LONG-TERM DEMOGRAPHIC MONITORING OF TWO STANLEY BASIN ENDEMICS, *DRABA TRICHOCARPA* AND *ERIOGONUM MELEDONUM*.
II. SECOND-YEAR RESULTS

by

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February 1992

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

Purchase Order Number 43-0269-1-36

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 Conservation Data Center[1]. 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 1990, six permanent monitoring transects were established in guardian buckwheat and Stanley whitlow-grass populations on Forest Service land in the Stanley Basin. These transects were read again in June 1991, and these second year results are reported here.

[1]Formerly the Idaho Natural Heritage Program.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

INTRODUCTION

Demographic monitoring of rare plant species has become increasingly important as the efforts of natural resource agencies have evolved from an emphasis on 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.

Long-term demographic monitoring of Stanley whitlow-grass and guardian buckwheat was established in 1990. Moseley and Mancuso (1990) reported the first-year results, including transect establishment and a summary of selected 1990 density and fecundity data.

METHODS

Sampling

Sampling methodology was described in detail by Moseley and Mancuso (1990). Maps showing the location of the six demographic monitoring transects established in the Stanley Basin, in July 1990, are included in our 1990 report, along with descriptions of transect locations, habitats and anthropogenic disturbance regimes. 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. 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 1)

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 seeds produced by each fruit was recorded.

Guardian buckwheat:

Stage classes

S Seedlings = plants that lack woody tissue. 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 1)

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 seeds per fruit.

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.

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 a specifically-designed computer software package, RAMAS/stage (version 1.1), developed by Scott Ferson of Applied Biomathematics.

RESULTS

During June 25-28, 1991, we reread plots along the six transects established in 1990, in guardian buckwheat and Stanley whitlow-grass populations. As summarized in Table 1, three transects had both species, two had only Stanley whitlow-grass and one had only guardian buckwheat.

Table 1. Demographic monitoring transects for Draba trichocarpa and Eriogonum meledonum established in the Stanley Basin, July 1990, and reread in June 1991.

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

For each transect, the location of each plant and pertinent coded life stage and reproductive data were recorded on special field forms (Appendix 1). This data was later entered into data files set-up in Lotus 1-2-3, Release 2.2 (Appendix 2). Fruits of Stanley whitlow-grass were collected on June 25-28. Guardian buckwheat inflorescences were bagged with netting on July 22 (after pollination) to allow fruit maturation but prevent dispersal. The netted fruits were collected on August 27. A summary of density and selected fecundity data is presented in Table 2 for Stanley whitlow-grass and in Table 3 for guardian buckwheat.

Table 2. 1990 and 1991 population density and fecundity data for *Draba trichocarpa* in long-term monitoring transects established in the Stanley Basin.

TRANSECT #	**1**		**3**		**4**	
	1990	1991	1990	1991	1990	1991
Total # plots/transect	25	25	25	25	25	25
Total # plants/transect	63	82	93	102	81	76
Density (plants/m^2)	2.5	3.3	3.7	4.1	3.2	3.0
Total # seedlings/transect (% population)	0(0)	6(7)	0(0)	1(1)	8(10)	2(3)
Total # nonreprod/transect (% population)	30(48)	18(22)	38(41)	18(18)	40(49)	15(20)
Total # reprod/transect (% population)	33(52)	58(71)	55(55)	83(81)	33(41)	59(77)
Avg # fruits/inflorescence	3.3	2.9	3.2	5.5	2.9	4.7
Total # fruits/transect	633.6	1241	1130	5803	529	1894
Avg # fruits/reprod plant	19.2	21.4	20.5	70	16	32.1
# fruits predated/transect (% population)	0	0	0	0	0	0
# fruits aborted/transect (% population)	1	0	16	276	0	150
Avg # seeds/fruit	2.3	1.9	1.9	2.3	2.3	2.3
Total seeds/transect	1457	2358	2146	13,347	1216	4356
Avg seeds/reprod plant	44.2	40.7	39.0	161	36.9	74

Table 2. Continued

TRANSECT #	5		6	
	1990	1991	1990	1991
Total # plots/transect	15	7	25	25
Total # plants/transect	110	34	68	84
Density (plants/m^2)	7.3	4.9	2.7	3.4
Total # seedlings/transect (% population)	0(0)	0(0)	3(5)	2(2)
Total # nonreprod/transect (% population)	70(64)	2(6)	18(26)	18 (22)
Total # reprod/transect (% population)	40(36)	32(94)	47(69)	64(76)
Avg # fruits/inflorescence	3.0	5.4	4.1	4.6
Total # fruits/transect	588	1444	1476	2737
Avg # fruits/reprod plant	14.7	45.1	31.4	42.8
# fruits predated/transect (% population)	0	0	0	0
# fruits aborted/transect (% population)	0	28	2	214
Avg # seeds/fruit	1.1	1.1	1.6	1.6
Total seeds/transect	646.8	1588	2362	4379
Avg seeds/reprod plant	16.2	49.6	50.2	68.4

Table 3. 1990 and 1991 population density and fecundity data for Eriogonum meledonum in long-term monitoring transects established in the Stanley Basin

TRANSECT #	**1**		**2**	
	1990	1991	1990	1991
Total # plots/transect	25	25	50	50
Total # plants/transect	55	56	129	126
Density (plants/m^2)	2.2	2.2	2.6	2.5
Total # seedlings/transect (% population)	0(0)	4(7)	0(0)	0(0)
Total # nonreprod/transect (% population)	33(60)	31(55)	61(47)	93(74)
Total # reprod/transect (% population)	22(40)	21(38)	68(53)	33(26)
Avg # fruits/inflorescence	20.9	5.5	18.0	29.2
Total # fruits/transect	4617	787	5796	3154
Avg # fruits/reprod plant	210.0	95.6	85.2	95.6
# inflor predated/transect (% population)	0	0	0	0
# inflor aborted/transect (% population)	0	0	13	0
Avg # seeds/fruit	0.04	0.0	0.44	0.28
Total seeds/transect	184.8	0.0	2550	883
Avg seeds/reprod plant	8.4	0.0	37.5	26.8

Table 3. Continued

TRANSECT #	**5**		**6**	
	1990	1991	1990	1991
Total # plots/transect	15	15	25	25
Total # plants/transect	62	71	42	42
Density (plants/m^2)	4.1	4.7	1.7	1.7
Total # seedlings/transect (% population)	0(0)	0(0)	0(0)	0(0)
Total # nonreprod/transect (% population)	38(61)	57(80)	11(26)	27(64)
Total # reprod/transect (% population)	24(39)	14(20)	31(74)	15(36)
Avg # fruits/inflorescence	30.1	11.5	44.8	24.6
Total # fruits/transect	1535	276	10,348	1649
Avg # fruits/reprod plant	63.9	19.7	333.8	110
# inflor predated/transect (% population)	1	0	4	0
# inflor aborted/transect (% population)	16	1	27	0
Avg # seeds/fruit	0.2	0.14	0.46	0.1
Total seeds/transect	307	38.6	4760	165
Avg seeds/reprod plant	12.8	2.8	153.6	11

A total of 378 Stanley whitlow-grass plants were mapped in the five transects containing that species in 1991. This is similar to the 375 plants recorded in 1990, taking into account the shortened Transect 5. The highest density population remained Stanley #4 (Transect 5) in 1991. Although the number of plants remained the same in 1991, the reproductive output of all populations except Stanley Creek (Transect 1) increased dramatically. Middle Stanley (Transect 3) had the most dramatic increase with the mean seeds per reproductive plant statistic increasing from 39 in 1990, to 161 in 1991. The increase in reproductive output resulted from a large increase in the number of inflorescences and number of fruits produced; the number of seeds produced by each fruit remained the same. Seedlings were again very scarce in the transects in 1991, with a slight decline recorded for 1991. No predated fruits were recorded in 1991, but the number of aborted fruits increased dramatically. This rise in aborted fruits, however, appears to have had little impact on overall reproductive output.

For guardian buckwheat, the total number of plants recorded and their density remained relatively constant in 1990 and 1991. The reproductive output, however, decreased dramatically in 1991. This included a decrease in both the number of reproductive individuals comprising the four populations, the number of inflorescences, and, except for Transect 2, the number of fruits per inflorescence. Seed viability also remained very low.

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.

2. It became clear during the 1991 sampling that a small difference in tape position will create problems in exactly lining up the plots to map individual plants at their same coordinates as 1990. For modeling purposes, it is important that we are able to track each individual over the years and record demographic data for each of those plants. When establishing the transects in 1990, we permanently marked the start and end of each transect. It appears that this is not enough and we will place intermediate markers in 1992. Also, some of the stakes used to mark the plots were dislodged between 1990 and 1991. We will try to more solidly place the transect markers.

3. While the method of mapping individual plants along a transect employed in this study works well with low- to medium-density populations, it does not work well with high-density populations. Such is the case with the first eight plots of Transect 5 (Stanley #4), where the population density of Stanley whitlow-grass was so high, that in 1991 it was impossible to precisely determine the location of individuals mapped in 1990. (Guardian buckwheat was of sufficiently low density along this transect that we could map it properly.) Because of this lack of precision, we determined that the first eight plots along this transect were unusable for population modeling. No data is recorded for these plots in Appendix 2.

Along these lines, we will probably alter our data collection techniques for all transects in 1992, to assure that we are precise in matching up the position of previously mapped individuals with the 1990 and 1991 maps (Appendix 1) and identify each plant using the plant number from the Lotus data file (Appendix 2). We will also keep the 0,0 position of each plot along the transect the same as it was on 1990 field forms (Appendix 3 in Moseley and Mancuso 1990).

4. Fruit and seed collection procedures and seed-viability testing have been refined in the last two years and will probably be refined further for 1992. Procedures and protocols for this part of the monitoring project will be fully reported following the third year of data collection.

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Appendix 1.

1991 demographic data field forms
for the six Stanley Basin transects.

Appendix 2.

1991 Lotus 1-2-3 data files for the six Stanley Basin transects.