MONITORING OF RARE PLANT POPULATIONS ON THE CLEARWATER NATIONAL FOREST

by

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ABSTRACT

Plant population monitoring is part of a rare plant program on the Clearwater National Forest that seeks to acquire information on the distribution, conservation status, response to environmental variables, and vigor of rare plant populations under various habitat and management conditions. Six separate population monitoring projects have been carried out under challenge cost-share agreements between the Clearwater National Forest and the Idaho Conservation Data Center (CDC). This report covers four of those projects–those for which data were collected in during the 1996 field season. For each project, the purpose of monitoring is specified, a simplified summary of the data is presented, a brief interpretation is given, and recommendations are made. In addition, cumulative, raw data sets are included in the appendices. For two of the projects, data files on disk are included with copies of this report to the Clearwater National Forest and the CDC.

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INTRODUCTION

The National Forest Management Act and Forest Service policy require that Forest Service lands be managed to maintain viable populations of all existing native animal and plant species at or above the minimum viable population level. Each Region has developed a list of sensitive species that require special attention because of their rarity. Land managers faced with protection of these species are hindered by a paucity of information on which to base decisions. Questions about the causes of rarity, optimum habitat, and response to land management practices cannot be answered by casual observation, and therefore some level of monitoring is needed (Sutter 1986).

The Idaho Conservation Data Center (CDC) has primary responsibility for seven projects that monitor sensitive plant populations on the Clearwater National Forest (Table 1). Population monitoring plots in Aquarius RNA, on the North Fork District, are part of baseline ecological monitoring specified in the *Implementation Plan for Management and Monitoring* for Aquarius RNA (Lichthardt 1995a). Demographic monitoring of Pacific dogwood (*Cornus nuttallii*) is part of a comprehensive conservation strategy for the species (Lorain 1991, Lichthardt 1997). Monitoring of Constance's bittercress (*Cardamine constancei*) was recommended as part of a conservation strategy for the Clearwater refugium ecosystem (Lichthardt and Moseley 1994). Monitoring of the population of clustered lady's slipper orchid (*Cypripedium fasciculatum*) at Apgar campground was initiated in 1988 to observe the response of a population subjected to foot traffic and weeds (Caicco 1988; Lichthardt 1995b). Monitoring was established on the Big Smith and Steep Creek timber sales to compare trends in rare plant populations between harvested and undisturbed stands. Plots in Aquarius RNA serve as additional controls for these plots. Periodic reports have been submitted for all of these projects and are on file at the Clearwater National Forest Supervisor's office and the CDC office in Boise.

During 1996, data were collected for projects 1, 2, 3, and 4 in Table 1, and are reported here. This report summarizes data for these projects, over the term of monitoring, and makes recommendations. For each project except #2, I have also included a cumulative set of raw data (Appendices A-D). All data for Aquarius RNA and Big Smith timber sale have been entered, and are stored in ASCII format at the CDC. For presentation in the appendices, column titles and explanation have been added to the data files. For a complete explanation of methods used, plot diagrams, and maps of plot locations, see specific reports cited in the text.

The Idaho CDC maintains an Ecomonitoring database which stores and tracks information on plant population monitoring throughout the State. All monitoring projects on the Clearwater National Forest have records in the database. An Ecomonitoring report form should be submitted each time plant population data is collected. These reports are used to update computer records which show plots monitored, the date of monitoring, and where data were reported and stored. The report form can also be used to record any changes in, or clarification of, methods used. The database does not contain monitoring results, but indicates where they are stored.

Table 1. Plant population monitoring projects conducted on the Clearwater National Forest as challenge cost-share projects with the CDC. Element occurrence numbers follow plant common names.

Project	District	Plant species monitored	Years of monitoring
1. Aquarius RNA	3	Clustered lady's-slipper orchid (038) Western starflower (004) Henderson's sedge (001) Constance's bittercress (029)	Annually, 1991 to 1996
2. Constance's bittercress	3	Constance's bittercress (025, 029, 088)	1995 & 1996
3. Steep Creek timber sale	3	Henderson's sedge (031) Crinkle-awn fescue Western starflower (005)	1992, `94, and `96
4. Big Smith timber sale	5	Henderson's sedge (026)	Annually, 1993 to 1996
5. Clustered Lady's-slipper orchid, Apgar campground	5	Clustered lady's-slipper orchid	1988 & 1994
6. Bank monkeyflower	5	Bank monkeyflower	1989, `90, `91
7. Pacific dogwood	5	Pacific dogwood	1991, `92, `93, `95

AQUARIUS RNA

Five monitoring plots for rare plant populations are permanently marked and documented in Aquarius RNA. Each plot is used to monitor 1 to 3 plant species. Only two years of data were taken at Plot 91JL011, but the transect is still marked. Monitoring plot diagrams and plot locations are given in Lichthardt (1992a). Raw data are presented for each plot in Appendix A, Tables 1-3. Plot numbers also refer to Ecodata forms which document the plant community at the site.

Clustered lady's-slipper orchid (Plot 91JL010)

A population of clustered lady's-slipper orchid, ca. 0.1 acre in extent is monitored by tracking each individual (genet). Table 2 follows individuals over 6 years, showing whether they were reproductive (R) or vegetative (V) in each year. Other data collected include numbers of ramets, numbers of fruits, and plant height (Appendix A, Table 1). Interestingly, no plant has produced more than one ramet over the course of monitoring. In four instances individuals were dormant for a single season. Two individuals have now been dormant (or dead) for two years. Only one individual has produced aerial growth for six consecutive years.

Table 2. A population of *Cypripedium fasciculatum* over six years. R = reproductive individual; V = vegetative, or no fruits produced. - = plant not located. Plot 91JL010, Aquarius RNA.

Genet No.	Reproductive status 1991	'92	'93	'94	'95	'96
1	R	-	V	R	R	R
2	R	R	R	R	-	R
3	R	R	R	R	R	R
4	R	R	R	R	-	-
5	R	R	R	R	-	-
6	R	-	R	R	-	R
7			R	V	V	R
8			V	V	R	-
9				R	R	-

Western starflower (Plot 91JL010)
The center post of the clustered lady's-slipper orchid plot marks the center point of a permanent, 100-ft belt transect in which stems (ramets) of western starflower are counted. The transect is divided into a series of continuous, 3 x 3 ft microplots. Raw data are included in Appendix A, Table 2. Table 3 shows variation in numbers of ramets over a 5 year period.

Table 3. Numbers of ramets of western starflower in a 100 x 3 ft belt transect in each of five years. Plot 91JL010, Aquarius RNA.

	1991	1992	1994	1995	1996
Total no. of ramets	83	196	277	200	306
Frequency[1] (% of microplots)	57%	87%	81%	81%	85%

[1] 1 x 3 ft microplots used in 1991-1994, and converted to 3 x 3 ft basis for comparison with 1995 and 1996.

Table 3 shows dramatic increases in the number of ramets in all but one year. The result is nearly a four-fold increase in ramet density in the transect over 4 years. The cause is unknown. No visible change has taken place on the site. Because this plot represents baseline ecological monitoring, this background variation must be considered when interpreting changes that are observed in plots subjected to management treatments.

Henderson's sedge (Plot 91JL008)

A circular plot of 37-ft radius was established in 1991 to monitor what was then thought to be virtually an entire local population of Henderson's sedge on a level river terrace. This was identified as a "source" population in Lichthardt and Moseley (1994). A source population is considered a stable population that provides a seed source for outlying, ephemeral populations.

A notable feature of this population that has proven useful in monitoring is the fact that plants occur in rather discrete colonies, generally less than 0.25 m^2. The distance and azimuth from the center post to each colony is recorded, along with the number of genets, number of ramets per genet, and number of inflorescence-bearing ramets per genet. It was originally thought that a plot of 45-ft radius encompassed the entire population, but in following years plants were found further out, and 45 ft became an arbitrary limit.

Six years of data are contained in Appendix A, Table 3. Figure 1 shows the number and reproductive status of genets within each colony, over the 6 years of monitoring. Individual genets within a colony were not marked, so Figure 1 does not track the presence or reproductive status of specific plants, except where a colony consists of only one plant.

Within the approximately 0.1-acre plot, the number of colonies more than doubled between 1991 and 1992 (Figure 1). However, ten of the new colonies did not persist into 1993, resulting in only a small net increase. In 1994 there was again a sharp increase, but this time nearly all of these colonies or individual plants persisted into 1996. Overall, the data set shows a large fluctuation in numbers of plants over time, pointing to successful establishment from seed, at least in the limited area of the population, where habitat appears to be optimum. The sudden appearance of large colonies (e.g., 19, 21, 27, and 37) is troubling, possibly indicating that plants were missed at times. The data indicate that first-year plants can be reproductive. The complete data set also indicates the sizes of plants in terms of numbers of ramets making up a clump (Appendix 1, Table 3).

Although dynamic, it appears that this population is persistent and expanding. This seems to support our previous interpretation of optimum habitat for this species (Lichthardt and Moseley 1994). It would be interesting to compare it to less vigorous populations in more marginal habitat.

Constance's bittercress (plot 91JL002)

One monitoring plot was estabished in 1991 for a Constance's bittercress population in Aquarius RNA. Stems (ramets) were counted in contiguous 1 x 1 m microplots along a 20 m transect. Data are presented in Table 4. In the five years of monitoring, no plants in the transect flowered, and only in 1991 were any flowering individuals observed in the population. In 1995, this transect was terminated when the population was made part of an expanded monitoring program for Constance's bittercress (explained in following section).

Fig. 1 Not included.

Table 4. Density and frequency of stems (ramets) of Constances' bittercress in a permanent, 1 x 20 m belt transect divided into contiguous, 1 x 1 m microplots.

	1991	1992	1993	1994	1995
# Ramets	27	25	40	43	47
Frequency (% of microplots)	35	50	65	65	55

Recommendations for rare plant monitoring in Aquarius RNA

Aquarius population monitoring plots have now been read for six consecutive years, resulting in fairly good baseline data on variation in numbers of individuals over time. All of these plots would benefit from replication, i.e., additional sites, so that we could assess to what extent patterns are parallel, or how they differ in different habitats. Field time required to read these plots is not great, but there is a significant amount of work in documenting and storing data.

Monitoring of the clustered lady's slipper plot (91JL010) should be continued, because orchids have the ability to remain dormant for a number of years, and it may take longer for a pattern to become evident. Also, a range-wide conservation strategy is currently being written for this species and monitoring data from various portions of its range will be useful.

Regarding the western starflower plot (91JL010), six years of measurements are probably enough for basic ecological monitoring at a single site. However, the plot serves as an additional control for logged plots of the Steep Creek timber sale, so additional monitoring might be tied to that project. In any case, plot markers should remain in place for long-term remeasurement.

Six years has provided an interesting although not entirely clear picture of the population of Henderson's sedge at plot 91JL008. Yearly monitoring of this plot is probably not a high priority. I would recommend monitoring again in 1999. The plot should be revisited whenever convenient to make sure the stakes are firmly planted and clearly marked. An important comparison with the information obtained from this plot could be gained from establishing several additional, probably smaller plots, in populations that occupy what we would characterize as marginal habitat.

The Constance's bittercress plot (91JL002) has been terminated, and that population is now part of a replicated sampling design that includes another large population in the RNA, as well as populations outside the RNA (see following section).

CONSTANCE'S BITTERCRESS

Constance's bittercress is a Clearwater basin endemic that occurs in scattered populations in the North Fork Clearwater canyon, all under two acres in extent. A small population occurs in unit 7 of the Dog-Salmon timber sale, which was clearcut in 1993. In order to evaluate the dynamics of Constance's bittercress populations in different seral communities, including the clearcut, permanent transects were established at four sites in 1995. Habitats include the 1993 clearcut (Dog-Salmon), mid-seral western redcedar/queencup beadlily dominated by medium grand fir (Larson Creek), late-seral western redcedar/wild ginger with canopy openings (Aquarius north), and old-growth western redcedar/woodfern (Aquarius south).

Field observations (Crawford 1980) indicate that flowering of Constance's bittercress is induced by opening or removal of the tree canopy. Although flowering individuals are rarely observed under closed-canopy conditions, flowering is profuse after both ground and canopy fires. However, fruit and seed production are thought to be low and seed viability has not been tested. Crawford (1980) hypothesized that seed production requires a combination of light and moisture that occurs infrequently.

A macroplot was established that encompassed all, or a large portion, of the local population. Macroplots are variable in size and confined to an area continuous slope, aspect, and habitat. Starting points of three transects were randomly located along one side of the macroplot, generally moving from up to down slope (Appendix B, Figures 1-4). Transects extend the length of the macroplot and run along the contour (CC001 is an exception). Stems (ramets) of Constance's bittercress are counted in 1 x 1 m contiguous microplots along each transect, noting reproductive status and phenological stage. Baseline data were collected in 1996 and are contained in Appendix B, along with plot diagrams, which are not included in any other report.

The number and size of plots currently in use are insufficient to characterize or make comparisons of numbers flowing ramets, which are generally scarce. Since reproductive output is an important parameter determining trends in these populations, some method should be devised to objectively describe the amount of flowering in different populations. Since at least a few flowering ramets can generally be found in the monitored populations, I recommend that a sample of these be marked and revisited to determine seed production and viability.

STEEP CREEK TIMBER SALE

Permanent belt transects, 3 x 30 ft, were placed in units of the Steep Creek timber sale, North Fork District, in 1992 to monitor western starflower, Henderson's sedge, and crinkle-awn fescue following harvest. Control plots were placed outside cutting units. Established plots in adjacent, Aquarius RNA provide additional controls. Methods, and directions to plots are reported in Lichthardt (1992b). Raw data are included as Appendix C.

Western starflower exhibited a similar pattern among plots in cutting units–all decreased in number or stayed the same in the year after logging, while the control plots all increased (Table 5). After burning, all plots exceeded their original numbers including the controls. It is not unusual to observe lush herbaceous growth following fire due to a flush of nutrients and increased light. The ability of plants to survive in the open will likely depend on the aspect of the site, proximity to the seed wall, and the innate ability of the species to withstand competition from a dense herbaceous and shrub growth. Henderson's sedge numbers rebounded three years after logging in all plots except S03, which apparently burned hotter than the others. Interestingly, the control plot (S05) shows the same pattern.

Table 5. Numbers of individuals (ramets for western starflower and crinkle-awn fescue, genets for Henderson's sedge) in permanent 30 x 3 ft plots placed within, outside, and on the edge of units of the Steep Creek timber sale[1]. Various combinations of three species of interest are monitored.

Plot	Species	Number of of individuals			Treatment
		'92	'94	'96	
S01	Western starflower	113	67	237	Edge of cutting unit
	Crinkle-awn fescue	10	9	M	
S02	Western starflower	133	213	200	Control
S03	Henderson's sedge	17	7	9	Clearcut (1993), hot burn
	Crinkle-awn fescue	13	16	0	
S04	Henderson's sedge	12	3	9	Clearcut (1993), cool burn
S05	Western starflower	21	60	M	Control
	Henderson's sedge	62	35	45	
S06	Western starflower	220	162	403	Shelterwood cut (1993)
S07	Henderson's sedge	11	9	12	Edge of cutting unit
S08	Western starflower	114	114	157	Shelterwood cut (1993)
S09	Crinkle-awn fescue	32	8	-	Control

[1] Harvested in winter of 1993, then burned and planted prior to the 1996 data.

BIG SMITH TIMBER SALE

Henderson’s sedge was found in two cutting units during clearance surveys for the Big Smith timber sale on the Lochsa District. As a consequence, monitoring was included in NEPA documentation for the project. Monitoring is designed to detect changes in the affected populations following logging. Four plots were established around Henderson’s sedge populations within proposed clearcut units 8 and 15, and four plots in populations that would not be disturbed by logging. Plots are 25 x 25 ft and marked at three corners and the center with steel fence posts. Plants were mapped by azimuth and distance to the center post, then marked with wooden stakes in 1995. For methods and plot locations see Lichthardt (1996). Four to five years of data are documented Appendix D (not all plots were read in 1992). A subset of the data is summarized in Figure 2 to compare logged vs. unlogged plots.

Figure 2. (Not included)

Only two plots (6 and 7) represent the effects of logging because unit 8 has not been logged to this date. Unit 15 was clearcut and broadcast burned in 1993 after one year of baseline data. Plot 6 is at the edge of clearcut unit 15, but is completely open overhead and to the south, and thus represents clearcut conditions. Plot 7 lies further within the clearcut. The site of plot 7 was relocated following logging but the centerpoint could never be reestablished since the marker posts had been removed. Without the centerpost it became impossible to relocate individual plants. For this plot we can only look at the total number of plants in vicinity of the plot. Consequently Figure 2 uses only data from plot 6 to represent a logged plot.

Since unit 8 was never harvested, plots 2 and 3 can serve as controls. However, plot 2 was subjected to natural disturbance by water and a falling tree.

Results

Plot 6 shows a greater than 50% decrease in Henderson's sedge plants in the year following logging. However, after 3 years there is a net loss of only 2 out of 12 plants. There was also a decrease in the number of reproductive plants after logging and that number is recovering more slowly than the total number of plants.

The population in the vicinity of plot 7, also in clearcut unit 15, has changed amazingly little in overall profile, considering the original plants do not appear to have survived the logging/burn (Appendix D). This is surmised by trying to match up maps of plant locations before and after logging. In 1993 there were 13 vegetative plants and 5 reproductive within the plot, in 1996 there were 24 vegetative and 6 reproductive plants, not all of which would have fallen within the original plot because they are too far apart. Many of the vegetative plants appear to be seedlings. Although it is difficult to say, most of the original plants seem to have died, and the population is persisting by recruiting new seedlings. The fate of seedlings is very insecure–they may die later the same year in which they were recorded. Since the amount of seed produced per plant is not great, the low number of reproductive plants may eventually result in loss of the population.

Recommendations

One more year of monitoring is required by the NEPA document. The time of monitoring is very short relative to the time required to reestablish a forest canopy. I recommend that markers remain in place so that plots might be revisited about 5 years out.

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APPENDICES NOT AVAILABLE ON WEB PAGE

CONTACT THE IDAHO DEPARTMENT OF FISH AND GAME, CONSERVATION DATA CENTER FOR THIS INFORMATION