle grazing has been noted for the occurrence in the past, but in 2005 only a few scattered cattle feces were observed. The 4-wheel drive road to Railroad Ridge passes near the downslope edge of both subpopulations.

Southwest of Frog Lake (EO 4) – This occurrence is located along a discontinued cut-off trail downslope from the main trail to the Spring Basin/Frog Lake area. It occurs on a narrow southwest-facing spur ridge supporting a mountain big sagebrush/Idaho fescue community. Less than 10 White Cloud milkvetch plants were reported in 1986, but in 2005, 48 individuals were counted in an approximately 10 x 10 m area along and within the old trail. Most plants were growing in the partial shade of a band of whitebark pine trees. The cut-off trail was used by hikers, horsemen, and motorcycles in the past. It was closed to use in 2004, with the USFS placing branches and rocks in the old pathway to discourage users. Old horse feces persists in the old trail, but no evidence of cattle use or ORV tracks were observed in 2005.

Red Ridge (EO 7) – This occurrence is located on an open ridgecrest and moderately steep upper slope in volcanic scree. It was estimated to have 1500 White Cloud milkvetch plants in 1990. Plants were reported to be local in extent and not found in other suitable-looking habitat in the general area. Locally heavy cattle and horse (wild?) use was also reported (Mancuso and Moseley 1990). In 2005, only older cattle feces were observed within the occurrence.

Bowery Ridge (EO 8) – This occurrence consists of 8 subpopulations scattered over approximately 3.2 km (2 mi) of ridgecrest and associated upper slope habitats having loose, gravelly volcanic substrate. The occurrence was estimated to have 2000 White Cloud milkvetch plants when visited in 1990, with most subpopulations containing >50 individuals. No threats were reported in 1990. Cattle did not appear to reach the occurrence (Mancuso and Moseley 1990). In 2005, a monitoring transect was established in the southernmost subpopulation, approximately 100 m (328 ft) northeast of the Bowery cut-off pack trail. Recent cattle tracks and feces were observed in the subpopulation, with evidence of heavy use <100 m away. In addition, the subpopulation is bisected by a pioneer motorcycle trail that appears to receive at least a moderate level of use. Cattle, wildlife, and perhaps hikers also use the trail. The other subpopulations comprising this occurrence were not visited in 2005.

Upper Big Lake Creek (EO 9) – This small occurrence was estimated to have 20 White Cloud milkvetch plants when it was discovered in 1999. In 2005, 20-25 individuals were found within an approximately 40 x 10 m area. The occurrence is an open, level to gently sloping, rocky,

relatively sparsely vegetated ridgecrest with volcanic bedrock close to the surface. In 1999, ORV tracks and cattle loafing disturbances were reported at the occurrence. In 2005, a few scattered cattle feces were observed, but not ORV tracks or other recreation-related disturbances except for some glass on the ground.

Mountain Meadow Creek (EO 10) – This occurrence was reported to have 10 White Cloud milkvetch plants in an approximately 30 x 15 m area in 1990. A total of 68 individuals were counted in 2005, most in a 25 x 10 m area, the others approximately 75 m further upridge in a small 2 x 2 m zone. The monitoring transect was established in the larger of the two groupings. The occurrence is located along an exposed, open, shrubless, rocky section of ridgecrest and appeared undisturbed in 2005. One old cattle feces was observed approximately 100 m (328 ft) downridge and cattle use is evident in the flats at the head of Mountain Meadow Creek south of the occurrence. This occurrence was formerly part of the Germania Creek occurrence (EO 6).

The two occurrences not included in the monitoring program at this time are both located in relatively remote areas. Neither was reported to be imminently threatened when last visited in 1990, although old cattle feces were noted for the Germania Ridge occurrence (EO 6), and a portion of the Wickiup Creek Ridge occurrence (EO 5) is near a recreation trail.

DISCUSSION

A report on the conservation status of White Cloud milkvetch recommended the establishment of a monitoring program to assess disturbance impacts and trends (Moseley and Mancuso 1994). The monitoring program initiated in 2005 is designed to document long-term trends in White Cloud milkvetch abundance, habitat condition, and disturbances such as cattle use, ORV use, and weed invasion. Baseline results showed occurrences had variable White Cloud milkvetch density and habitat characterized by low vegetation cover. Most occurrences had minimal or no disturbance. The landscape surrounding all occurrences was dominated by native vegetation and unfragmented except for occasional secondary roads.

Based on monitoring information and observations made in 2005, Bowery Ridge is the occurrence requiring the most immediate management attention. Recent cattle and off-trail motorcycle use were observed within the southernmost subpopulation (having the monitoring transect). Cattle use was heavy within 100 m (328 ft) of the subpopulation. Imminent, serious threats were not observed within the other occurrences visited in 2005. Cattle feces were observed at the majority of occurrences, but except for Bowery Ridge, none appeared to be the current season's vintage. ORV disturbance could become a conservation concern at the Railroad Ridge occurrence if the pioneer ORV trail observed in 2005 begins to receive more use or branches off directly into occupied White Cloud milkvetch habitat. At the Jim Creek occurrence, both subpopulations are located in close proximity to the road leading to Railroad Ridge. Road maintenance or improvement projects could potentially destroy portions of the occurrence. Monitoring will enable managers to evaluate the response of White Cloud milkvetch to closing the cut-off trail that bisected the Southwest of Frog Lake occurrence.

Grazing allotment changes instituted in 2004 should reduce cattle-related disturbances within most White Cloud milkvetch occurrences and be beneficial to the species' long-term conservation. Other existing or potential threats such as ORV disturbance and road maintenance are concerns managers have at least some control over. The relatively low number of plants and limited extent of occupied habitat makes all occurrences vulnerable to stochastic disturbance events that could eliminate or reduce their size, and which managers can probably do very little to protect against. The long-term conservation of White Cloud milkvetch

appears favorable barring unforeseen large scale disturbances affecting multiple occurrences. The establishment of monitoring transects at the Wickiup Creek Ridge (EO 5) and Germania Ridge (EO 6) would make the program more comprehensive. An additional transect may be prudent for the large occurrence at Bowery Ridge as well. Periodic monitoring is recommended to ensure managers are kept apprised of population and habitat trends, the status of any threats, and to evaluate whether directed management actions such as grazing allotment boundary adjustments are having the intended effect. The 2005 monitoring dataset serves as a baseline to compare and evaluate future monitoring results.

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Appendix 1

White Clouds milkvetch monitoring transect sampling information.

All compass readings with declination set at 16° east. All transects are 25 m in length. All GPS coordinates are UTM zone 11T, Map Datum NAD 27 CONUS.

Railroad Ridge (EO 1) – Transect 1-1

Transect azimuth = 289°

Transect sampled on the north side of tape.

Transect marker stake GPS = N4890510 E696698

The rebar marker stake is positioned approximately 15 cm north of an old, weathered, upturned whitebark pine stump. It is <5 m south of the edge of a whitebark pine-dominated woodland patch. The transect end spike is located at the 25 m mark at the base of and partially hidden by a mountain sagebrush shrub. The immediate transect zone is flat and characterized by open, sparse vegetation. A whitebark pine tree occurs along the transect close to the 15 m point.

South of Bowery Creek (EO 2) – Transect 2-1

Transect azimuth = 216°

Transects sampled on the southeast (left-hand) side of tape.

Transect marker stake GPS = N4874694 E704556

The rebar marker stake is located in the open directly along a narrow north-south trending ridgecrest. The transect end spike sits at the 25 m mark, approximately 18 cm southeast of a relatively large (roughly 45 x 25 cm in size) rock covered with orange lichen. In 2005, the spike was partially hidden by a lupine plant and positioned near the northwest corner of a stunted, sprawling mountain sagebrush shrub. It was also located 18 steps upslope (north) of an obvious cattle/wildlife trail that passes near the very head of an unnamed side drainage.

Jim Creek (EO 3) – Transect 3-1

Transect azimuth = 308°

Transect sampled on the north (uphill) side of tape.

Transect marker stake GPS = N4889808 E694634

This transect is located in close proximity to the jeep road leading from Livingston Mill upslope to Railroad Ridge. It is roughly 0.3 km (0.2 mi) east of a good campsite within a whitebark pine grove. The rebar marker stake is positioned at the downhill base of a small boulder roughly 3 m uphill from the top of the roadcut. A large boulder (see Appendix 11 photo 21) is perched in the roadcut downslope of the stake. The transect end spike is located at the 26 m mark, at the base of an Idaho fescue plant and partially hidden by a mountain sagebrush shrub.

Southwest of Frog Lake (EO 4) – Transect 4-1

Transect azimuth = 205°

Transect sampled on the west (right-hand) side of tape.

Transect marker stake GPS = N4883025 E696245

The rebar marker stake is positioned adjacent to the eastern edge of a discontinued shortcut trail, approximately 10 m downslope (south) of the main hiking trail leading to Frog Lake. The transect end spike is located at the 25 m mark, along the west edge of the discontinued trail and at the base of a fairly large, dark gray- and rust-colored rock. Approximately half of the spike

protrudes above ground and its long-term security is suspect. From the marker start stake the transect runs downslope along the eastern edge of the discontinued trail to near the 9 m point. The transect then runs through the middle of the old trail to the 12 m point; then along the trail's western margin to the 13 m point; then again through the middle of the trail to the 15 m point; then along the eastern margin to the 21.5 m point; back through the middle of the trail to 23.5 m point; and finally along its western margin to the 25 m point. In 2005, nearly all White Cloud milkvetch plants occurred between the 7 and 19 m points of the transect.

Red Ridge (EO 7) – Transect 7-1

Transect azimuth = 236⁰

Transect sampled on the west (uphill) side of tape.

Transect marker stake GPS = N4885404 E701416

The rebar marker stake is located on a flat to gently sloping bench. A fenceline occurs to the west of plot zone. A large previously burned area occurs below the bench and plot zone. The marker stake is positioned beneath a large sagebrush and rock cairn. The transect end spike is located at the 25 m mark.

One route to access the occurrence requires taking Big Boulder trail about six miles to the saddle between Little Boulder and Big Boulder drainages. From the divide walk roughly 3.5 miles down Red Ridge on a pioneered trail – until large red scree slopes facing west towards Castle Peak become visible. On the southeast side of the second red summit a small trail enters the trees. These are the first trees encountered in several miles. The occurrence occurs approximately 200 m below the pioneered trail. When returning from plot, it is not recommended to drop down into the East Fork Salmon River by simply heading east. This route requires traversing extremely steep terrain and emerges onto private property.

Bowery Ridge (EO 8) – Transect 8-1

Transect azimuth = 199⁰

Transect sampled on the north side of tape.

Transect marker stake GPS = N4873655 E699162

The rebar marker stake is positioned approximately 125 m upslope from the saddle between Germania Creek and the East Fork Salmon River. The transect start point is in a large boulder pile. The end spike is downslope at the 25 mark. A pioneered trail runs perpendicular to the Bowery Ridge cutoff trail. The transect crosses this pioneered trail. A large Douglas-fir (*Pseudotsuga menziesii*) tree occurs on the east side of the trail.

Upper Big Lake Creek (EO 9) – Transect 9-1

Transect azimuth = 3⁰

Transect sampled on the east (uphill) side of tape.

Transect marker stake GPS = N4892187 E695072

The transect runs along a very upper west-facing ridge knoll slope. The rebar marker stake is embedded in a low cushion goldenweed (*Haplopappus acaulis*) plant at very upper edge of where the flat ridge knoll begins to gently dip to the northwest. The rocky surface and shallow bedrock prevented hammering the stake into other nearby spots. The transect end spike is located in the open at the 25 m mark.

Mountain Meadow Creek (EO 10) - Transect 10-1

Transect azimuth = 55°

Transect sampled on the northwest (downhill) side of tape.

Transect marker stake GPS = N4880630 E700311

The rebar marker stake is positioned on the top of a rock outcrop directly on the ridgeline leading to topographic map point 9119. The stake is wedged in a rock crack with a small rock cairn built up around it. The transect end spike is located at the 24.85 m mark (not 25 m due to the presence of rock at the 25 m point) on the open ridgeline.

Appendix 2

Map locations for White Cloud milkvetch monitoring transects.

Appendix 3

White Cloud milkvetch monitoring plot location forms.

Appendix 4

Element Occurrence Records for White Clouds milkvetch.

Appendix 5

Map locations for White Cloud milkvetch Element Occurrences.

Appendix 6

White Clouds milkvetch census and ground disturbance monitoring data sheets, 2005.

Appendix 7

General disturbance monitoring data sheet, 2005.

Appendix 8

Plant community monitoring data sheets, 2005.

Appendix 9

Plant community dataset spreadsheets, 2005.

Appendix 10

List of common plant names.

List of common plant names for plant species encountered in plant community sampling, 2005.
Nomenclature mostly follows Hitchcock and Cronquist (1973).

Scientific name	Common name
<i>Agropyron spicatum</i>	Bluebunch wheatgrass
<i>Antennaria lanata</i>	Wooly pussytoes
<i>Antennaria microphylla</i>	Rosy pussytoes
<i>Arabis</i> sp.	Rockcress sp.
<i>Arenaria aculeata</i>	Needleleaf sandwort
<i>Artemisia arbuscula</i>	Low sagebrush
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>	Mountain big sagebrush
<i>Astragalus purshii</i>	Pursh's milkvetch
<i>Astragalus veilliflexus</i> var. <i>nubilus</i>	White Cloud milkvetch
<i>Astragalus whitneyi</i>	Balloon milkvetch
<i>Bupleurum americanum</i>	Bupleurum
<i>Carex elynoides</i>	Kobresia-like sedge
<i>Carex</i> sp.	Sedge sp.
<i>Castilleja</i> sp.	Indian paintbrush sp.
<i>Chrysothamnus nauseosus</i>	Gray rabbitbrush
<i>Chrysothamnus viscidiflorus</i>	Green rabbitbrush
<i>Collinsia parviflora</i>	Small-flowered blue-eyed Mary
<i>Cymopterus bipinnatus</i>	Hayden's cymopterus
<i>Draba</i> sp. ¹	Whitlow-grass sp.
<i>Erigeron compositus</i>	Cut-leaf daisy
<i>Eriogonum caespitosum</i>	Mat buckwheat
<i>Eriogonum microthecum</i>	Slenderbush buckwheat
<i>Eriogonum ovalifolium</i>	Cushion buckwheat
<i>Festuca ovina</i>	Sheep fescue
<i>Festuca</i> sp.	Fescue sp.
<i>Haplopappus acaulis</i>	Stemless goldenweed
<i>Gilia aggregata</i>	Skyrocket
<i>Koeleria cristata</i>	Prairie junegrass
<i>Leptodactylon pungens</i>	Prickly phlox
<i>Linum perenne</i>	Blue flax
<i>Lithospermum ruderale</i>	Columbia paccoon
<i>Lupinus argenteus</i>	Silvery lupine
<i>Microseris</i> sp.	Microseris sp.
<i>Oenothera caespitosa</i>	Evening-primrose
<i>Oryzopsis exigua</i>	Little ricegrass
<i>Oryzopsis hymenoides</i>	Indian ricegrass
<i>Penstemon humilus</i>	Lowly penstemon
<i>Phacelia incana</i>	Hoary phacelia
<i>Phlox hoodii</i>	Hood's phlox
<i>Phlox</i> sp. ²	Phlox sp.
<i>Physaria</i> sp.	Twinpod sp.
<i>Poa secunda</i>	Sandberg's bluegrass
<i>Poa</i> sp.	Bluegrass sp.
<i>Potentilla</i> sp.	Cinquefoil sp.
<i>Sedum lanceolatum</i>	Lanceleaf stonecrop
<i>Senecio canus</i>	Wooly groundsel

Scientific name

Sitanion hystrix

Taraxacum officinale

Tetradymia canescens

Draba sp.¹ – most likely *Draba densifolia*

Phlox sp.² – most likely *Phlox pulvinata*

Common name

Squirreltail

Common dandelion

Spineless horsebrush

Appendix 11

White Clouds milkvetch monitoring transect photo point photographs, 2005.