

LONG-TERM DEMOGRAPHIC MONITORING OF TWO STANLEY BASIN ENDEMICS,
DRABA TRICHOCARPA AND ERIOGONUM MELEDONUM.
I. MONITORING ESTABLISHMENT AND
FIRST-YEAR RESULTS

by

Robert K. Moseley and Michael Mancuso
Natural Heritage Section
Nongame/Endangered Wildlife Program
Bureau of Wildlife

December 1990

Idaho Department of Fish and Game
600 South Walnut, P.O. Box 25
Boise, Idaho 83707
Jerry M. Conley, Director

Cooperative Challenge Cost-share Project
Sawtooth National Forest
Idaho Department of Fish and Game

Purchase Order Number 40-0261-0-0801

ABSTRACT

Draba trichocarpa (Stanley whitlow-grass) and Eriogonum meledonum (guardian buckwheat) are endemic to the Stanley Basin, Idaho, where they occur in small populations on restricted habitats. Stanley whitlow-grass is restricted to a series of granite outcrops surrounding the floor of the Stanley Basin. Less than 7,000 individuals are known to occur in 14 populations, occupying less than 100 acres. Guardian buckwheat occurs in similar habitats, where only ten populations are known, containing less than 4,500 individuals and comprising less than 45 acres. Guardian buckwheat and Stanley whitlow-grass are sympatric at seven sites.

Thorough status surveys were conducted for these species in 1987 and 1988 by the Idaho Natural Heritage Program. While no short-term, extrinsic threats were observed, population vulnerability remained a concern because of low numbers and very restricted distribution. Stanley whitlow-grass is currently a category 2 candidate for federal listing. Guardian buckwheat has only recently been described, and has been recommended for inclusion on the candidate list in category 1. It has been recommended that the Sawtooth National Forest develop a conservation plan for both species.

A demographic monitoring program was deemed necessary to provide pertinent population data for habitat management plan development. During July 1990, six permanent monitoring transects were established in guardian buckwheat and Stanley whitlow-grass populations on Forest Service land in the Stanley Basin. A total of 415 Stanley whitlow-grass plants was mapped in the five transects containing that species and 288 guardian buckwheat plants were mapped in four transects. Selected density and fecundity data are presented, as are recommendations concerning sampling protocol and population modeling.

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INTRODUCTION

The management of natural communities containing rare plant populations poses several basic questions for land managers: Are current land management practices adequate to maintain the community or the species? What effect will specific management activities have on the rare plant on a site? What is necessary to ensure the survival of a species? Most of these questions cannot be answered by casual observation and, therefore, some level of monitoring is needed (Sutter 1986).

For this study, I define monitoring as the quantitative assessment of the status of a population over time using data derived from individual plants. A monitoring census is accomplished by identifying individual plants in a population and repeatedly measuring characteristics of their performance. Monitoring is, therefore, capable of identifying the timing and possibly the causes of poor performance, if any, and providing specific management recommendations for rectifying population declines (Pavlik and Barbour 1988).

Demography is the study of population changes and their causes throughout the life cycle. Population attributes such as birth and death rates, growth, size, density and distribution are some of the characteristics measured. Demographic studies of plants have indicated that each population possesses attributes that determine local abundance and/or persistence through time. A thorough analysis of these attributes is of primary importance in the management of rare and endangered plant populations, simply because abundance and persistence are at the center of all conservation efforts (Pavlik and Barbour 1988). Demographic monitoring studies can help determine the factors that control the abundance and distribution of a species and can generate data useful in predicting the future size and age structure of a population.

Demographic monitoring of rare plant species has become increasingly important as the efforts of natural resource agencies have evolved from an emphasis on the inventory and status determination of rare species to active protection efforts, such as management of rare plant populations. Such is the case with the two Stanley Basin endemics, Draba trichocarpa (Stanley whitlow-grass) and Eriogonum meledonum (guardian buckwheat). Both species have only recently been described (Rollins 1984; Reveal 1989), although the existence of guardian buckwheat has been known since the early 1970's. Thorough status surveys were conducted for these species in 1987 and 1988 by Caicco (1988) and Moseley (1988). We found that both species occur in small populations on restricted habitats in the basin. While no short-term, extrinsic threats were observed, population vulnerability remained a concern because of low numbers and very restricted distribution.

Stanley whitlow-grass is currently a category 2 candidate for federal listing (U.S. Fish and Wildlife Service 1990), but is recommended for category 1 status when the next list is published. Now that it has been formally described, guardian buckwheat has been recommended for inclusion on the candidate list in category 1. Caicco (1988) and Moseley (1988) recommended that the Sawtooth National Forest develop a habitat management plan for both species. The results of this study will provide important data for management plan development.

NATURAL HISTORY AND MORPHOLOGY

Stanley whitlow-grass

Stanley whitlow-grass is restricted to a series of granite outcrops surrounding the floor of the Stanley Basin in south-central Idaho. Less than 7,000 individuals are known to occur in 14 populations, occupying less than 100 acres. It occurs on moderately steep, south-facing slopes, where bedrock is close to the surface. The associated community is characteristically open, with widely scattered plants and large amounts of exposed soil/bedrock.

Stanley whitlow-grass is a perennial forb from a narrow taproot, with a low, compact growth form commonly referred to as a cushion. It has small, but conspicuous, yellow flowers. The flowers, and later the fruits, are borne at the end of short, leafless stems which are carried upright at the ends of short, densely leafy branches (Moseley 1988).

Guardian buckwheat

Guardian buckwheat occurs in habitats around the Stanley Basin similar to Stanley-whitlow grass, although its distribution extends farther south, into the north end of the Sawtooth Valley. Only ten populations are known, containing between 3,500 and 4,500 individuals and comprising less than 45 acres. Guardian buckwheat and Stanley whitlow-grass are sympatric at seven sites (Caicco 1988; Moseley 1988).

Guardian buckwheat is a grayish-woolly, perennial subshrub forming moderately dense mats 5 - 30 cm in diameter. No vegetative propagation has been observed in this species. The numerous erect leaves are oblanceolate, about 5 cm long. The inflorescence consists of a capitate cluster of numerous, small, bright yellow flowers terminating a naked, 8 - 12 cm tall scape (Moseley 1988).

METHODS

Sampling

For recording of demographic data for guardian buckwheat and Stanley whitlow-grass we used methods developed by Lesica (1987). The technique employs a contiguous, subdivided belt transect that has been found to be useful for nonrhizomatous perennial plants with low to moderate density.

Our choice of transect locations included only those populations or portions of populations where the act of sampling would not significantly disturb the population; i.e., we did not place transects in steep, loose scree. Each transect is randomly placed within a population. The transects are of variable length, depending on population density; the object is to sample a sufficiently large number of individuals for modeling. Each transect was permanently marked by placing reinforcing bar at the start and end points. They were colorfully marked with orange paint and their location marked on maps and described in relation to conspicuous landmarks.

A transect consists of adjacent 1 m^2 quadrats placed along one side of a tape stretched between the start and end points. The quadrat is graduated in 1 cm increments along the x and y axes to be used for establishing a coordinate locator for each target plant encountered. For each quadrat along the transect there is a corresponding box on the data form where the location of each plant is mapped. Coded life history data for each plant are written next to the corresponding mark on the data form.

Lesica (1987) found that life history codes have to be developed on a case by case basis. Following is a list of categories and their codes that we used for Stanley whitlow-grass and guardian buckwheat.

Stanley whitlow-grass:

Stage classes

- S Seedlings = very small plants with one rosette of leaves. Attribute recorded: presence/location.

- N Nonreproductive = plants with greater than one rosette that are not producing inflorescences. Attribute recorded: presence/location.

- R Reproductive = plants that have one or more inflorescences. Attributes recorded: (1) presence/location; (2) reproductive classes as described below.

We also measured the diameter of each plant by averaging of the longest and shortest dimensions of the living portion of the cushion, in cm.

Classes for reproductive plants (each code is followed by a number in superscript on data form; Appendix 3)

- I Indicates the number of inflorescences per plant.
- F Indicates the average number of mature fruits per inflorescence.
- A Indicates the number of aborted fruits per plant.
- P Indicates the number of inflorescences removed by predation per plant.

In addition to the above information recorded for each quadrat, between 50 and 100 fruits were collected from the population in areas well removed from the transect (greater than 10 m). The number of viable-appearing seeds produced by each fruit was recorded.

Guardian buckwheat:

Stage classes

- S Seedlings = plants that lack woody tissue (Kaye et al. 1990). Attribute recorded: presence/location.
- N Nonreproductive = plants with woody stems that are not producing inflorescences. Attribute recorded: presence/location.
- R Reproductive = plants that have one or more inflorescences. Attributes recorded: (1) presence/location; (2) reproductive classes as described below.

We also measured the diameter of each plant by averaging of the longest and shortest dimensions of the living portion of the cushion, in cm.

Classes for reproductive plants (each code is followed by a number in superscript on data form; Appendix 3)

- I Indicates the number of inflorescences per plant.
- A Indicates the number of aborted inflorescences per plant (flowers with no apparent fruit formation).

P Indicates the number of inflorescences removed by predation per plant.

Since it would have been too time consuming to count flowers on each inflorescence of guardian buckwheat, we sampled plants in the population (greater than 10 m from the transect) to get an average number of flowers per inflorescence. From this sample of flowers, we sampled 50 fruits for an estimate of percent aborted fruits and average number of viable-appearing seeds per fruit.

Community composition data were also collected for each plot of the six transects. These data are currently being analyzed and will be discussed in next year's report.

Population Modeling

After at least three years of demographic data have been collected, modeling can be used to predict the extinction probability and minimum viable population level in individual plant populations. We will use transition matrix techniques to project population age structures through time. Refer to Bierzychudek (1982), Menges (1986) and Fiedler (1987) for detailed explanations of the use of transition matrices for studying plant population dynamics.

For Stanley whitlow-grass and guardian buckwheat, matrix projections will begin with the stage structure (i.e., seed, seedling, nonreproductive, reproductive) of the population in 1990. The stage structure then changes over one year as some individuals remain at that stage, while others grow to another stage or die. Stage-specific survivorships, fecundity, and transfer (growth) rates project the future dynamics of the population.

Matrix projections will be computed using specifically-designed computer software, several of which are reviewed in Caswell (1989).

RESULTS

During June 10-12, 1990, we established six transects in guardian buckwheat and Stanley whitlow-grass populations on Forest Service land in the Stanley Basin. The location of each transect appears on maps in Appendix 1 and a detailed description of each transect is found in Appendix 2. As summarized in Table 1, three transects had both species, two had only Stanley whitlow-grass and one had only guardian buckwheat.

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Table 1. Demographic monitoring transects for Draba trichocarpa and Eriogonum meledonum established in the Stanley Basin, July 1990.

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#	Site	Species (occurrence #)	Length (m)
1.	Stanley Creek	<u>Draba trichocarpa</u> (001) <u>Eriogonum meledonum</u> (002)	25
2.	Sportsmen's Access #3	<u>Eriogonum meledonum</u> (005)	50
3.	Middle Stanley	<u>Draba trichocarpa</u> (004)	25
4.	Mile 377.5 Gulch	<u>Draba trichocarpa</u> (007)	25
5.	Stanley #4	<u>Draba trichocarpa</u> (003) <u>Eriogonum meledonum</u> (008)	15
6.	Arrow A Ranch North	<u>Draba trichocarpa</u> (009) <u>Eriogonum meledonum</u> (006)	25

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For each transect, the location of each plant and pertinent coded life stage and reproductive data were recorded on special field forms (Appendix 3). Fruits of Stanley whitlow-grass were collected on July 10-12, and guardian buckwheat on August 5. This data was later entered into data files set-up in Lotus 1-2-3, Release 2.2 (Appendix 4). A summary of density and selected fecundity data is presented in Table 2 for Stanley whitlow-grass and in Table 3 for guardian buckwheat.

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Table 2. First-year population density and fecundity data for *Draba trichocarpa* in long-term monitoring transects established in the Stanley Basin, July 1990.

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TRANSECT #	1	3	4	5	6
Total # plots/transect	25	25	25	15	25
Total # plants/transect	63	93	81	110	68
Density (plants/m ²)	2.5	3.7	3.2	7.3	2.7
Total # seedlings/transect (% population)	0 (0%)	0 (0%)	8 (10%)	0 (0%)	3 (5%)
Total # nonreprod/transect (26%) (% population)	30 (48%)	38 (41%)	40 (49%)	70 (64%)	18
Total # reprod/transect (% population)	33 (52%)	55 (59%)	33 (41%)	40 (36%)	47(69%)
Avg # fruits/inflorescence	3.3	3.2	2.9	3.0	4.1
Total # fruits/transect	633.6	1,129.6	529	588	1,476
Avg # fruits/reprod plant	19.2	20.5	16	14.7	31.4
Avg diameter of plants (cm)	2.2	2.7	2.1	2.7	2.6
Avg diameter reprod plants(cm)	2.5	3.2	3.4	3.0	3.1
# fruits predated/transect (% population)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
# fruits aborted/transect (% population)	1 (0.2%)	16 (1.4%)	0 (0%)	0 (0%)	2(0.1%)
Avg # seeds/fruit	2.3	1.9	2.3	1.1	1.6
Total seeds/transect	1,457.3	2,146.2	1,216.7	646.8	2,361.6
Avg seeds/reprod plant	44.2	39.0	36.9	16.2	50.2

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Table 3. First-year population density and fecundity data for Eriogonum meledonum in long-term monitoring transects established in the Stanley Basin, July 1990.

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TRANSECT #	1	2	5	6
Total # plots/transect	25	50	15	25
Total # plants/transect	55	129	62	42
Density (plants/m ²)	2.2	2.6	4.1	1.7
Total # seedlings/transect (% population)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total # nonreprod/transect (% population)	33 (60%)	61 (47%)	38 (61%)	11 (26%)
Total # reprod/transect (% population)	22 (40%)	68 (53%)	24 (39%)	31 (74%)
Avg # fruits/inflorescence	20.9	18.0	30.1	44.8
Total # fruits/transect	4,617	5,796	1,535	10,348
Avg # fruits/reprod plant	210.0	85.2	63.9	333.8
Avg diameter of plants (cm)	5.7	6.5	4.4	7.7
Avg diameter reprod plants (cm)	7.7	7.5	5.2	8.4
# inflor predated/transect (% population)	0 (0%)	0 (0%)	1 (1.4)	4 (2%)
# inflor aborted/transect (% population)	0 (0%)	13 (4%)	16 (24%)	27 (10%)
Avg # seeds/fruit	0.04	0.44	0.2	0.46
Total seeds/transect	184.8	2,550.2	307	4,760
Avg seeds/reprod plant	8.4	37.5	12.8	153.6

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A total of 415 Stanley whitlow-grass plants were mapped in the five transects containing that species. The highest density population is Stanley #4, although this site had the lowest reproductive output, with only 16.2 seeds produced per plant. Transect 6 at Arrow A Ranch North, in contrast, had the second lowest density population but the highest reproductive output, with 50.2 seeds produced per plant. Very few seedlings were observed in general, with only 8 being recorded on transect 4 and 3 on transect 6. Although seedlings are very small and care must be taken when recording data, the community is very open and we doubt that many were missed. We observed no predated fruits and very few were aborted.

For guardian buckwheat, a total of 288 plants were mapped in four transects. As with Stanley whitlow-grass, the highest density population at Stanley # 4 had relatively low reproductive output, while the Arrow A Ranch North population had the lowest density and the highest reproductive output. We observed no seedlings in the four transects. Very few inflorescences were observed to be predated, but a relatively high percentage of inflorescences were aborted at Stanley #4 and Arrow A Ranch North. The reproductive output of guardian buckwheat in the four transects was highly variable and very low, ranging from 8.4 seeds produced per plant, to 153.6. There is generally only one seed produced per fruit and we found very few viable-appearing or mature seeds in an inflorescence; the average number of seeds per fruit along the four transects ranged from 0.04 to 0.46 (Table 3). This may be a sampling artifact due to rapid dispersal of the seeds. See Recommendations section, below, for further details.

RECOMMENDATIONS

1. A minimum of three years of data are needed to make predictions on future population trends using matrix models, although a decade or more of data will appreciably increase the power of the model by including relatively long-term annual variability.

Population modeling and consequent analyses of extinction probabilities and minimum viable population sizes cannot take place until after the third year of data are collected. Funding has been secured through the Challenge Cost-share program to collect second-year data in 1991.

2. The estimation of seed production in guardian buckwheat was problematic. Kaye *et al.* (1990) found that the estimation of seed production in two closely-related species of *Eriogonum* in Oregon was problematic. They found that fruits rapidly break free from the inflorescence, often with the perianth attached, allowing for rapid dispersal. We found this also was the case with guardian buckwheat. It was difficult to find intact inflorescences with mature fruits that had not dispersed when we collected our sample in early August. This may account for the wide variability in fruit and seed production estimates from our samples (Table 3).

To aid in the collection of a representative fruit sample in 1991, we will encapsulate inflorescences in a population, after pollination but before maturation, with mesh fabric to catch mature fruits as they disperse.

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Appendix 1.

Maps showing the location of six demographic monitoring transects established in the Stanley Basin, July 1990.

- Map 1. Location of Transect 1 (Stanley Creek). Portion of 1963 Basin Butte 7.5' quadrangle.
- Map 2. Location of Transect 2 (Sportsmen Access #3), Transect 3 (Middle Stanley), Transect 4 (Mile 377.5 Gulch), Transect 5 (Stanley #4), Transect 6 (Arrow A Ranch). Portion of 1963 Stanley 7.5' quadrangle.

Appendix 2.

Detailed description of transect locations, habitats and anthropogenic disturbance regimes.

TRANSECT 1

STANLEY CREEK

Location

We put a 25 m transect, more or less on the northerly-facing ridgeline. The westerly-facing slope was deemed too steep and unstable to put a transect.

The 0.0 stake is located at the toe of the ridge (N end) several meters above the prominent cow trail that skirts the base of the ridge. The 0.0 stake is located at a bearing of 104° at 36 m from wooden-posted FS "Camping Limit" sign, which is on W side of the road to the sand pit, ca. 0.1 mile S of intersection with Stanley Creek Road. McGown Peak is at a 245° bearing from the 0.0 stake.

The azimuth of transect is 170° , read downhill to uphill (N to S). Plots were read on the W side of the tape. Aspect of the transect generally 340° . Slope varies from 10° to 20° .

Disturbance

Cattle grazing occurs in surrounding meadows, where it is locally heavy. Cattle trail across the population to short-cut getting from the side draw (W of population) into main Stanley Creek meadows and visa versa. In fact, Michael bravely headed off a stampede of ca. 8 head that were about to run over the tape. Not much actual grazing takes place on the site due to the sparse vegetation, although some Festuca idahoensis bunches were munched to the crown along the transect.

ORV (motorbikes) tracks have been seen cutting through the population in the past. No evidence of this activity was observed in July 1990.

Habitat

The community is undescribed in the literature, but comes closest to the Artemisia arbuscula ssp. thermopola/Festuca idahoensis habitat type. There is much more Sitanion hystrix than F. idahoensis, however. The surrounding vegetations are the Artemisia tridentata ssp. vaseyana/F. idahoensis and Pseudotsuga menziesii/Calamagrostis rubescens habitat types. The Artemisia cana/Deschampsia cespitosa riparian community dominates surrounding lowland meadows.

Transect 1 (continued)

Species list for Stanley Creek transect:

SHRUBS

Artemisia arbuscula spp. thermopola
Chrysothamnus viscidiflorus

FORBS AND SUBSHRUBS

Antennaria microphylla
Draba trichocarpa
Erigeron compositus
Erigeron linearis
Eriogonum flavum
Eriogonum meledonum
Eriogonum umbellatum
Lesquerella occidentalis
Penstemon procerus
Phlox austromontana
Sedum lanceolatum
Thlaspi aileeniae

GRAMINOIDS

Carex douglasii ? (too early; rhizomatous)
Festuca idahoensis
Koeleria cristata
Oryzopsis exigua
Poa secunda
Sitanion hystrix

TRANSECT 2

SPORTSMEN'S ACCESS #3

Location

A 50 m transect runs S, down the slope from the N edge of the subpopulation on the ridge below Pk 6775. The other subpopulations on the steep, S-facing slopes above Valley Creek were deemed too steep and unstable for sampling.

Beginning of the transect is located just SW of the end of a 2-track jeep trail that ends on the flat just below (S) of Pk 6775. The 0.0 stake is located on level ground of ridgeline, several meters and 7° azimuth from a small pile of rocks at southern edge of knob, where slope changes declivity abruptly. McGown Peak is at a 264° bearing from the 0.0 stake, Williams Peak is 200° , and Mt. Heyburn is 188° .

Azimuth of transect is 214° , read uphill to downhill (NE to SW). Plots read on upstream, westerly side of tape. Transect is nearly level for the first 9 m, then changes to 10° for the remaining 41 m.

Disturbance

The near-by 2-track jeep trail does not enter the population. Some old cow pies (several years old) occur along the transect. An old boundary fence cuts through the population several meters below the end of the transect.

Habitat

This subpopulation occurs in a relatively small microsite dominated by Phlox austromontana and Sitanion hystrix with high prominence of Astragalus whitneyi, Poa secunda, and Erigeron compositus. Surrounding slopes are mostly Artemisia tridentata ssp. vaseyana/F. idahoensis with pockets of Pseudotsuga menziesii/Calamagrostis rubescens on north slopes.

Transect 2 (continued)

Species list for Sportsmen's Access #3 transect:

SHRUBS

Artemisia tridentata spp. vaseyana
Chrysothamnus viscidiflorus

FORBS AND SUBSHRUBS

Achillea millefolium
Antennaria microphylla
Arabis sp.
Astragalus whitneyi
Crepis acuminata
Erigeron compositus
Erigeron linearis
Eriogonum flavum
Eriogonum meledonum
Eriogonum umbellatum
Lesquerella occidentalis
Lupinus sericeus
Penstemon procerus
Phlox austromontana
Sedum lanceolatum
Thlaspi aileeniae

GRAMINOIDS

Carex rossii
Festuca idahoensis
Koeleria cristata
Oryzopsis exigua
Poa secunda
Sitanion hystrix

TRANSECT 3

MIDDLE STANLEY

Location

This population is very small, about 40 m by 15 m, with only a few hundred plants. We were able to put one 25 m transect at this site.

Mt. Heyburn is at a bearing of 205° from the 0.0 stake, and the Husky Service Station sign in Lower Stanley is 71° . The transect was read downhill to uphill at 239° (NE to SW). Plots read on uphill, NW side of tape. Transect is on a 7° slope, facing 16° .

Disturbance

Virtually none. Highway construction may have disturbed some habitat on lower slope, but they did not cut into slope much, just filled in the river. Effluent from Stanley sewage ponds was pumped up to ridge several hundred meters up ridge from site when their system broke temporarily. No impact to population seen.

Habitat

The community in which Draba trichocarpa occurs is the Artemisia arbuscula ssp. thermopola/Festuca idahoensis habitat type, with bedrock very close to the surface. Above this is the Artemisia tridentata ssp. vaseyana/F. idahoensis habitat type, occurring on old, perched river gravels.

Transect 3 (continued)

Species list for Middle Stanley transect:

SHRUBS

Artemisia arbuscula spp. thermopola
Chrysothamnus nauseosus

FORBS AND SUBSHRUBS

Antennaria dimorpha
Antennaria microphylla
Arabis sp.
Chaenactis douglasii
Draba trichocarpa
Erigeron compositus
Eriogonum flavum
Eriogonum ovalifolium
Eriogonum umbellatum
Lesquerella occidentalis
Lomatium foeniculaceum
Penstemon procerus
Phlox austromontana
Phlox hoodii
Polemonium viscosum
Potentilla glandulosa
Sedum lanceolatum
Taraxacum officinale
Tragopogon dubius

GRAMINOIDS

Carex rossii
Festuca idahoensis
Oryzopsis exigua
Poa secunda
Sitanion hystrix

TRANSECT 4

MILE 377.5 GULCH

Location

This is a ridgeline population of moderate density. The 25 m transect is located on ridge E of gulch. There is a steep slope immediately above highway for about 75 m, then it breaks at a rock outcrop and becomes gentler. The population occurs on the gentler portion and the transect runs on westerly side of ridgeline.

The 0.0 stake is on the uphill end of the transect and runs N to S, down the ridge at 193° . Plots read on uphill (downstream) side of tape. The slope has a westerly aspect at 290° , and the declivity is 10° . Mt. Heyburn is at 204° from the 0.0 stake, and it is 224° to Williams Peak.

Disturbance

Virtually none. No evidence of cattle grazing. It appears that elk winter on ridge, with some spring use also possible.

Habitat

The transect runs through the windswept portion of the Artemisia tridentata ssp. vaseyana/F. idahoensis habitat type. Artemisia tridentata cover is low along the transect. A Purshia tridentata community occurs on adjacent slopes.

Transect 4 (continued)

Species list for Mile 377.5 Gulch transect:

SHRUBS

Artemisia tridentata spp. vaseyana
Chrysothamnus nauseosus
Chrysothamnus viscidiflorus

FORBS AND SUBSHRUBS

Antennaria dimorpha
Antennaria microphylla
Arabis sp.
Astragalus whitneyi
Draba trichocarpa
Erigeron compositus
Erigeron linearis
Eriogonum flavum
Lesquerella occidentalis
Lomatium foeniculaceum
Lupinus sericeus
Phlox austromontana
Sedum lanceolatum
Thlaspi aileeniae

GRAMINOIDS

Carex rossii
Festuca idahoensis
Koeleria cristata
Oryzopsis exigua
Poa secunda
Sitanion hystrix

TRANSECT 5

STANLEY #4

Location

The 15 m transect is located just N of FS boundary in southern part of saddle. The 0.0 stake is 16.9 m at 340° from Forest Service boundary marker (on fiberglass wand).

The transect runs 356° , read uphill to downhill (S to N). Plots read on uphill (E) side of tape. Slope aspect is 282° . Declivity of tape is 8° . Mt. Heyburn is at 222° from the 0.0 stake, and it is 207° to Williams Peak.

Disturbance

Dirt track on ridgeline for motorbikes, mountain bikes, and hikers bisects the population, but does not come near the transect. No evidence of cattle grazing.

Habitat

Exposed Artemisia arbuscula ssp. thermopola site with little Festuca idahoensis present. Geum triflorum common in stand; Polemonium viscosum and Calamagrostis purpurascens also prominent. Deeper soil sites in vicinity are Artemisia tridentata ssp. vaseyana/Festuca idahoensis with Pinus contorta and Pseudotsuga menziesii on northerly slopes.

Transect 5 (continued)

Species list for Stanley #4 transect:

SHRUBS

Artemisia arbuscula spp. thermopola
Potentilla fruticosa

FORBS AND SUBSHRUBS

Antennaria dimorpha
Antennaria microphylla
Arabis sp.
Draba trichocarpa
Erigeron compositus
Eriogonum meledonum
Geum triflorum
Lesquerella occidentalis
Lomatium foeniculaceum
Penstemon procerus
Phlox hoodii
Polemonium viscosum
Potentilla glandulosa
Sedum lanceolatum
Taraxacum officinale
Thlaspi aileeniae

GRAMINOIDS

Calamagrostis purpurascens
Carex rossii
Festuca idahoensis
Poa secunda
Sitanion hystrix

TRANSECT 6

ARROW A RANCH NORTH

Location

The 25 m transect is located on broad ridge ca 75 m uphill from FS boundary marker above the cluster of rocks above the ranch. The transect runs diagonally across ridgeline, crossing several animal trails and small erosion rills.

The transect runs 262° , read uphill to downhill with plots on uphill side of tape. Slope aspect is 212° . Declivity of slope is 5° . Bearing from 0.0 stake to Arrow A Ranch bridge across Salmon River is 288° .

Disturbance

Elk winter on slope, although not too heavy at elevation of transect. Animal trails (probably mostly elk, but also horses and cattle) run down the ridge through the transect. Draba trichocarpa does not appear to be abundant near erosion channels/animal trails.

Habitat

Exposed Artemisia arbuscula ssp. thermopola/Sitanion hystrix site; highly erosive.

Transect 6 (continued)

Species list for Arrow A Ranch North transect:

SHRUBS

Artemisia arbuscula spp. thermopola
Chrysothamnus nauseosus
Chrysothamnus viscidiflorus

FORBS AND SUBSHRUBS

Antennaria dimorpha
Antennaria microphylla
Arabis sp.
Arenaria congesta
Astragalus whitneyi
Chaenactis douglasii
Cryptantha sp.
Draba trichocarpa
Erigeron compositus
Eriogonum meledonum
Eriogonum umbellatum
Gayophytum ramosissimum
Lesquerella occidentalis
Lomatium foeniculaceum
Machaeranthera canescens
Penstemon procerus
Phlox hoodii
Polemonium viscosum
Sedum lanceolatum
Taraxacum officinale
Thlaspi aileeniae

GRAMINOIDS

Carex douglasii
Carex rossii
Poa secunda
Sitanion hystrix

Appendix 3.

Demographic data field forms for the six Stanley Basin transects.

Appendix 4.

Lotus 1-2-3 data files for the six Stanley Basin transects.

Appendix 5.

Selected slides of transects and plots.

- Slide 1. Overview of Transect 1 (Stanley Creek); 0.0 stake in foreground, looking uphill along tape.
- Slide 2. Overview of Transect 2 (Sportsmen's Access #3); looking downhill along tape to 50 m mark; 0.0 stake out of view in back of camera.
- Slide 3. Overview of Transect 3 (Middle Stanley); 0.0 stake in foreground, looking upriver along tape.
- Slide 4. Overview of Transect 4 (Mile 377.5 Gulch); 0.0 stake in foreground, looking downhill along tape.
- Slide 5. Overview of Transect 5 (Stanley #4); 0.0 stake in upper left; transect read from left (uphill) to right (downhill); Michael standing at 15 m end of transect.
- Slide 6. Overview of Transect 6 (Arrow A Ranch North); looking downhill along transect; 0.0 stake just out of view in lower center of photo.
- Slide 7. Close-up of 0.0 and end stake; it is a potato-digger bar, with top painted orange with rust-proof machine paint.
- Slide 8. Close-up of quadrat along tape.
- Slide 9. Close-up of portion of quadrat along tape; note 1 cm increments marked on quadrat frame. Meter stick used to derive coordinates of rare species within quadrat, in this case Eriogonum meledonum.