

FIELD INVESTIGATION OF MIMULUS CLIVICOLA (BANK MONKEYFLOWER),
A REGION 1 SENSITIVE SPECIES,
ON THE CLEARWATER AND NEZ PERCE NATIONAL FORESTS

by

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ABSTRACT

A field investigation of *Mimulus clivicola* (bank monkeyflower) was carried out on the Nez Perce and Clearwater National Forests by the Idaho Department of Fish and Game's Natural Heritage Program. The investigation was a cooperative Challenge Cost Share project between the Department and the Nez Perce and Clearwater National Forests.

Bank monkeyflower, a Region 1 Sensitive Species and a proposed Category 2 candidate species¹, is a regional endemic to northern Idaho and northeastern Oregon. Within Idaho, bank monkeyflower is now known from portions of the St. Joe, North Fork Clearwater, Selway, and Lochsa River canyons and the Elk Creek Falls vicinity. Most of these lands are administered by the Clearwater and Nez Perce National Forests.

Our investigation revealed the presence of many more populations of bank monkeyflower than previously known. A total of 56 populations from 29 sites are now documented for bank monkeyflower in Idaho. Only one historical site was relocated and at least seven sites have been extirpated. Despite the number of new populations and flowering individuals, the occupied habitat of this diminutive annual was observed to be less than 12 hectars (ca. 30 acres).

All populations are known from relatively narrow corridors along valley bottoms where human habitat-altering activities are taking place. Several recommendations are made relative to the long-term conservation of bank monkeyflower on the Clearwater and Nez Perce National Forests, including future investigations into population dynamics and a long-term monitoring program.

¹ Candidate Species - "those plant and animal species that, in the opinion of the Fish and Wildlife Service, may become endangered or threatened". Three types of candidate species exist, C1, C2 and C3. Category 2 - "taxa for which information now in possession of the Service indicates that proposing to list them as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support the immediate preparation of rules" (USDI Fish and Wildlife Service 1985).

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INTRODUCTION

The National Forest Management Act of 1976 (16 U.S.C. 1600 (note). Planning Regulations Section 219.19, Fish and Wildlife Resource) and Forest Service policy require that Forest Service land be managed to maintain populations of all existing native animal and plant species at or above the minimum viable population level (USDA Forest Service 1984). A minimum viable population consists of the number of individuals, adequately distributed throughout their range, necessary to perpetuate the existence of the species in natural, genetically stable, self-sustaining populations.

The Forest Service, along with other Federal and State agencies, has recognized the need for special planning considerations in order to protect the flora and fauna on the lands in public ownership. Species recognized by the Forest Service as needing such considerations are those that (1) are designated under the Endangered Species Act as endangered or threatened, (2) are under consideration for such designation, or (3) appear on a regional Forest Service Sensitive Species² list.

Mimulus clivicola (bank monkeyflower) is a regional endemic³ to the interior Pacific Northwest. This species is presently listed as a Region 1 Sensitive Species and is a Proposed Category 2 Candidate Species. During the 1989 field season an investigation of bank monkeyflower was conducted on the Nez Perce and Clearwater National Forests by the Idaho Department of Fish and Game's Natural Heritage Program through the Cooperative Challenge Cost Share Program.

Additional individuals consulted on this project were Steve Caicco (formerly with the Idaho Natural Heritage Program), Jimmy Kagan (Oregon Natural Heritage Program), Dr. Bob Meinke (Oregon Dept. of Agriculture), John Gamon (Washington Natural Heritage Program), and Dr. David Thompson (Research Botanist, Rancho Santa Ana Botanic Garden, Calif.).

The primary objectives of this investigation were as follows:

- 1) Relocate and survey known populations, potentially extirpated populations, and historical collection sites of Mimulus clivicola in northern Idaho.
- 2) Survey for potential habitats and new populations on the Clearwater and Nez Perce National Forests.
- 3) Better delineate the distribution of bank monkeyflower within Region 1.
- 4) Acquire population data and characterize habitat conditions for known populations.
- 5) Establish long-term monitoring plots in selected populations.
- 6) Assess population trends and threats to existing populations and make management recommendations to the forests based on these assessments.

² Sensitive Plant Species - a plant species, or recognized subspecies or variety, for which the Regional Forester has determined there is a concern for population viability, within a state, as evidenced by significant current or predicted downward trend in populations or habitat (USDA Forest Service 1984, 1988).

³ A species confined naturally to a certain limited area or restricted locality. In this instance, confined to narrow river canyons in northern Idaho and far northeastern Oregon.

Information from Washington state is confusing and was recently reevaluated by the Washington Natural Heritage Program (Gamon 1989). The Heritage Program's Illustrated Guide (Washington Natural Heritage Program 1981) indicates four historical locations for Mimulus clivicola and lists its status as possibly extirpated. A Klicitat County site was later determined to be a misidentification. Despite the fact that most of the floras of the Pacific Northwest describe this species as occurring in Washington, there is only one documented record for the state as of 1989. David Thompson (1989), Research Botanist, who has compiled a comprehensive list of herbarium records for this species, reports a single collection by George Vasey in 1889 collected in "Washington"; too vague to relocate.

Two principle objectives of the 1989 field season were to (1) attempt to relocate historical and extirpated populations in Idaho, and (2) search for suitable habitats within northern Idaho for new populations.

Five of the ten historical locations had sufficient information to attempt relocation (#1-5). The remaining five were either too vague or far outside our area of concentration (#6-10). The following is a list of the 10 historical sites, including the five sites we attempted to relocate(*):

- 1) 14 miles east of Kooskia along Hwy 12 - 1966 *
- 2) Wiessner's Peak, Kootenai Co. - 1892 *
- 3) Mitzpah Mine, Latah Co. - 1962
- 4) Cedar Mts. [Palouse Range], Latah Co. - 1894 *
- 5) Lake Waha, Nez Perce Co. - 1894
- 6) Clearwater Co., near Pierce - 1946 (vague)
- 7) Idaho Co., South Fork Clearwater River - 1941 (vague)
- 8) Kootenai Co., Palouse Country and about Lake Coeur d'Alene - 1892 (vague)
- 9) Adams Co., Weiser Forest, Squaw Flat - 1923 (outside area)
- 10) Clearwater National Forest - 1950 (vague)

Mimulus clivicola was relocated at only one of the above mentioned sites, Wiessner's Peak in Kootenai County (#2). No populations (#1) were located anywhere along the Middle Fork Clearwater River (between Kooskia and Lowell). Additionally, no suitable habitat was found in the Mitzpah Mine (#3) vicinity or the Cedar Mountains region (#4). Early maps indicate that the Cedar Mountains are now called the Palouse Range and consists of Moscow Mountain and the associated ridge. Many changes have occurred in this region since 1894 and it is quite likely that this population is extirpated due to human disturbances. The search around Lake Waha (#5) (and a smaller lake near Lake Waha) was also fruitless, however, a few individuals of Mimulus nanus were located along the southern slopes of the lake. The original collections mention light-flowered [M. clivicola] and dark-flowered [M. nanus] forms, and apparently herbarium sheets contain mixes of the two species (Thompson 1989). The habitat around Lake Waha is drier than other known sites of M. clivicola in Idaho.

The Wiessner's Peak location was collected by Sandberg, MacDougal, and Heller on 8 July 1892 and is the type location for the species. The original label reads "slopes near the foot of Weissner's Peak, Kootenai County". Heller (1904) additionally adds, "obtained on a grassy slope in the forest on the trail leading from the St. Joseph's river at Reid's landing, to Weissner's Peak". This peak is now known as Mt. Wiessner and is located some 12 miles northeast of the town of St. Maries in the far southeastern corner of Kootenai County. Attempts were made to relocate "Reid's landing". The closest name was Reeds Gulch which was explored with no success. Although the exact location was not found, Mimulus clivicola was located along Black Prince Creek, just northeast of the town of Marble Creek (north side of the St. Joe River), about 12 airmiles southeast of Mt. Wiessner. This property is privately owned and is within one mile of the St. Joe National Forest boundary. The land owners are aware of the species and its significance. Although an intensive search of the St. Joe area was not conducted, suitable habitat occurs throughout the region and it is reasonable to assume that M. clivicola is present. During the 1989 field season attempts were also made to relocate the 4 populations considered extirpated. For documentation these sites are:

- 1) O'Hara Camp, Nez Perce NF - 1942
- 2) Mouth Three Devils Creek, Clearwater NF - 1936
- 3) Along river near Dent - 1958
- 4) Along North Fork 4 mi north of Ahasahka - 1937

The first two locations were not relocated during the 1989 field season nor the 1988 or 1987 field seasons (Caicco 1988). The two locations along the North Fork Clearwater River (#3 and #4) were inundated by Dworshak Reservoir. Chances are likely that the present fluctuating water level of the reservoir would not allow establishment and survival of bank monkeyflower.

The second principal objective was met through an extensive search for new populations and suitable habitats of bank monkeyflower in northern Idaho, principally within the Clearwater and Nez Perce National Forests. This was carried out by centering searches in the vicinity of known locations and extending the search area from that point. By this method 39 new populations were located at 19 sites. Additionally, through informing Forest Service personnel working on habitat sampling and members of the Idaho Native Plant Society, another 7 new populations at 5 sites were confirmed (see Appendices II and III for distribution in Idaho and demographic data). The majority of these are small populations with less than 200 flowering individuals. Only two populations were of considerable size, numbering greater than 500 flowering individuals.

Within Idaho, bank monkeyflower is now known from 56 populations at 29 sites from portions of the St. Joe, North Fork Clearwater, Selway, and Lochsa River canyons and the Elk Creek Falls vicinity. The species is most abundant along the North Fork Clearwater and Selway Rivers (Appendix II). In 1989, virtually all of the open, grassy, south-facing slopes above these rivers supported small, scattered populations of bank monkeyflower. Although a number of new populations were located and some consisted of large numbers of flowering individuals, the total area known to be occupied is less than 12 hectares (30 acres).

Habitat and Associated Species: Bank monkeyflower occurs within a narrow set of environmental conditions. It almost exclusively inhabits south and southwestern exposures, although it can occasionally be found on southeastern aspects. Most often the microhabitat is open and exposed to direct sunlight, but it is possible to find some individuals in semi-shaded conditions at the base of rocks or shrubs (this is most likely due to greater moisture availability). Slopes are steep, generally greater than 30 percent. The best populations were located 50-400 feet above river levels.

The vegetation is comprised of open stands of Pinus ponderosa, Pseudotsuga menziesii and occasionally Abies grandis dominated by a grass or shrub understory. The corresponding habitat types are Pseudotsuga menziesii/Festuca idahoensis, Pseudotsuga menziesii/Physocarpus malvaceus, and Abies grandis/Physocarpus malvaceus (Cooper et al. 1987). It is important, however, to note that although these habitats are relatively xeric, they occur within a regional macroclimate that supports the Thuja plicata series habitat types (see Appendix IV for photos of habitat).

Mimulus clivicola is typically found growing in pockets of moist, exposed mineral soil created by erosion or elk/deer disturbance. These soils are relatively deep and loose and are primarily derived from decomposed schist or gneiss parent material. A combination of steep slopes and the loose nature of the decomposed granitics cause a highly erosive soil condition.

One of the most important factors for observing this species seems to be spring moisture. All populations located this year were found in moist microhabitats such as seepages, areas where water channels following rain, or moist pockets created by elk tracks. These areas tend to dry out later in the summer, but retain enough moisture in the spring for seed germination and maturation. The high precipitation during the spring of 1989 seems to have been particularly beneficial for many species, including bank monkeyflower. Most of the populations located this year were vigorous and consisted of numerous flowering individuals (often 100-200 plants).

The role of a seedbank in the population dynamics of an annual species is extremely

important and must be addressed. Presumably, annual species have evolved to handle wide fluctuations in climatic conditions. Seeds generally remain viable as a seedbank in the soil until favorable conditions allow for germination. The number of individuals observed in the last few years have been the flowering members of the population, with an unknown number of individuals remaining in the soil as seeds. So, while moisture levels of a given spring may be an important factor for observing flowering individuals, it may mean very little to the long-term viability of the species.

Due to the annual nature of this species, the size and extent of the observed members of the populations can fluctuate drastically in relation to annual climatic conditions. Previous surveys by Steve Caicco (1987a, 1987b, 1988) resulted in very few populations and flowering individuals. A case in point, during the 1988 field season Caicco was only able to locate "one very small population of about nine individuals" at Elk Creek Falls, while Charles Wellner (original collector at this site) observed thousands of plants in 1989. To explain this discrepancy are two likely possibilities:

- 1) Insufficient moisture in previous years for seed germination
- 2) Insufficient microhabitat of exposed mineral soils

Prior to 1989 the Pacific Northwest was experiencing a 5-year drought. During the drought, insufficient moisture and premature summer drying undoubtedly resulted in poor germination and/or high mortality of shallow-rooted annual species. In 1989, moisture was not a limiting factor due to the considerable amounts of precipitation that fell in the spring. Additionally, the previous winter was quite severe with high snow levels and long periods of freezing temperatures. This situation resulted in large numbers of elk and deer converging on the low-elevation valley bottoms, especially the open, south-facing slopes. This likely helped distribute seeds and expose large amounts of mineral soil. Elk tracks also help create small moisture traps, thereby producing the ideal situation for bank monkeyflower germination and growth.

Elk and deer activity may be benefitting bank monkeyflower in yet another aspect. Cheatgrass (Bromus tectorum) is a highly competitive, introduced winter annual that often grows in association with bank monkeyflower. Because cheatgrass germinates in the fall, it may be out-competing the spring-germinating Mimulus clivicola for the limited moisture on southern slopes, especially during droughty springs. Wintering elk/deer herds on these slopes trample the cheatgrass seedlings, subsequently reducing moisture competition.

Other species commonly found growing with bank monkeyflower include, Collomia linearis, Clarkia pulchella, Sedum lanceolatum, Pteridium aquilinum, Collinisa parviflora, Achillea millefolium, Agropyron spicatum, and Tridonis perfoliata. Two of the associated species, Clarkia pulchella and Collomia linearis, proved to be excellent indicators for identifying potential habitat of bank monkeyflower. Not only were these species very consistent associates, but they were also easily distinguished from a distance. Additionally, two noxious weeds, Centaurea maculosa (spotted knapweed) and Hypericum perforatum (St. John's-wort or goat weed), were also found as associated species.

Permanent Monitoring Plots: In order to monitor the trends in bank monkeyflower populations, permanent monitoring plots were established during the 1989 field season. Four permanent ecodata plots were established, each within a different river drainage. Plots were set up at Elk Creek Falls, and one each along the North Fork Clearwater, Lochsa, and Selway Rivers. Red-painted rebar was placed at the center of each circular tenth-acre plot. Complete ecodata (USDA Forest Service 1987) information was collected in addition to making counts of all Mimulus clivicola plants that fell within a 2-meter wide belt transect, which ran in a due N-S direction from the center of the circle. All individuals were counted, including seedlings. Ecodata information and counts of bank monkeyflower are presented in Appendix IV.

STATUS

Ownership: The majority of the known Mimulus clivicola populations occur on lands

administered by the Clearwater and Nez Perce National Forests. This species also occurs on the St. Joe National Forest at Elk Creek Falls Recreation Area, which is administered by the Clearwater National Forest. It is also likely that bank monkeyflower occurs further north in that portion of the St. Joe National Forest administered by the Idaho Panhandle National Forests, since a known location is within one mile of the forest boundary.

Threats: Seven known populations of bank monkeyflower, and possibly other unknown populations, have been extirpated by road building and maintenance, invasion of exotic weeds, inundation by Dworshak Reservoir, and recreational disturbances. Extensive erosion may also play a role in eliminating populations.

Direct timber harvest activities are unlikely to threaten bank monkeyflower because this species occurs in non-timbered or very open stands, unsuitable for intensive logging. Indirect logging activities, however, such as road building, road maintenance, and development or expansion of rock quarries, do pose a threat. For example, the quarry pit along O'Hara Creek has likely reduced the population of bank monkeyflower that is found above the pit, and probably extended down the slope prior to pit development.

Additionally, road and quarry activities are inevitably associated with erosion and invasion of exotic species. Highly competitive weeds, such as knapweed, goatweed, and cheatgrass, commonly occur on the same habitats as bank monkeyflower. Caicco (1988) believes that the disappearance of many historical sites can be directly attributed to road construction followed by the invasion of exotic weeds. Chemical control methods for these exotic weeds could pose a further threat (Caicco 1987a).

One of the best populations of bank monkeyflower encountered in the 1989 field season was along Canyon Creek (Lochsa River) near the Lost Irishman Mine. Although the mine does not presently seem to be active, a possible threat exists should further mining development take place.

Management Implications: It appears that current land-use and management of habitat containing Mimulus clivicola on the Clearwater and Nez Perce National Forests does not conflict with the species long-term viability. Future management activities, particularly road construction, improvement and/or maintenance, should be carefully assessed with regard to their impact on the conservation status of bank monkeyflower. While individual activities may not cause extinction, they do reduce habitat and could have a deleterious cumulative effect within the species' narrow range; human-caused extirpation has been documented for several populations.

ASSESSMENT AND RECOMMENDATIONS

Summary: Mimulus clivicola is a regional endemic with a limited distribution in the Northern Region. A total of 56 populations at 29 sites are documented for bank monkeyflower in Idaho. Only one historical site was relocated and at least seven sites have been extirpated. Within Idaho, bank monkeyflower is now known from portions of the St. Joe, North Fork Clearwater, Selway, and Lochsa River canyons and the Elk Creek Falls vicinity.

Despite the number of new populations found in 1989, the overall area covered by this species is still quite limited (< 12 hectares or 30 acres total). The majority of these new sites consisted of fewer than 200 flowering individuals. The species is restricted to a very specific set of habitat requirements, and strongly influenced by climatic conditions. As with many annuals, this species exhibits erratic population fluctuations in flowering individuals in relation to annual weather conditions.

Virtually all of the known populations of Mimulus clivicola occur on land administered by the Clearwater and Nez Perce National Forests. The majority of these populations appear not to conflict with current land-use and management. Several populations, however, do exist along roadsides or proposed road building projects, which makes them susceptible to road maintenance or exotic weed invasion.

At present very little is known about the autecology of this species. In particular, we are lacking in information about the seedbank and seed viability. It

appears that high spring precipitation results in good seed germination and flowering in bank monkeyflower, but this may mean very little in relation to the long-term viability of the species. The unknown number of individuals remaining in the soil as seeds is far more important. Based on 1989 field data alone, there does not appear to be any immediate threat to the vigor or conservation status of the species. However, continued monitoring is essential to assess correctly the proper status for this taxon.

Recommendations to the U.S. Fish and Wildlife Service: Prior to 1989, *Mimulus clivicola* was thought to be extremely rare, with only five small populations known extant in Idaho and six in Oregon. Based on this information, it was recommended that bank monkeyflower be considered a Category 2 candidate; that is, listing of Threatened or Endangered under the Endangered Species Act is possibly warranted, but the Fish and Wildlife Service lacks sufficient biological information necessary for such a listing. This report provides additional information regarding the distribution, ecology, and conservation status of bank monkeyflower in northern Idaho.

Our investigation indicates that bank monkeyflower is more abundant and widespread than previously thought. We now know of 56 populations, occurring at 29 sites in northern Idaho. Many thousands of individuals of this diminutive annual were observed in flower, due largely to favorable environmental conditions during the winter and spring of 1989. However, occupied habitat was observed to be less than 12 hectares (30 acres)(Appendix III) and at least seven historically-known populations are considered extirpated due to human-caused habitat alteration. In addition, all populations are known from relatively narrow corridors along valley bottoms, where numerous and varied development and other habitat-altering activities are taking place. For these reasons, we recommend that bank monkeyflower remain a Category 2 candidate.

Recommendations to the Regional Forester: As stated above, our investigation revealed the presence of many more populations of bank monkeyflower than previously known. It appears, however, to have very narrow habitat requirements and occupies a relatively small total area in portions of the Northern Region that have been, and will probably continue to be, impacted by habitat-altering activities. Also, comparing 1987 and 1988 data with our 1989 data, it is clear that we still know very little about autecology and populations dynamics of this species. We therefore recommend that *Mimulus clivicola* be maintained as a Region 1 Sensitive Species for the Clearwater and Nez Perce National Forests. Surveys should be initiated in the St. Joe River drainage to determine if it occurs on the Idaho Panhandle National Forests.

While it is clear from our data that the isolated loss of a single population will not place the species in jeopardy of extinction, the cumulative effect of all development activities need to be assessed in this light. As part of a comprehensive conservation strategy, the Forest Service should develop a Species Management Guide for bank monkeyflower in the Northern Region. Two major areas need to be addressed in such a plan. The first is the collection of further biological data on which informed management decisions can be based. Fruitful topics for investigations may include the role of the seed bank in population dynamics, seed dispersal mechanisms, effect of big game wintering patterns and climatic variability on population dynamics, effect of exotic weeds on population levels and interactions of several of these factors.

The second area addressed by the Species Management Guide should be a long-term monitoring and protection strategy. A successful strategy that has been used elsewhere is to classify populations into three protection categories, as follows:

- (1) Permanent protection of several, key populations throughout the range of bank monkeyflower in the Northern Region. These would most likely be the largest populations, where existing special designations protect natural values (e.g., Elk Creek Falls Recreation Area), and/or where existing and future monitoring is considered important.
- (2) Populations, usually of moderate size, that are managed within a

multiple-use framework, with at least some special considerations given to their maintenance.

- (3) Populations, usually the smallest, that could be sacrificed if necessary, if there is some assurance that the best populations are being protected.

Recommendations to the Clearwater National Forest: During the 1989 field season, numerous populations of bank monkeyflower were found along the North Fork Clearwater River and a few along the Lochsa River. Along the North Fork Clearwater River, 31 populations were located from Marquette Creek to Weitas Creek with the majority (27) between Marquette and Quartz Creeks (Appendix III).

Two to four known populations of bank monkeyflower are located along alternative routes of the proposed Dworshak Access road through the proposed Aquarius Research Natural Area. This proposed activity has initiated considerable controversy. Given the information available at the time, appropriate recommendations were made in accordance with Forest Service policy for sensitive species. Although unknown at the time, an accurate assessment of the species status was complicated by the 5-year drought. Based on our current knowledge, it appears that while this action will cause habitat reduction, it may not pose an immediate threat to the conservation of the species. This is contingent on the implementation of a conservation strategy similar to that outlined in the previous section.

Clearance surveys should be conducted for any projects in suitable habitat along the North Fork Clearwater and Lochsa Rivers and their tributaries, that may support Mimulus clivicola populations (as outlined in the Habitat and Associated Species section).

Recommendations to the Nez Perce National Forest: Populations of bank monkeyflower were found along the upper, south-facing slopes of the Selway River from just south of Lowell to the Selway-Bitterroot Wilderness border (Appendix III). While most populations are 50 to 300 feet above the road, there are a few populations located directly along the road. A field evaluation of the proposed improvements along the Selway River Road indicate that very few, if any, Mimulus clivicola populations will be impacted by the proposed activities.

The forest should carefully consider the impacts of its future management activities on the conservation status of this species. Clearance surveys should be conducted for any projects in suitable habitat along the Selway River and tributaries that may support bank monkeyflower populations.

Recommendations to the Idaho Panhandle National Forests: Bank monkeyflower is known to occur close to the St. Joe National Forest along the St. Joe River. Suitable habitat appears to occur on the Forest. A status inventory should be conducted on the St. Joe.

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Appendix I

Line drawings of Mimulus clivicola and
comparison drawings of
Mimulus breweri and Mimulus nanus.

Appendix II

Map of overall distribution of
Mimulus clivicola
in Idaho

Appendix III

Demographic data for 29 Mimulus clivicola
sites (56 populations) in Idaho.

* - previously known and documented populations

Categories follow those on the Idaho Natural Heritage Program's Special Plant Survey Form. The categories breakdown as follows:

<u>Pop. Size</u>	-	actual #	<u>Pop. Area</u>	-	1yd ²
		estimated #			1-5 yds ²
		1-10			5-10 yds ²
		11-50			10-100 yds ²
		51-100			100 yds ² - 2 ac
		101-1000			2 ac+
		1001-10,000			actual area
		10K+			(if known)

- * 1. Elk Creek Falls
 - a. Location:
 - b. Area: ca. 5 acres
 - c. Number of plants: 9 plants in 1988. Several thousand plants in 1989
 - d. Density: Moderate to High
 - e. Evidence of expansion/contraction: from <1 yd[@] to 5 acres.

- * 2. Aquarius Proposed RNA-Dworshak
 - a. Location:
 - b. Area: ca. 1 acre
 - c. Number of plants: 6 sm. pops, 51-100 plants total in 1988, same in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence

- 3. Isabella Landing East
 - a. Location:
 - b. Area: 5-10 yds²
 - c. Number of plants: 11-50 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence

- 4. Canyon Work Center West
 - a. Location:
 - b. Area: 10 yds²
 - c. Number of plants: 2 pops. approx 100 ft apart, one of 75 plants, another of 150 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence

- 5. Canyon Work Center East
 - a. Location:
 - b. Area: 10 yds²
 - c. Number of plants: 2 pops., one of 100 plants, another of 200 plants in 1989
 - d. Density: Moderate
 - e. Evidence of expansion/contraction: No evidence

- 6. Lost Pete Creek
 - a. Location:
 - b. Area: 10 yds²
 - c. Number of plants: 2 pops. about 75 feet apart, one of 100 plants, another of 150 plants in 1989
 - d. Density: Moderate
 - e. Evidence of expansion/contraction: No evidence

- 7. North Fork Clearwater River
 - a. Location:
 - b. Area: ca. 1 acre (scattered)
 - c. Number of plants: 5 pops. total of 400-1000 plants in 1989
 - d. Density: Moderate
 - e. Evidence of expansion/contraction: No evidence

8. Upper Twin Creek East
 - a. Location:
 - b. Area: 10 yds²
 - c. Number of plants: 2 pops., one of 101-300 plants, another of 25 plants in 1989.
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
9. Skull Creek/Martin Creek
 - a. Location:
 - b. Area: 10-100 yds²
 - c. Number of plants: 4 pops., two of 101-200 plants, one of 51-100 plants and one of 101-300 plants in 1989
 - d. Density: Moderate
 - e. Evidence of expansion/contraction: No evidence
10. Quartz Creek
 - a. Location:
 - b. Area: 5-10 yds²
 - c. Number of plants: 3 pops., two of 101-200 plants and one of 100-1000 plants in 1989
 - d. Density: Moderate
 - e. Evidence of expansion/contraction: No evidence
11. Burnt Creek
 - a. Location:
 - b. Area: 5-10 yds²
 - c. Number of plants: 101-200 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
12. North Fork Clearwater River/Washington Creek
 - a. Location:
 - b. Area: 1 yd²
 - c. Number of plants: 11-50 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
13. North Fork Clearwater River/Siwash Creek
 - a. Location:
 - b. Area: 1 yd²
 - c. Number of plants: 11-50 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
14. Weitas Creek Pack Bridge
 - a. Location:
 - b. Area: ca. 50 yds²
 - c. Number of plants: 150 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
15. Canyon Creek/Lost Irishman Mine
 - a. Location:
 - b. Area: ca. 1 acre
 - c. Number of plants: 1001-5000 plants in 1989
 - d. Density: High
 - e. Evidence of expansion/contraction: No evidence
16. Deadman Creek/Van Camp Road
 - a. Location:
 - b. Area: 10 yds²
 - c. Number of plants: 5 small populations totaling 51-100 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
17. Roar Creek/Selway River

- a. Location:
 - b. Area: 10 yds²
 - c. Number of plants: 51-100 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
18. Johnson Creek
- a. Location:
 - b. Area: scattered within 3 acres
 - c. Number of plants: 200 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
19. O'Hara Creek
- a. Location:
 - b. Area: 10 yds² (scattered)
 - c. Number of plants: 12 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
20. Hamby Fork
- a. Location:
 - b. Area: scattered within 1 acre
 - c. Number of plants: 200 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
21. Twentymile Bar
- a. Location:
 - b. Area: ca. 1 acre
 - c. Number of plants: 3 pops., one 100 plants, another 200 plants and last 20 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
22. Rock Island West
- a. Location:
 - b. Area: 5-10 yds²
 - c. Number of plants: 2 pops., one 11-50 plants, another 51-100 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
- * 23. Cache Creek East
- a. Location:
 - b. Area: <1 yd²
 - c. Number of plants: 2 plants in 1987
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
24. Glover Campground
- a. Location:
 - b. Area: 5-10 yds²
 - c. Number of plants: 11-50 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: No evidence
- * 25. Gedney Creek West
- a. Location:
 - b. Area: 10 yds²
 - c. Number of plants: 1-10 plants in 1987
101-200 plants in 1989
 - d. Density: Low
 - e. Evidence of expansion/contraction: from <1 yd² to 10 yds²
- * 26. Race Creek Campground
- a. Location:
 - b. Area: ca. 1 acre

- c. Number of plants: 11-50 plants in 1987, 501-750 plants in 1989
 - d. Density: Moderate
 - e. Evidence of expansion/contraction: from 10 yds² to scattered over 1 acre
27. Slims Campground/Meadow Creek
- a. Location:
 - b. Area: 3 acre
 - c. Number of plants: 3 populations totaling 1000-3000 plants in 1989
 - d. Density: Moderate to High
 - e. Evidence of expansion/contraction: No evidence
28. Black Prince Creek/Rechard Site
- a. Location:
 - b. Area: scattered within 2 acres
 - c. Number of plants: 101-1000 plants in 1989
 - d. Density: Moderate
 - e. Evidence of expansion/contraction: No evidence
29. Elk River Gravel Pit
- a. Location:
 - b. Area: 10 yds²
 - c. Number of plants: 101-300 plants in 1989
 - d. Density: Moderate
 - e. Evidence of expansion/contraction: No evidence

Appendix IV

Permanent Monitoring Plot Data

1. Diagram of Ecodata Plot Set-up
2. Ecodata from Permanent Plots and number of counted Mimulus clivicola within plots.

Appendix V

Slides of Mimulus clivicola and its habitat.

Maps of precise occurrences of
Mimulus clivicola

Clearwater National Forest
(or administered by)

- Map A. Portion of Elk Creek Falls 7.5' quadrangle
- Map B. Portion of Thompson Point 7.5' quadrangle
- Map C. Portion of Sheep Mountain 7.5' quadrangle
- Map D. Portion of Sheep Mountain 7.5' quadrangle
- Map E. Portion of The Nub 7.5' quadrangle
- Map F. Portion of The Nub 7.5' quadrangle
- Map G. Portion of Clarke Mountain 7.5' quadrangle
- Map H. Portion of Lean-to Point 7.5' quadrangle
- Map I. Portion of Lowell 7.5' quadrangle
- Map J. Portion of Coolwater Mountain 7.5' quadrangle

Nez Perce National Forest

Map K. Portion of Goddard Point 7.5' quadrangle
Map L. Portion of Goddard Point 7.5' quadrangle
Map M. Portion of Goddard Point 7.5' quadrangle
Map N. Portion of Stillman Point 7.5' quadrangle
Map O. Portion of Stillman Point 7.5' quadrangle
Map P. Portion of Selway Falls 7.5' quadrangle
Map Q. Portion of Selway Falls 7.5' quadrangle

Private Property

Map R. Portion of Marble Creek 7.5' quadrangle
Map S. Portion of Elk River 7.5' quadrangle

Location of four permanent ecodata plots on
Clearwater and Nez Perce NFs.

Location of Permanent Plots

Elk Creek Falls Plot - see Map A
#1 - Elk Creek Falls populations

Skull Creek Plot - see Map E
#9 - Skull Creek/Martin Creek
Population 1

Lost Irishman Mine Plot - see Map I
15 - Canyon Creek/Lost Irishman
Mine population

Twentymile Bar Plot - see Map N
#21 - Twentymile Bar Population 2