

CHRIST'S INDIAN PAINTBRUSH (*CASTILLEJA CHRISTII*)
MONITORING ON THE SAWTOOTH NATIONAL FOREST:
SECOND-YEAR RESULTS

by

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ABSTRACT

Christ's Indian paintbrush (*Castilleja christii*) is Idaho's rarest plant, consisting of a single population on Mount Harrison at the north end of the Albion Mountains, Cassia County. Due to its extreme rarity and the numerous disturbances that take place on the summit plateau of Mount Harrison, a Conservation Agreement was signed between the Sawtooth National Forest and the U.S. Fish and Wildlife Service that enumerates conservation actions that will be implemented to protect habitat for Christ's Indian paintbrush, including establishing a monitoring program to assess impacts to the population associated with recreational uses. The monitoring program was established by the Idaho Department of Fish and Game's Conservation Data Center in 1995 (Moseley 1996). The objectives for 1996 were to: (1) continue to collect density and frequency data for Christ's Indian paintbrush at the 20 transects established in 1995 and (2) establish monitoring of habitat recovery where a buried electronic cable was laid through a small portion of paintbrush habitat in late 1995. Results of the population monitoring show that the total number of plants and stems increased in 1996, but in only one transect was that increase statistically significant for plant density. Three transects showed significant increases in stem production. Population and habitat recovery monitoring should continue annually for at least three more years to assure that some annual variability in the population is accounted for in any management recommendations generated from this monitoring program.

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INTRODUCTION

Christ's Indian paintbrush (*Castilleja christii*) is Idaho's rarest plant, consisting of a single population, covering approximately 200 acres on Mount Harrison, the highest peak at the north end of the Albion Mountains, Cassia County. More precisely, the southern limit of the population begins approximately 250 feet north of the lookout and continues north for approximately 0.75 mile. The east-west extent of the population is somewhat over one mile in width. The population is entirely on publicly held land, managed by the Burley Ranger District of the Sawtooth National Forest (NF). See Moseley (1993) for more information on the distribution, abundance, and conservation status of Christ's Indian paintbrush.

Due to its extreme rarity and the numerous disturbances that take place on the summit plateau of Mount Harrison, a Conservation Agreement was signed between the Sawtooth NF and the U.S. Fish and Wildlife Service that enumerates conservation actions that will be implemented to protect habitat for Christ's Indian paintbrush (U.S. Fish and Wildlife Service 1995). One of the proposed conservation actions under this agreement (VI.A.14) states that the Forest Service shall:

Establish a monitoring program in 1995 for Christ's Indian paintbrush. A primary objective of this program should be to monitor impacts to the Christ's Indian paintbrush population associated with recreational uses. As part of the monitoring schedule, conduct inventories of existing habitat to determine if the population is expanding or contracting. Accommodate needed changes if monitoring determines that deleterious impacts are taking place. Monitoring will be conducted on an annual basis for at least the first five years of this agreement.

A rigorous monitoring program will help separate the "signal" of a population decline from the "noise" of inherent population variability. A non-rigorous program will not separate the noise from the signal. Another conservation action related to this states (VI.A.15):

Delimit Christ's Indian paintbrush populations on a large scale map by the three community types present. Monitoring plots should be established in each of these community types. Establish permanent photoplots; photos will be retaken each year and evaluated for apparent changes in density or distribution of *Castilleja christii*.

To fulfill these requirements, the Forest Service retained the services the Idaho Department of Fish and Game's Conservation Data Center (CDC) in 1995 to establish permanent monitoring transects and delineate paintbrush habitats on a large-scale aerial photograph. See Moseley (1996) for a summary of the 1995 results.

The two objectives for 1996 were:

1. Population monitoring - Continue to collect density and frequency data for Christ's Indian paintbrush at the 20 transects established in 1995.

2. Electronic Line Habitat Recovery - Establish monitoring of habitat recovery where a buried electronic cable was laid through a small portion of paintbrush habitat in late 1995.

POPULATION MONITORING

Refer to last year's report (Moseley 1996) for a detailed discussion of methods for transect establishment, population sampling, photo points, and ecological sampling. Also, the locations of the transects and monuments are mapped in that report. A brief summary of the methods follows:

Twenty permanently-marked transects were established in the habitat of Christ's Indian paintbrush. The transects were 20 meters long and the beginning and ending points were marked with rebar. An objective was to place plots in each of the three habitats identified by Moseley (1993): graminoid, snowbed, and *Artemisia tridentata vaseyana/Festuca idahoensis*. Seven monuments were established to aid in relocation of the 20 transects.

The 20 meter-long transect was divided into 20 one-meter-square "stations" or plots, forming what is actually a continuous one-meter-wide belt transect. In each station, I recorded: (1) the number of Christ's Indian paintbrush plants, and (2) the number of stems (sterile and reproductive were combined) for each plant. I used the number of stems as a surrogate for above-ground production and, to a lesser degree, fecundity.

At each transect, ecological data was collected for Christ's Indian paintbrush habitat. A 10 x 10 m macroplot was established, with one corner of the plot the same point as the beginning of the transect. Data collected in each plot include location, environmental features and general site description, as well as the estimated cover for every plant species in the plot.

Two photos were taken at each transect. One photo was taken down the belt from just behind the beginning stake. Another photo was taken of the ecological plot.

During August 1996, only the population data were sampled at the transects. Moseley (1993) recommended that population data be sampled annually for at least five years and the habitat data and photo points be sampled every five years.

One correction in the ecological data should be noted: In the initial survey (Moseley 1993) and the summary of last year's results (Moseley 1996; Table 3), I identified one of the dominants in the snowbed community as *Aster foliaceus*. This is incorrect. The plant is actually *Erigeron peregrinus*.

The population data for the two years was entered into Lotus 1-2-3 and summary statistics were produced (averages and standard deviations) for the data. Also, mean plant density and stem

values for 1995 and 1996 were tested for significant differences using a Student's t-test.

1996 Population Data

Table 1 shows the population density and stem counts for Christ's Indian paintbrush in the 20 transects in 1995 and 1996. The total number of plants increased by 367 in 1996, from 1750 to 2117. There was a corresponding increase in average plant density from 4.4 plants/m² to 5.3 plants/m². Because of the great variability in plant density (as expressed by the standard deviation), however, only Transect 15 had a significant ($P < 0.1$) increase between 1995 and 1996. Plant density changes in all other transects were not significantly different between the two years. The total number of stems in the 20 transects increased by nearly 3,000 between the two years, although the average stems/plant remained the same (Table 1). Similar to the whole plant values, even with this large increase only Transects 4, 15, and 20 had statistically significant increases, with the latter two having nearly double the number of stems in 1996. All three transects that had significant increases in density and stem production values (Transect 15) or just stem production (Transects 4 and 20) were from the snowbed community.

The 1996 population data forms for each transect are contained in Appendix 1 [1995 data forms are in Appendix 4 of Moseley (1996)]. These data are also in a Lotus 1-2-3 file at the CDC office in Boise. All original forms, maps, slides, and other information related to this monitoring project are in the *Plant and Community Monitoring File* at the CDC office.

Table 1.

ELECTRONIC LINE HABITAT RECOVERY

An old buried electric cable that services several electronic sites on Point 9033, about one mile north of Mount Harrison traverses the Christ's Indian paintbrush population in several places. This cable out-lived its expected life span and has been causing problems with delivering power to the sites. In 1995, Raft River Electric proposed replacing the cable. Instead of following the old route and disturbing considerable habitat, they wanted to follow a new route and cut below most of the paintbrush population. In August 1995, Pete Peterson and Howard Hudak, Sawtooth NF, a representative from Raft River Electric, and myself surveyed a new route that minimized the impact to Christ's Indian paintbrush. The route selected traversed only a few meters of occupied habitat. The cable was buried along the new route late in the 1995 season. Burying the cable created a two-meter-wide swath of bare ground.

On August 7, 1996, I established a permanent transect that can be used to monitor habitat recovery along the part of the route that traverses occupied and suitable-appearing habitat. The transect starts (0 m) at the base of the road fill where the line crosses beneath the road bed and heads west across the slope (Figure 1). The beginning was marked with a red fiberglass post in 1996, although beginning the transect at the base of the road fill in the middle of the bare-ground swath will suffice. The transect is 325 m long, with a 1 m² plot placed every 25 m. Plots were placed directly over the depression where the cable was buried, which generally lies in the center of the two-meter-wide swath of bare ground. The first plot was put in at 25 m. A photograph was taken of each plot (Appendix 3). I estimated the percent cover for every plant species in the plot using the midpoint of 12 cover classes, as follows:

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

Table 2 contains baseline cover data for the 13 plots along the transect. Plant cover was very low in the first year following disturbance, with bare soil accounting for most of the cover of each plot. Many species persisted as rooted individuals in the disturbed area, but several species had obviously seeded into the swath: *Cymopterus davisii* (several plants in fruit), some *Achillea millefolium*, *Spraguea umbellata*, *Lupinus argenteus*, *Microsteris gracilis* (annual), *Polygonum* sp. (annual), and possibly *Lewisia pygmaea* and *Agoseris glauca*. The "Aster/Erigeron" listed in Table 2 is used to denote a vegetative plant that could be either *Aster integrifolius* and/or *Erigeron speciosus*. Both species occur in the vicinity of the transect and vegetative material is difficult to tell apart. Data forms for this transect are contained in Appendix 2.

Figure 1. Location of Electronic Line Habitat Recovery Transect. Portion of the 1968 Mount Harrison 7.5' USGS topographic quadrangle.

Table 2. Cover of species along the Electronic Line Habitat Recovery Transect. Blanks indicate that the species does not occur at that station.

Species	Station (Plot) Along Transect												
	25	50	75	100	125	150	175	200	225	250	275	300	325
<i>Achillea millefolium</i>					1	10	1		3	3		1	1
<i>Agoseris glauca</i>				1	1		1		1	1	1	1	
<i>Artemisia ludoviciana</i>	1												
Aster/ <i>Erigeron</i>			3	1	1	1	1	1	1		1	3	3
<i>Bromus marginatus</i>					1				10				
<i>Chenopodium</i> sp.					1				1				
<i>Cymopterus davisii</i>						1		1					
<i>Eriophorum lanatum</i>				1		1			1	1			
<i>Galium boreale</i>					1								
<i>Lewisia pygmaea</i>											1	1	
<i>Ligusticum tenuifolium</i>			1		1	1		1				1	3
<i>Lupinus argenteus</i>			1			1			1		1		
<i>Microsteris gracilis</i>							1		1				
<i>Penstemon rydbergii</i>						1			1	20	1		1
<i>Polygonum</i> sp. (annual)	1		1	1	1	1	1	1	1		1		1
<i>Sedum lanceolatum</i>									1				
<i>Solidago multiradiata</i>				1			1		1	10			
<i>Spraguea umbellata</i>				1		1				1			
<i>Stellaria jamesiana</i>				1	1	1			1				
<i>Thlaspi montanum</i>									1				

RECOMMENDATIONS

1. *Population Monitoring* - Remeasure population data annually for at least the first five years, as specified in the Conservation Agreement. This will assure that some annual variability in the population is accounted for in any management recommendations generated from this monitoring program.
2. *Habitat Recovery Monitoring* - The Electronic Line Habitat Recovery Transect should be sampled annually for at least five years.
3. *Habitat Monitoring and Photo Points* - As I recommended last year (Moseley 1996), methods employed for vegetation monitoring at the 20 transects will detect habitat change at a lower resolution than those employed for population monitoring. Therefore, the ecological plots should be sampled every five years. Similarly, the photo points should be retaken every five years instead of annually, as recommended in the Conservation Agreement.

REFERENCES

- Moseley, R.K. 1993. The status and distribution of Christ's Indian paintbrush (*Castilleja christii*) and Davis' wavewing (*Cymopterus davisii*) in the Albion Mountains, Sawtooth National Forest and City of Rocks National Reserve. Unpublished report on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise, ID. 18 p., plus appendices.
- Moseley, R.K. 1996. Christ's Indian paintbrush (*Castilleja christii*) monitoring on the Sawtooth National Forest: Transect establishment and baseline data. Unpublished report on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise, ID. 16 p., plus appendices.
- U.S. Fish and Wildlife Service. 1995. Conservation Agreement: *Castilleja christii*/Christ's Indian paintbrush. Unpublished document on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise, ID.

Appendix 1

Copies of field sheets with 1996 *Castilleja christii* population data.

Appendix 2

Copies of field sheets with 1996 species cover data for the
Electronic Line Habitat Recovery Transect.

Appendix 3

Color slides of Electronic Line Habitat Recovery Transect (overview)
and the 13 stations along the transect.

Table 1. Population data for Christ's paintbrush in 20 permanently-marked transects, recorded in 1995 and 1996. Number in parentheses denotes ± 1 standard deviation. * Significant at $P < 0.1$; ** significant at $P < 0.05$. Community types are: G = graminoid; S = snowbed; A = sagebrush/Idaho fescue .

Transect	Community Type	PLANTS				STEMS			
		Total		Density (sd)		Total		Avg/Plant (sd)	
		95	96	95	96	95	96	95	96
1	G	122	129	6.1(5.1)	6.5(6.0)	629	735	5.2(3.6)	5.7(4.1)
2	A	21	21	1.1(2.2)	1.1(2.4)	115	112	5.5(4.2)	5.3(3.1)
3	A	26	36	1.3(1.6)	1.8(2.5)	151	221	5.8(3.1)	6.1(3.3)
4	S	64	90	3.2(4.4)	4.5(6.6)	261	435	4.1(1.9)	4.8(2.4)*
5	S	36	55	1.8(1.5)	2.8(2.1)	145	290	4.0(2.2)	5.3(4.1)
6	G	174	193	8.7(5.0)	9.7(5.6)	935	1199	5.3(3.9)	6.2(4.3)
7	S	143	165	7.2(3.8)	8.3(3.9)	922	1082	6.4(5.3)	6.6(5.2)
8	A	12	21	0.6(0.9)	1.1(1.4)	54	86	4.5(2.4)	4.1(2.3)
9	A	49	39	2.5(4.4)	2.0(4.2)	167	142	3.4(2.2)	3.6(2.1)
10	A	10	7	0.5(1.1)	0.4(0.8)	30	30	3.0(1.6)	4.3(1.7)
11	A	8	11	0.4(0.7)	0.6(1.1)	52	52	6.5(3.5)	4.7(1.9)
12	S	46	54	2.3(3.1)	2.7(2.4)	223	233	4.8(3.1)	4.3(2.6)
13	G	178	206	9.2(6.5)	10.3(7.1)	1063	1073	6.0(6.4)	5.2(3.6)
14	S	148	178	7.4(6.4)	8.9(8.3)	800	944	5.4(4.4)	5.3(3.6)
15	S	222	384	11.1(4.7)	19.2(9.7)*	1046	2119	4.7(3.0)	5.5(4.3)**
16	S	38	27	1.9(2.5)	1.4(2.1)	262	218	6.9(6.4)	8.1(6.4)
17	G	78	88	3.9(3.1)	4.4(3.6)	360	479	4.6(2.7)	5.4(3.9)
18	G	192	181	9.6(6.9)	9.1(7.9)	922	862	4.8(3.6)	4.8(3.4)
19	A	12	13	0.6(1.3)	0.7(0.9)	56	91	4.7(4.8)	7.0(4.1)
20	S	171	219	8.6(8.2)	11.0(7.3)	773	1434	4.5(3.1)	6.5(4.8)**
Total		1750	2117	----	----	8966	11,837	----	----
Average (\pm sd)		87.9 (70.9)	105.9 (96.4)	4.4 (3.6)	5.3 (4.8)	448.3 (375)	591.9 (556)	5.0 (1.0)	5.4 (1.1)
Range		8-222	7-384	0.6-11.1	0.4-19.2	----	----	----	----