A FOURTH YEAR OF MONITORING CHRIST'S INDIAN PAINTBRUSH ON THE SAWTOOTH NATIONAL FOREST: 2000 RESULTS

by

Michael Mancuso
Conservation Data Center

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Idaho Department of Fish and Game
600 South Walnut, P.O. Box 25
Boise, ID 83707
Rod Sando, Director

Sawtooth National Forest
Idaho Department of Fish and Game
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ABSTRACT

The global distribution of Christ's Indian paintbrush (*Castilleja christii*) is restricted to a single population on Mount Harrison at the north end of the Albion Mountains, in Cassia County, Idaho. This species is currently a candidate for listing as Threatened or Endangered under the Endangered Species Act. In 1995, a monitoring program for Christ's Indian paintbrush was established by the Idaho Department of Fish and Game's Conservation Data Center under contract from the Sawtooth National Forest. Monitoring transects were then resampled in 1996, 1997, and 2000.

My objectives for 2000 were (1) to collect population monitoring data for Christ's Indian paintbrush at the 20 monitoring transects; (2) to resample vegetation plots associated with each transect; (3) to re-take photopoint photographs at each transect; and (4) to resample a special transect monitoring habitat recovery in a portion of the population disturbed by the burying of an electronic cable line in late 1995. This report summarizes the 2000 results and makes comparisons to results from previous years.

Significant increases and decreases in the density of Christ's Indian paintbrush were recorded for several transects, although the total number of plants tallied was similar to previous years. All transects had fewer reproductive stems in 2000 than any other year; however, not all decreases were statistically significant. Overall, vegetation monitoring results were similar to the 1995 baseline results, although several species decreased, and a few others increased in cover at a number of transects. Monitoring results along the Electronic Line Habitat Recovery transect suggest forb species common on Mount Harrison are contributing the most to the revegetation process, and that vegetation is slowly re-establishing along most of the transect.

ACKNOWLEDGEMENT

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INTRODUCTION

Christ's Indian paintbrush (*Castilleja christii*) is one of Idaho's rarest plant species, consisting of a single population. The population covers approximately 200 acres on Mount Harrison, the highest peak at the northern end of the Albion Mountains, in Cassia County. It is currently a candidate for listing as Threatened or Endangered under the Endangered Species Act. The single known population is located entirely on public land managed by the Burley Ranger District, Sawtooth National Forest. Information concerning the distribution, abundance, habitat, and conservation status of Christ's Indian paintbrush has been detailed elsewhere (Moseley 1993).

Due to its extreme rarity and the numerous disturbances that take place on the summit plateau of Mount Harrison, a Conservation Agreement for Christ's Indian paintbrush was signed between the Sawtooth National Forest and the U.S. Fish and Wildlife Service specifying several conservation actions to protect the species and its habitat (U.S. Fish and Wildlife Service 1995). One of the agreed upon conservation actions was for the Sawtooth National Forest to establish a monitoring program for the Christ's paintbrush population, especially in regards to recreation-related impacts atop Mount Harrison. Under contract from the Forest, a monitoring program was established and baseline data collected by the Idaho Department of Fish and Game's Conservation Data Center (CDC) in 1995 (Moseley 1996). The monitoring transects were resampled in 1996, 1997, and 2000 (Moseley 1997; 1998). This report summarizes the year 2000 monitoring results.

My primary objectives in 2000 were: (1) to collect population monitoring data at the 20 transects originally established in 1995; (2) to resample the habitat plots associated with each transect; (3) to re-take photopoint photographs at each transect; and (4) to resample the Electronic Line Habitat Recovery transect originally established in 1996.

METHODS

Moseley (1996) provides a detailed discussion of the methods used for transect establishment, population sampling, photopoints, and ecological sampling. Directions and map locations of the transects and monuments are also included in this earlier report. A brief review of the methodology is presented here.

Population monitoring

Twenty permanently marked transects were established throughout the Christ's Indian paintbrush population. The transects were 20 meters long, with the beginning and ending points marked with a rebar stake. They were distributed in each of the three habitats known to support Christ's Indian paintbrush - graminoid, snowbed, and mountain big sagebrush/Idaho fescue (*Artemisia tridentata vaseyana/Festuca idahoensis*). Seven rock or rock outcrop monuments were identified to help relocate the transects.

The transects are divided into 20 one-meter-square "stations" or microplots, forming what is essentially a continuous one-meter-wide belt transect. The number of Christ's Indian paintbrush plants and the number of reproductive stems for each plant are recorded at each microplot. These two attributes can be used as measures of above-ground production and fecundity.

Year 2000 marked the fourth year Christ's Indian paintbrush population data were collected. Copies of the population monitoring data sheets for each transect are in Appendix 1. I entered the four year dataset into a Microsoft Excel spreadsheet that contains plant and stem data for each transect, for each year (Appendix 2). The 2000 plant and stem datasets were tested against previous sample years for significant differences using the Student's t-test. This analysis was done using data analysis tools associated with the Excel software

Habitat monitoring

To monitor Christ's Indian paintbrush habitat, baseline plant community and other ecological data were collected at each transect in 1995. To do this, 10 x 10 m macroplots were established along each transect using the beginning stake of the transect as one of the plot corners. Species composition and cover class data for all vascular plants occurring within the plot were originally reported in 1995 (Moseley 1996). This information was collected again in 2000 to meet the habitat monitoring protocol recommendation that macroplots be re-sampled every five years. Although the monitoring program's 12 cover classes and their associated values have been explained in earlier reports (Moseley 1996; 1997), I list them here again to help interpret data tables associated with this report.

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

The methodology used to monitor changes in the vegetation is based on ocular estimates of cover classes for vascular plant species in the plot. It is a method adapted from the ECODATA protocol originally designed by the U.S. Forest Service and has an accuracy standard of +/- one cover class (Bourgeron et al. 1992). In light of this accuracy standard, I considered a change to have occurred only when the 1995 versus 2000 results for any given species or other comparison group differed by two or more cover classes. The two years of cover class data for all transects have been entered into a Microsoft Excel spreadsheet, and includes averages and constancy values (Appendix 3). Copies of the 2000 vegetation monitoring field sheets are in Appendix 4.

Two photographs were originally taken at each transect in 1995, and monitoring protocol recommended these photos be retaken every five years. One photo looks down the transect belt, while the other provides an overview of the ecological plot area. I re-took the photos in 2000, and they are on file at the CDC office in Boise, with copies at the Sawtooth NF headquarters in Twin Falls. The photographs provide a visual, time-lapse record of the vegetation and other habitat conditions for each transect site.

Electronic Line Habitat Recovery monitoring

In 1995, a new cable line was buried by Raft River Electric to service several electronic sites on Mount Harrison. In 1996, a permanent transect was established to monitor recovery of the vegetation along that segment of the cable route which passed through occupied and suitable-appearing Christ's Indian paintbrush habitat (Moseley 1997). The 325 m long transect is sampled at 25 m intervals using a 1 m^2 plot frame placed directly over the middle of the two-meter-wide cable route swath. Cover class values are then estimated for all vascular plant

species in the 13 microplots along the transect. Baseline data were collected in 1996. The transect was resampled in 1997, and again in 2000. Copies of the 2000 Electronic Line Habitat Recovery transect field sheets are in Appendix 6. A photograph was also taken at each sample station along the transect. They are on file at the CDC, with copies at the Sawtooth NF headquarters.

RESULTS

Population monitoring

Analysis of the 1995, 1996, and 1997 monitoring results have been discussed in previous reports (Moseley 1996; 1997; 1998). Results for this report are based on analysis and comparison of the 2000 dataset against data collected these three previous years. Population data for the four-year monitoring dataset are summarized in Tables 1 and 2, with plant number and density information in the former, and reproductive stem data in the latter table. Table 3 is a matrix of significance values for the 2000 plant and reproductive stem datasets when tested against monitoring results from previous years.

Due to the large variability in plant density (as evidenced by the large standard deviations), annual increases or decreases in plant or stem numbers have to be fairly dramatic to be statistically significant. The high variability is evident by looking at the transect data, not only for 2000, but for all of the previous monitoring years as well (Appendix 2). For many transects in the graminoid and snowbed communities, it was common to find one microplot with few or no paintbrush plants, yet another might have tens or even hundreds of plants. This variability in plant numbers tended to be less extreme for transects in the sagebrush/Idaho fescue community type where paintbrush plants were not as common. Stem data also tended to be very variable, with many plants having few if any reproductive stems, while others had ten or more. Variance in the population data helps to highlight the clumpy distribution of paintbrush plants, even at a scale as small as a 20 m transect.

Plant density data

* The 2000 total plant number tally was the second highest of the four monitoring years (Table 1). The 2,145 plant tally was 395 plants more than 1995, 28 plants more than 1996, and 250 plants less than in 1997.

* Fifteen of the 20 transects (75%) had more plants in 2000 compared to one or more of the previous three monitor years. Eleven (55%) of these had a greater plant tally than any of the previous years, although this across the board increase was significant for only two of the transects (#1 and #5; Table 3).

* Increases in plant density were found along transects representing each of the three plant community types, but significant increases were limited to one of the graminoid (#1), and one of the snowbed (#5) transects.

* Five transects (#6, #9, #14, #15, #18) tallied fewer plants in 2000 compared to each of the previous monitoring years. For each of these transects, a significant decrease in plant number occurred versus one or two, but not all three of the previous years.

Table 1. Four years of plant number and plant density data for Christ's Indian paintbrush. Community type (Comm. Type) codes are: A = sagebrush/Idaho fescue; G = graminoid; S = snowbed.

		Total # Plants				Plant Density (+/- 1 s.d.) # of plants/m^2			
Transect	**Comm. Type**	**1995**	**1996**	**1997**	**2000**	**1995**	**1996**	**1997**	**2000**
1	G	122	129	168	212	6.1 (5.1)	6.5 (6.0)	8.4 (6.4)	10.6 (6.7)
2	A	21	21	23	61	1.1 (2.2)	1.1 (2.4)	1.2 (2.2)	3.1 (4.5)
3	A	26	36	38	35	1.3 (1.6)	1.8 (2.5)	1.9 (3.0)	1.8 (1.8)
4	S	64	90	129	98	3.2 (4.4)	4.5 (6.6)	6.4 (8.0)	4.9 (4.1)
5	S	36	55	69	116	1.8 (1.5)	2.8 (2.1)	3.5 (2.3)	5.8 (4.4)
6	G	174	193	195	140	8.7 (5.0)	9.7 (5.6)	9.8 (5.3)	7 (6.2)
7	S	143	165	190	206	7.2 (3.8)	8.3 (3.9)	9.5 (4.3)	10.3 (7.3)
8	A	12	21	43	58	0.6 (0.9)	1.1 (1.4)	2.2 (3.4)	2.9 (2.9)
9	A	49	39	55	24	2.5 (4.4)	2.0 (4.2)	2.8 (4.3)	1.2 (1.9)
10	A	10	7	11	12	0.5 (1.1)	0.4 (0.8)	0.6 (1.2)	0.6 (1.4)
11	A	8	11	15	33	0.4 (0.7)	0.6 (1.1)	0.5 (1.3)	1.7 (2.9)
12	S	46	54	108	69	2.3 (3.1)	2.7 (2.4)	5.4 (5.7)	3.5 (2.7)
13	G	178	206	249	260	9.2 (6.5)	10.3 (7.1)	12.5 (7.0)	13 (4.8)
14	S	148	178	182	109	7.4 (6.4)	8.9 (8.3)	9.4 (6.7)	5.5 (2.8)
15	S	222	384	317	181	11.1 (4.7)	19.2 (9.7)	15.1 (7.1)	9.1 (5.1)
16	S	38	27	40	41	1.9 (2.5)	1.4 (2.1)	2.0 (2.4)	2.1 (1.7)
17	G	78	88	86	110	3.9 (3.1)	4.4 (3.6)	4.3 (3.3)	5.5 (3.1)
18	G	192	181	218	127	9.6 (6.9)	9.1 (7.9)	10.9 (10.1)	6.4 (4.6)
19	A	12	13	13	21	0.6 (1.3)	0.7 (0.9)	0.7 (1.3)	1.1 (1.6)
20	S	171	219	246	232	8.6 (8.2)	11.0 (7.3)	12.3 (8.5)	11.6 (5.6)
Sum		1750	2117	2395	2145	-	-	-	-
Average		87.5	105.9	119.8	107.3	4.4	5.3	6	5.4
Std. Dev.		72.7	98.9	94.2	76.5	3.6	4.8	4.5	3.8

Table 2. Four years of reproductive stem data for Christ's Indian paintbrush. Community type (Comm. Type) codes are: A = sagebrush/Idaho fescue; G = graminoid; S = snowbed.

		Total # Stems				**Average # Stems/Plant (+/- 1 s.d.)**			
Transect	**Comm. Type**	**1995**	**1996**	**1997**	**2000**	**1995**	**1996**	**1997**	**2000**
1	G	629	735	982	127	5.2 (3.6)	5.7 (4.1)	5.8 (3.9)	0.6 (5.0)
2	A	115	112	152	33	5.5 (4.2)	5.3 (3.1)	6.6 (4.1)	0.5 (4.7)
3	A	151	221	223	24	5.8 (3.1)	6.1 (3.3)	5.9 (3.5)	0.7 (1.6)
4	S	261	435	963	161	4.1 (1.9)	4.8 (2.4)	7.5 (5.9)	1.6 (8.8)
5	S	145	290	503	171	4.0 (2.2)	5.3 (4.1)	7.3 (4.6)	1.5 (9.6)
6	G	935	1199	1067	104	5.3 (3.9)	6.2 (4.3)	5.8 (3.8)	0.7 (9.2)
7	S	922	1082	1352	482	6.4 (5.3)	6.6 (5.2)	7.1 (5.9)	2.3 (27.1)
8	A	54	86	153	10	4.5 (2.4)	4.1 (2.3)	3.6 (2.8)	0.2 (1.0)
9	A	167	142	144	5	3.4 (2.2)	3.6 (2.1)	2.6 (2.0)	0.2 (0.7)
10	A	30	30	36	13	3.0 (1.6)	4.3 (1.7)	3.3 (1.8)	1.1 (1.5)
11	A	52	52	111	22	6.5 (3.5)	4.7 (1.9)	7.4 (5.8)	0.7 (1.7)
12	S	223	233	623	88	4.8 (3.1)	4.3 (2.6)	5.8 (4.2)	1.3 (4.6)
13	G	1063	1073	1849	586	6.0 (6.4)	5.2 (3.6)	7.4 (6.5)	2.3 (18.7)
14	S	800	944	1220	92	5.4 (4.4)	5.3 (3.6)	6.7 (4.4)	0.8 (2.8)
15	S	1046	2119	2440	351	4.7 (3.0)	5.5 (4.3)	7.7 (5.4)	1.9 (11.2)
16	S	262	218	268	94	6.9 (6.4)	8.1 (6.4)	6.7 (5.0)	2.3 (8.2)
17	G	360	479	464	53	4.6 (2.7)	5.4 (3.9)	5.4 (3.6)	0.5 (3.5)
18	G	922	862	1284	87	4.8 (3.6)	4.8 (3.4)	5.9 (4.1)	0.7 (6.2)
19	A	56	91	66	20	4.7 (4.8)	7.0 (4.1)	5.1 (2.1)	1 (2.3)
20	S	773	1434	1834	451	4.5 (3.1)	6.5 (4.8)	7.5 (5.5)	1.9 (11.6)
Sum		8966	11837	15734	2974	-	-	-	-
Average		448.3	591.9	786.7	148.7	5	5.4	6.1	1.1
Std. Dev.		385	570	704	175	1	1.1	1.4	0.7

Table 3. Significance values for the 2000 monitoring results tested against the 1995, 1996, and 1997 datasets. Significance was calculated at P <0.05 using the Student's t-test. Differences significant at this threshold are marked with an asterisk (*).

	Plant density			Average # Stems/Plant		
Transect	**1995/2000**	**1996/2000**	**1997/2000**	**1995/2000**	**1996/2000**	**1997/2000**
1	0.0018*	0.0005*	0.0469*	0.0019*	0.0003*	3.6E-05*
2	0.0392*	0.0364*	0.0562	0.2148	0.1501	0.1503
3	0.3359	0.9375	0.4455	0.0156*	0.0198*	0.0565
4	0.0607	0.6798	0.2452	0.1666	0.0574	0.0051*
5	0.0003*	0.0008*	0.0112*	0.7128	0.0142*	0.0002*
6	0.2700	0.0305*	0.0094*	2.1E-06*	5.7E-06*	7.7E-07*
7	0.1628	0.2943	0.6665	0.0931	0.0121*	4.5E-05*
8	0.0007*	0.0013*	0.2344	0.0107*	0.0059*	0.0149*
9	0.1151	0.3091	0.0453*	0.0486*	0.0633	0.0253*
10	0.8126	0.4979	0.9077	0.3045	0.3464	0.2610
11	0.0547	0.0284*	0.1194	0.2993	0.1973	0.0815
12	0.0815	0.1670	0.0423*	0.0433*	0.0024*	0.0026*
13	0.0221*	0.1616	0.8030	0.0405*	0.0201*	0.0006*
14	0.2392	0.1035	0.0395*	0.0015*	0.0023*	9.5E-05*
15	0.0850	0.8E-06*	6.4E-05*	1.3E-05*	1.3E-06*	1.6E-07*
16	0.8649	0.1393	0.9126	0.0219*	0.0857	0.0096*
17	0.0062*	0.0690	0.0342*	5.6E-05*	0.0002*	4.6E-05*
18	0.0363*	0.0968	0.0282*	0.0002*	0.0015*	0.0001*
19	0.2826	0.2141	0.2876	0.1653	0.0460*	0.1892
20	0.1556	0.6181	0.6681	0.0869	0.0012*	0.0004*

* At seven transects (#3, #4, #7, #10, #16, #19, #20) there were no significant differences in plant density for 2000 versus any of the previous years. These transects represent four snowbed and three sagebrush/Idaho fescue community types.

* Plant density data for 2000 showed a significant increase at 30% of the transects compared to 1995, 25% compared to 1996, and 20% compared to 1997. In contrast, the 2000 data showed a significant decrease at 5% of the transects compared to 1995, 10% compared to 1996, and 25% compared to 1997.

* On average, Christ's Indian paintbrush had its highest density at transects within the graminoid community type, followed by the snowbed, and then sagebrush/Idaho fescue types (Figure 1). This pattern is consistent over the four monitoring years.

Reproductive stem data

* The 2000 total reproductive stem tally was much lower than any of the previous three monitoring years. The 2,974 total is 67% less than in 1995, 75% less than in 1996, and 81% less than in 1997. Correspondingly, the average number of stems/plant in 2000 was much lower compared to previous years - 78% less than in 1995, 80% less than in 1996, and 82% less than in 1997.

* All transects had fewer stems in 2000 than any other year, with nine of the transects (45%) having significantly fewer average stems/plant compared to each previous year (Table 3).

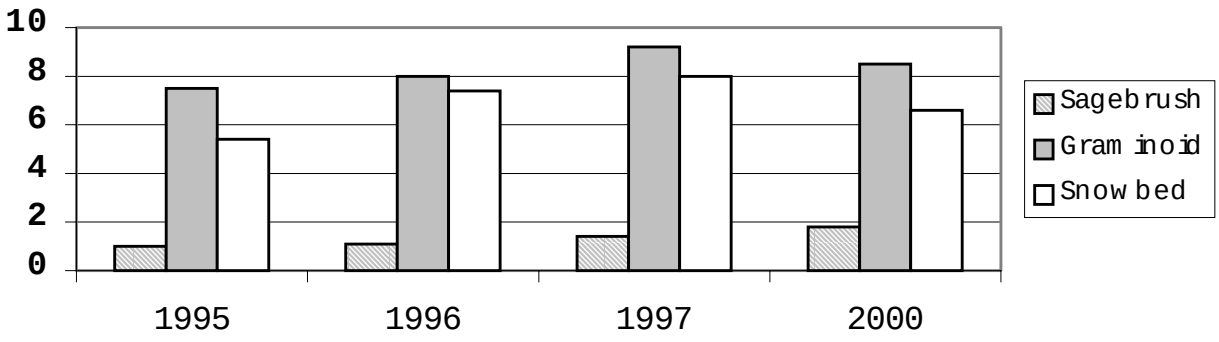
* The 2000 average number reproductive stems/plant was significantly less than 60% of the 1995, 70% of the 1996, and 75% of the 1997 transects. The total number of stems was highest in 1997, and lowest in 2000.

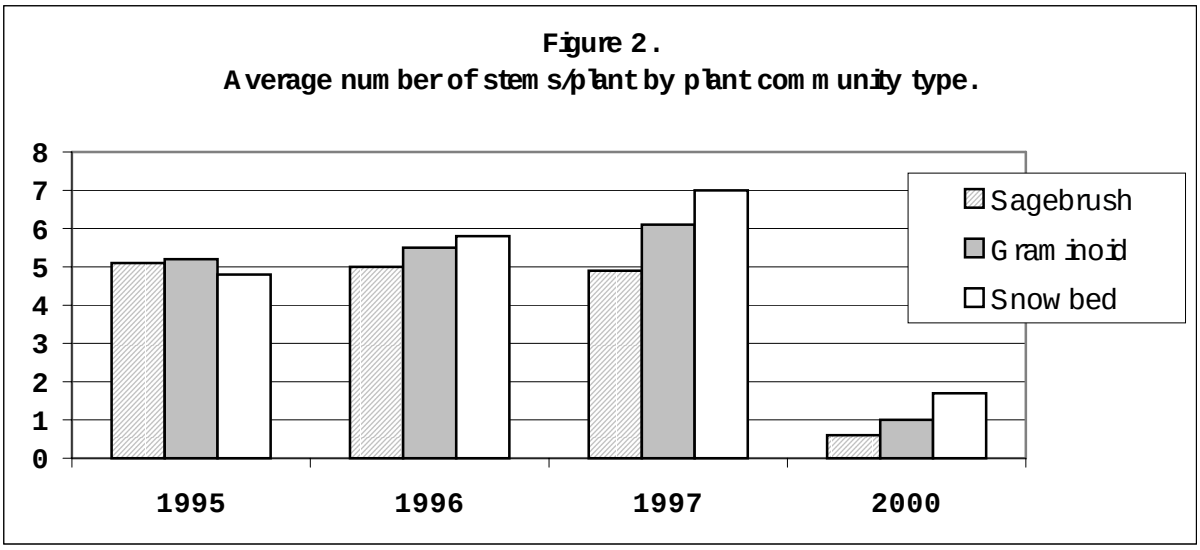
* In 2000, only three transects did not show a significant reduction in the average number of reproductive stems/plant relative to the other three years. These transects were all within the sagebrush/Idaho fescue community type and have relatively few paintbrush plants.

* Forty-six percent of plants tallied in 2000 did not have reproductive stems. These vegetative plants comprised 50% or more of the plants tallied at 11 of the 20 transects. The number of plants/transect that were vegetative varied from a low of 21% to a high of 84%. The lowest percent of vegetative plants was within the snowbed community at 36%, compared to 59% for the graminoid and 63% for the sagebrush/Idaho fescue types.

* The average number of reproductive stems/plant tends to be relatively consistent between the three plant community types in any given year, although the average has been slightly lower for the sagebrush/Idaho fescue type all four years, and slightly higher for the snowbed type three out of the four sample years. Figure 2 shows the average transect number of reproductive stems/plant for each community type by year.

Figure 1.
Plant density of Christ's Indian paintbrush by community type.
(plants/m^2)





Habitat monitoring

A summary of the vegetation data for the 1995 and 2000 habitat monitoring macroplots is included in Table 4. These data are grouped by plant community type and include cover class and constancy attributes. Overall, the vegetation data results for 2000 are similar to the 1995 baseline. This is not a surprise, as there have not been any pervasive, large-scale disturbances atop Mount Harrison in the five years since the monitoring plots were established. However, the results do document several differences between the two years that are discussed below. A few corrections and clarifications concerning the 1995 results are also outlined.

* When analyzed by plant community, a change of two or more cover classes between 1995 and 2000 occurred in only three instances (Table 4), they were: (1) Sagebrush/Idaho fescue community – the average cover class value for *Festuca idahoensis* decreased from 50 in 1995, to 30 in 2000; (2) Graminoid community - the average cover class value for *Festuca idahoensis* decreased from 70 in 1995, to 30 in 2000; and (3) Graminoid community - the average cover class value for *Agropyron trachycaulum* decreased from 30 in 1995, to 10 in 2000.

* When analyzed by transect, a change of two or more cover classes was observed in 22 instances (Table 5).

* Six new graminoid species were encountered in 2000. Two of them, *Agropyron* sp. (wheatgrass cultivar) and *Bromus inermis* (smooth brome) are introduced species that may have been part of the seeding mix used for restoration purposes after the road to the top of Mount Harrison was paved a few years ago. Both species are rhizomatous and have invasive tendencies. Both were found in the majority of graminoid community plots. To a lesser extent they were also found in the other community types as well. At this time, neither species seems sufficiently abundant to be adversely effecting Christ's Indian paintbrush. However, their establishment within the population may be cause for conservation concern in the future.

Table 4. Plant cover and constancy for macroplots associated with the Christ's Indian paintbrush monitoring transects. Plant cover values are explained in the text. Constancy values are: 10=<15%, 20=15-25%, 30=25-35%, 40=35-45%, 50=45-55%, 60=55-65%, 70=65-75%, 80=75-85%, 90=85-95%, 100=>95%.

	Artrv/Feid N = 7				**Graminoid N = 5**				**Snowbed N = 8**			
	Average cover class		Constancy		Average cover class		Constancy		Average Cover class		Constancy	
	1995	2000	1995	2000	1995	2000	1995	2000	1995	2000	1995	2000
SHRUB												
Artemisia vaseyana	60	50	100	100	3	3	40	40		1		10
Haplopappus macronema	3	3	30	30								
Symphoricarpos oreophilus	3	3	30	30								
GRAMINOID												
Agropyron trachycaulum	10	10	60	70	30	10	60	60	3	3	30	40
Agropyron sp.		1		10		1		60				
Bromus inermis						3		80		1		10
Carex microptera	1		10		1	1	20	60				
Carex xerantica	1	1	30	10	1	1	20	40				
Festuca idahoensis	50	30	100	100	70	30	80	100	1	1	10	40
Phleum sp.										1		10
Poa secunda	3	3	90	90	1	1	20	60	1	1	30	30
Sitanion hystrix		1		10		1		40		3		40
Stipa sp.						1		20		1		10
Trisetum spicatum	1	1	40	70	1	3	80	60	3	3	100	100
Unknown graminoid					3		40					
FORB												
Achillea millefolium	3	3	100	100	3	3	100	100	10	10	100	100
Agoseris glauca	1	1	10	30	1	1	20	40	3	3	60	80
Antennaria anaphaloides	3	3	100	100	3	3	40	40				
Antennaria microphylla		1		10	1	1	60	60		1		10
Arabis sp.	1	1	90	100	1	1	80	60	1	1	10	30
Arenaria capillaris	1	1	100	100	1	3	80	100		1		60
Aster foliaceus					10	3	40	40	30	20	100	100
Castilleja christii	1	1	100	100	3	3	100	100	3	3	100	100
Chenopodium sp.		1		10								
Cymopterus davisii	3	3	90	90	3	3	60	60	3	3	90	90
Erigeron peregrinus		1		10								
Eriogonum umbellatum	1	1	30	60								
Eriophyllum lanatum	3	3	90	90	3	3	60	60	10	3	30	30
Erysimum asperum		1		10								
Frasera speciosa	1	3	40	70								
Gayophytum decipiens		1		10						1		40
Geum triflorum		1		10								
Lewisia pygmaea	1	1	60	60	1	1	80	60	1	1	100	90
Ligusticum grayi					1	1	20	40				
Linum perenne	1	1	10	40								

	Artrv/Feid N = 7				Graminoid N = 5				Snowbed N = 8			
	Average cover class		Constancy		Average cover class		Constancy		Average cover class		Constancy	
	1995	2000	1995	2000	1995	2000	1995	2000	1995	2000	1995	2000
Lupinus argenteus	10	3	100	100	3	3	60	40	3	3	80	100
Microsteris gracilis		1		10					1		30	10
Pedicularis contorta	3	3	100	100	3	3	100	100	3	3	30	90
Penstemon rydbergii					1	1	20	40	10	10	30	80
Phlox multiflora	1	3	30	100								
Polygonum bistortoides	1	1	30	10	3	3	80	80	3	1	30	30
Polygonum douglasii		1		30		1		20		1		10
Polygonum sawatchense		1		30		1		20		1		10
Potentilla gracilis		1		10	1	1	20	40				
Rumex paucifolius					1	1	20	20	10	3	60	50
Sedum lanceolatum	1	1	30	30	1		20		1	1	10	30
Senecio integerrimus	1	1	40	60	1	1	40	40				
Sibbaldia procumbens									1		10	
Silene sp.		1		10		1		20				
Silene scouleri	1	1	40	70								
Solidago multiradiata	3	3	70	70					20	10	100	100
Spraguea umbellata					10	10	100	100	1	1	40	40
Stellaria jamesiana	1	1	40	90	1	1	20	40	1	1	30	50
Taraxacum officinale	1	1	40	60	1	1	20	20	1		10	
Thlaspi montanum	1	1	90	100	1	1	60	60				
Valeriana sitchensis	3	3	40	60								

Three of the other new graminoids, *Carex microptera* (small-winged sedge), *Sitanion hystrix* (squirreltail), and *Stipa* sp. (needlegrass sp.) were found in trace amounts in only a few plots. They could have been easily overlooked when the plots were originally sampled in 1995, especially the *Carex*. I am unsure whether the other new grass, *Phleum* sp., is the native species *P. alpinum* (alpine timothy), or the pasture grass *P. pratense* (common timothy). A trace amount was found in one of the snowbed plots.

* Eight new forb species were encountered in 2000, all in trace amounts, and in only one or a few plots. *Chenopodium* sp. (goosefoot sp.), G*ayophytum decipiens* (deceptive groundsmoke), *Polygonum douglasii* (Douglas' knotweed), and *Polygonum sawatchense* (sawatch knotweed) are annual, while *Erigeron peregrinus* (subalpine daisy), *Erysimum asperum* (yellow wallflower), *Geum triflorum* (prairie smoke), and *Silene* sp. (catchfly sp.) are perennial or biennial species. It is hard to know whether these species have recently colonized the transects, or were simply missed in 1995. It would be easy to overlook these species if they were not in flower because of their trace cover. The annual species are often associated with soil disturbances caused by gopher activity, a common natural disturbance at Mount Harrison. Their presence is not indicative of habitat degradation at the low cover in which they occur.

Table 5. Species with cover values differing by two or more classes - 1995 versus 2000.

Transect #	Species	1995 cover class	2000 cover class
Graminoid			
1	*Agropyron trachycaulum*	10	1
6	*Festuca idahoensis*	80	60
13	*Agropyron trachycaulum*	80	30
17	*Festuca idahoensis*	90	40
18	*Festuca idahoensis*	70	30
Sagebrush			
2	*Festuca idahoensis*	40	20
3	*Festuca idahoensis*	50	30
9	*Festuca idahoensis*	60	40
10	*Festuca idahoensis*	50	30
11	*Festuca idahoensis*	60	40
19	*Achillea millefolium*	20	3
Snowbed			
4	*Aster foliaceus*	70	40
5	*Solidago multiradiata*	30	10
7	*Aster foliaceus*	40	10
7	*Castilleja christii*	1	10
7	*Penstemon rydbergii*	3	20
12	*Aster foliaceus*	70	40
12	*Penstemon rydbergii*	0	10
14	*Aster foliaceus*	30	3
14	*Solidago multiradiata*	10	30
15	*Achillea millefolium*	20	3
16	*Achillea millefolium*	30	10

* Several taxonomic and plant identification clarifications need to be made between the 1995 and 2000 datasets.

1) I believe a low-growing shrub found in two of the sagebrush/Idaho fescue plots was originally misidentified by Moseley in 1995. What he identified as *Chrysothamnus viscidiflorus* (green rabbitbrush) is actually *Haplopappus macronema* (discoid goldenweed).

2) *Agropyron caninum* (bearded wheatgrass) was originally identified in many of the transect plots by Moseley. The correct scientific name for this species is *A. trachycaulum*.

3) I am unsure whether I encountered one or two *Poa* spp. while sampling. Most plants seemed to belong to the *Poa secunda* (Sandberg's bluegrass) complex, however, there may also have been some intermixed *Poa epilis* (skyline bluegrass). For analysis purposes in Table 3, I considered everything to be *Poa secunda*. This is also apparently what Moseley (1996) did in his report.

4) The *Carex* sp. originally noted to occur in two of Moseley's plots is most likely *Carex microptera*.

5) A large forb that Moseley originally identified in one of the graminoid plots as *Ligusticum tenuifolium* (slender-leafed lovage) is actually the similar-looking *L. grayi* (Gray's lovage).

Electronic Line Habitat Recovery monitoring

Year 2000 marked the third year the Electronic Line Habitat Recovery transect was sampled. Vascular plant species and associated cover class results for each microplot station for all three post-disturbance sampling years are listed in Table 6.

In past years, rock and gravel coverage within the microplot was considered part of the "bare ground" category. In 2000, I added a "rock/gravel" category to account for the cover of these materials separately from "bare ground". This was done to help monitor changes in the amount of bare ground along the transect area.

* Although he did not provide cover class values, Moseley (1997) noted that bare soil accounted for most of the cover in all microplots the year baseline data were collected in 1996. In 1997, he noted there was substantially more plant cover compared to 1996, but that bare ground cover remained high (Moseley 1998). Bare ground continued to have a cover class of 50 or higher in all but four (30%) of the transect microplots in 2000. Three of these four microplots had high rock cover, while the other one had high litter cover. Overall, there was not a substantial reduction in bare ground compared to 1997.

* *Lupinus argenteus* (silvery lupine) showed the largest increase in cover of any species along the transect in 2000. *Artemisia ludoviciana* (Louisiana mugwort)*, Erigeron peregrinus*, and *Solidago multiradiata* (northern goldenrod) had substantial cover increases at several microplots in which they occurred. All of these species except the *Artemisia* are common associates of Christ's Indian paintbrush elsewhere on Mount Harrison.

* Of the 28 species counted along the transect in 2000, 20 were perennial forbs, four were annual forbs, and four were perennial grasses. Two of the grasses, *Bromus inermis* and *Poa pratensis* (Kentucky bluegrass), and one of the forbs, *Taraxacum officinale* (common dandelion), are non-native species. Year 2000 marked the first time that common dandelion and Kentucky bluegrass were recorded along the transect.

* In 2000, Christ's Indian paintbrush was sampled along the transect for the first time. It was counted in three (23%) of the 13 transect microplots. This is the first indication the paintbrush can re-establish within the electronic cable pathway.

* *Cymopterus davisii* (Davis' wavewing) is another Forest Service Sensitive plant species that occurs at Mount Harrison. It was tallied in three microplots in 2000, compared to two the previous sampling years.

Table 6. Cover class values for species along the Electronic Line Habitat Recovery transect.

		Station (microplot) along transect												
Species	Year	25	50	75	100	125	150	175	200	225	250	275	300	325
Abies lasiocarpa	1996													
	1997													1
	2000													
Achillea millefolium	1996					1	10	1		3	3		1	1
	1997	1	1	1	1	10	1	1	1	1	3	1	1	1
	2000	20	10	1	3	3	1	3	1	1	10	1	1	3
Agoseris glauca	1996				1	1		1		1	1	1	1	
	1997			1			1	1		1	1			
	2000				3			1		10	10			
Agropyron trachycaulum	1996													
	1997								1					
	2000													
Agrostis variabilis	1996													
	1997		1									1		
	2000		1	1								1	1	
Allium brandegei	1996													
	1997			1										
	2000	1		1										
Artemisia ludoviciana	1996	1												
	1997	1		1		10	1	1	1					
	2000						20	10	20		1			
Aster integrifolius	1996													
	1997			1										
	2000													10
Bromus inermis	1996					1				10				
	1997					30								
	2000					50				3				
Castilleja christii	1996													
	1997													
	2000		3				1				1			
Chenopodium fremontii	1996					1				1				
	1997					1				1				
	2000													
Cymopterus davisii	1996						1		1					
	1997						1		1					
	2000		1				3		1					
Epilobium alpinum	1996													
	1997			1										
	2000			1	1					1			1	
Erigeron peregrinus	1996			3	1	1	1	1	1	1		1	3	3
	1997				1	3			1			1	1	1
	2000					3			1		10	20	3	20

	Station (microplot) along transect													
	Year	25	50	75	100	125	150	175	200	225	250	275	300	325
Eriophyllum lanatum	1996				1		1			1	1			
	1997	1			1		1	1		1	1			
	2000	3		1	1		3	1	3	1	1			
Galium boreale	1996					1								
	1997													
	2000													
Gayophytum racemosum	1996													
	1997								1				1	
	2000													
Lewisia pygmaea	1996											1	1	
	1997											1	1	
	2000		1	1			1					1	1	1
Ligusticum tenuifolium	1996		1			1	1		1				1	3
	1997	1					1		1				1	1
	2000			10	1		1		3				3	3
Lupinus argenteus	1996			1			1			1		1		
	1997						1	1	1	1	1	1	1	1
	2000	10		1	1	3	10	10	10	20	10	40	3	10
Microsteris gracilis	1996							1		1				
	1997				1	1	1	1		1	1			
	2000		1		1			1		1				
Penstemon rydbergii	1996					1				1	20	1		1
	1997						1			1	30			
	2000								1	10	3			
Poa pratensis	1996													
	1997													
	2000					1								
Poa ? sp.	1996													
	1997		1											
	2000													
Polemonium pulcherimum	1996													
	1997													
	2000													1
Polygonum douglasii	1996	1		1	1	1	1	1	1	1		1		1
	1997	3	3	1	40	10	20	60	1	1	1	1	1	1
	2000	1	1	1	1		1	1	1	1	1		1	
Polygonum kelloggii	1996													
	1997		1	1										
	2000													
Rumex paucifolius	1996													
	1997											1		
	2000													1
Sedum lanceolatum	1996									1				
	1997													
	2000													

	Station (microplot) along transect													
	Year	25	50	75	100	125	150	175	200	225	250	275	300	325
Solidago multiradiata	1996				1			1		1	10			
	1997							3	1	1	10			1
	2000		1		1	3	10	10	3	10	10	10		3
Spergularia rubra	1996													
	1997	1	1	1	1		1	3		1				1
	2000		1	1						1		1		3
Spraguea umbellata	1996				1		1				1			
	1997		1		1		1	1			1	1		1
	2000				1		1	1	1		1	1		1
Stellaria jamesiana	1996				1	1	1			1				
	1997				1	1			1	1				1
	2000				1	1	1	1	1	1				
Taraxacum officinale	1996													
	1997													
	2000	1	10						1					
Thlaspi montanum	1996									1				
	1997													
	2000					1	1			1				
Trisetum spicatum	1996													
	1997										1	1		
	2000										1	1		
Bare Ground	1996[1]													
	1997	90	90	90	80	20	80	70	90	80	50	90	98	98
	2000	80	40	60	80	30	40	70	40	70	50	70	80	50
Rock/Gravel	1996[1]													
	1997[2]													
	2000		40	30	10	1	50	20	50	3	3	3	20	3
Litter	1996													
	1997					20								
	2000					50								

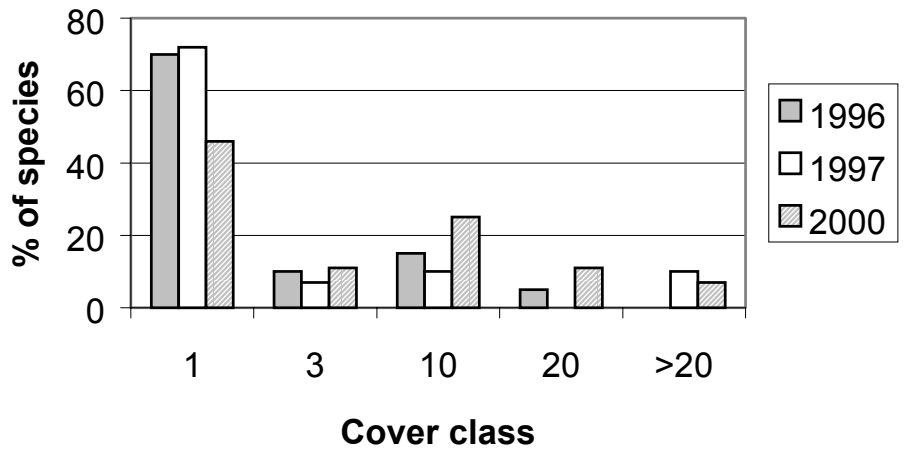
[1]not recorded in 1996.

[2]considered “bare ground” in 1997.

* A total of 35 plant species have been tallied along the transect at least one of the three monitoring years. Twenty of these were sampled in 1996, 29 in 1997, and 28 in 2000. Although there was not an increase in the number of species found in 2000, there was an increase in the cover class value for many species in one or more microplots. In 1996 and 1997, but not 2000, the majority of all species occurred only at trace amounts (cover class = 1; Figure 3).

* In 1996 and 1997, 20% of species occurred at a cover class of 10 or greater at least once along the transect. This more than doubles in 2000. Figure 3 compares the maximum cover class values for species by year. These results suggest that forb species common on Mount Harrison, such as *Lupinus argenteus, Solidago multiradiata*, and *Achillea millefolium* (common yarrow) are contributing the most to the revegetation process, and that vegetation is slowly re-establishing along most of the cable route.

Figure 3.
Maximum cover class values for the
Electronic Line Habitat Recovery Transect



DISCUSSION

Monitoring results for 2000 show there were about the same number of plants, but significantly fewer reproductive stems compared to previous years. The decline in stems is more likely due to environmental factors, then to biological, habitat, or management problems. Two thousand was one of the driest years in Cassia County during the past half century (Western Regional Climate Center 2000). Burley, located about 14 miles northwest of Mount Harrison, had approximately 40% less precipitation in 2000 than average. Below-average precipitation also fell in 1999, especially in the latter half of the year, the timeframe most likely to affect the next season's Christ's Indian paintbrush population. The 1997 increase in the number of paintbrush

plants may be further evidence that some population attributes are linked to precipitation patterns. Precipitation records for 1995 and 1996 were considerably (>140%) above average in Burley. These two wet years may have contributed to a pulse of paintbrush establishment, and help account for the increase in plants seen from 1995 to1997. Although Mount Harrison is much higher and receives more precipitation than Burley, the relative fluctuation in annual precipitation is likely similar.

Beside the fact that many plants did not flower, there were several other attributes displayed by Christ's Indian paintbrush plants to suggest 2000 was an unfavorable year. For many reproductive plants, inflorescences supported only a few flowers, or had one or more aborted fruit capsules. Inflorescences averaged only 15-20 cm tall, and many were even shorter. Other observations also point to 2000 being an unfavorable year for the vegetation. For example: (1) very little *Festuca idahoensis* flowered in 2000; I estimated only 1% or less at many of the vegetation monitoring plots; and (2) several common forb species such as *Penstemon rydbergii* (Rydberg's penstemon) and *Solidago multiradiata* had many more vegetative than flowering individuals.

Interpreting the significance of the decreases and few increases recorded for species in the vegetation monitoring plots (Table 5) is difficult based on only two years of data collection. These changes may simply represent natural fluctuations in community composition and other dynamics related to interacting biotic and abiotic factors. The only pattern that seems relatively consistent is a decrease in the cover of Idaho fescue at several transects. Future monitoring will help decide the degree and temporal scale of this apparent trend.

MONUMENT AND TRANSECT NOTES

In 2000, I obtained GPS readings for each of the seven monuments used to help relocate the Christ's Indian paintbrush monitoring transects (Appendix 7). These readings complement the location and description information for the monuments provided in an earlier report (Moseley 1996). Although the road to the fire lookout atop Mount Harrison has been paved since Moseley originally established the monuments, his relocation instructions remain accurate because this new road was simply placed over the old road. However, The orange paint Moseley originally used to help mark the transects is no longer visible.

I have updated or clarified information concerning several of the monuments:

* Monument 2 - Moseley noted that the monument is the most northeastern of three rocks arranged in a triangle. The south rock of this triangle was missing in 2000. However, the hole where it originally laid was still evident. The rock was likely removed and used to line the roadway to discourage off-road travel.

* Monument 5 – of all the monuments, this one is located the furthest from the reference point used to find it. The monument is located approximately 50 m west of a series of fenceposts marking the snowmobile route to the top of Mount Harrison. It is also about 80 m west of a sharp interface between sagebrush and herbaceous vegetation.

* Monument 6 – the "prominent" rock outcrop noted by Moseley is the largest of three outcrops aligned close to one another. It is the northwestern-most outcrop of the three.

Transect disturbances and other observations I made during 2000 are summarized below:

* Some level of gopher activity sign was evident at every transect. Sign included piles of soil, churned soil, and tunnel casts. Heavy gopher activity was evident at transects 1, 4, 5, 10, 14, 15, 17, and 20.

* Scattered cowpies (probably from 1999) were observed at transects 1, 4, 5, 6, 7, 8, 9, 16, 17, and 18.

* Deer prints were observed at transects 5 and 20. A small percentage (<5%) of Christ's Indian paintbrush inflorescences were grazed along these transects.

* Transect 7 – the original vegetation plot data has *Aster foliaceus* with a cover class of 40. I think Moseley mistook the vegetative rosettes of *Penstemon rydbergii* and perhaps also *Solidago multiradiata* for the *Aster*. This would be easy to do if few or no plants were in flower. *Penstemon* and *Solidago* were the primary forbs in the transect area in 2000, while the *Aster* was uncommon.

* Transect 12 - the lush forb community does a good job of hiding the transect stakes. The small metal transect identification tag was missing from the 20 m stake. The tag for the stake marking the beginning (0 m) of the transect had fallen off and was placed nearby under some small stones. A moderate level of gopher activity was present in the transect area.

* Transect 14 – several motorcycle tracks were observed while hiking to this transect. I did not see any in the immediate vicinity of the transect, however. Identification tags were missing from both rebar stakes and could not be found. The 0 m stake was found lying on the ground and put back in place using the 20 m stake as a reference.

* Transect 15 – the identification tag was missing from the 20 m stake.

* Transect 16 – the 20 m rebar stake was loose, but bedrock near the surface made it impossible to hammer it any deeper into the ground.

* Transect 17 – the rebar stake marking the end (20 m point) of the transect was bent and almost out of the ground. I replaced it with a new stake hammered to within two inches of the ground. The transect identification tag was missing for the 20 m stake. The tag for the 0 m stake had fallen off and I placed it next to the stake beneath some small stones.

RECOMMENDATIONS

1. Periodic monitoring should continue at the Christ's Indian paintbrush population. It should be a joint decision between the Sawtooth NF and the U.S. Fish and Wildlife Service. I recommend a minimum of every three to five years.

2. I think recreation and other potential anthropogenic impacts to Christ's Indian paintbrush and its habitat need to be more directly targeted and documented by the monitoring protocol. This could be something as simple as recording presence/absence of off-road vehicle tire tracks and livestock sign on the data field forms for each transect microplot. I suspect off-road use may

become a larger management issue now that access to the population area has been improved with the paving of the road to the fire lookout.

3. Increased access to the population area probably increases the potential for accidental weed introductions. I recommend annual weed surveys for Mount Harrison's summit plateau. It will be easier to eradicate or control noxious and other weeds that may become established in the area if detected in a timely manner.

4. I obtained GPS coordinates for all the monuments in 2000. It would probably be a good idea to do the same for the transect marker stakes to help document their location.

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Appendix 1

Copies of field sheets with 2000 Christ's Indian paintbrush data.

Appendix 2

1995 to 2000 dataset for Christ's Indian paintbrush population monitoring transects.

Appendix 3

1995 and 2000 cover class data for Christ's Indian paintbrush vegetation monitoring macroplots.

Appendix 4

Copies of field sheets with 2000 Christ's Indian paintbrush vegetation plot data.

Appendix 5

Copies of field sheets with Electronic Line Habitat Recovery transect data.

Appendix 6

GPS coordinates for reference monuments used to relocate Christ's Indian paintbrush transects.

Coordinates were obtained using a navigation grade (Garmin 12XL) hand-held GPS unit. The UTM coordinates are based on Map datum NAD27 and zone 12T.

Monument 1 – 0280737 4687672

Monument 2 - 0280708 4687801

Monument 3 - 0280864 4687467

Monument 4 - 0280926 4687570

Monument 5 – 0281100 4687666

Monument 6 - 0280525 4688163

Monument 7 - 0280832 4687599