ASSESSMENT OF THE GENUS *MIMULUS* (SCROPHULARIACEAE) WITHIN THE INTERIOR COLUMBIA RIVER BASIN OF OREGON AND WASHINGTON

PREPARED BY:

ROBERT J. MEINKE

DEPARTMENT OF BOTANY AND PLANT PATHOLOGY
OREGON STATE UNIVERSITY
CORVALLIS, 9733 1

AUGUST 1995

TABLE OF CONTENTS

ASSESSMENT OF THE GENUS *MIMULUS* (SCROPHULARIACEAE) WITHIN THE INTERIOR COLUMBIA RIVER BASIN OF OREGON AND WASHINGTON

Robert J. Meinke
Department of Botany and Plant Pathology
Oregon State University, Corvallis 97331

1. Introduction and Biogeography of *Mimulus* in the Columbia River Basin

The monkeyflower genus *Mimulus* (Scrophulariaceae) is a predominantly western North American group of annual and perennial herbs, currently believed to comprise 100 (Holmgren, 1984; Thompson, 1993) to 150 (Munz, 1959) species. This report is intended to provide information on the genus as it occurs in the Columbia River Basin (hereafter CRB) of Washington and Oregon, as defined by the U.S. Forest Service for the Eastside Ecosystem Management Project (EEMP). Limited coverage of the genus for adjacent west-central Idaho is provided as well. The emphasis in this report will be on species that are state or federally listed as threatened or endangered, candidates for listing, or any of the taxa on the current lists of endangered, threatened, or otherwise sensitive species as recommended by the Oregon or Washington Natural Heritage Programs (ONHP, 1993; WNHP, 1994).

The great majority of monkeyflowers occur in and west of the endemic-rich Sierra Nevada of California (Grant, 1924; Pennell, 1951; Munz, 1959; Thompson, 1993), although the genus is found worldwide with the exception of Europe and Antarctica. Secondary centers of distribution occur in southwestern South America, primarily in Chile and adjacent Argentina, and in the inland Pacific Northwest of North America, especially in eastern Oregon and adjacent Idaho and Washington. Many of the species are conspicuous and showy flowered, and are frequently prominent elements of native spring floras.

In the most recent monograph of the genus, Grant (1924) subdivided *Mimulus* into ten sections based on morphological similarities. *The* section *Diplacus* is today usually considered to constitute a separate genus, primarily because of its woody habit. Otherwise, most current floristic treatments in the United States still follow the basic phylogeny and species alliances proposed by Grant (1924), with her taxonomic sections generally corresponding to easily recognized, evidently natural groupings. Genetic studies by Vickery (1978) and Hiesey et al. (1971) have confirmed the existence of crossing barriers between several of these groups, although evolutionary relationships within much of the genus are still not well understood.

Even though *Mimulus* was reasonably well defined at the sectional level, there were a number of small species complexes that Grant (1924) found difficult to place. These were organized into the section *Paradanthus*, a problematic and probably

paraphyletic group (Argue, 1980, 1986). The 40-50 species presently referred to this section primarily occur in California and Oregon. The traits used by Grant (1924) to recognize *Paradanthus* were a prismatic calyx with equal or subequal teeth, funnelform corollas, and a central placental column that (upon maturity of the fruit) separates only near the apex or not at all. She believed that additional characteristics distinguishing species groups within *Paradanthus* did not warrant separate taxonomic status, and she elected to align all species into a single section for the sake of convenience. She conceded that elements of *Paradanthus* were not necessarily closely related and that their taxonomic affiliation had limited phylogenetic implications.

Paradanthus is represented in the Pacific Northwest primarily by two yellow-flowered species assemblages, one centered around the common *Mimulus moschatus* Dougl. in Lindl. and the other around the rare and local *Mimulus washingtonensis* Gand. The former group includes the widespread species *M. primuloides* Benth. and *M. floribundus* Dougl. in Lindl., and both *M. floribundus* and *M. moschatus are* geographically and morphologically linked to several less common taxa occurring in California. *Mimulus moschatus* and M. *floribundus* occur throughout western North America and are represented by many taxonomically unrecognized geographic races in the *CRB. The M. washingronensis* complex, as defined by Grant (1924), consists of *M. washingtonensis*, *M. pulsiferae Gray,* and *M. ampliatus* Grant, three locally distributed annuals from eastern Oregon, extreme southern Washington, western Idaho, and northern California. Other rare members of this group in the CRB include *M. hymenophyllus* Meinke, *M. evanescens* Meinke, and *M. jungermannioides* Suksd. Diagnostic traits for these taxa include yellow, bilabiate flowers (usually strongly zygomorphic), firmly adherent placentae, cylindrical fruiting calyces, long-pedicelled flowers, viscid pubescence, and petiolate leaves. Several of these characters were-also shared by members of the *M. moschatus* complex, and Grant (1924) implied a close relationship between the two species groups.

Recently, taxonomic interest in *the* section *Paradanthus* has been generated by the discovery of several new endemic or otherwise rare species in California and Oregon (Meinke, 1983, 1995; Heckard and Shevock, 1985; Heckard and Bacigalupi, 1986). It is in this section that the majority of monkeyflowers that are considered sensitive in the CRB are found. However, section *Eunanus* contributes two species (*M. jepsonii* Grant and *M. clivicola* Greenm.) as does section *Oenoe (M. tricolor* Lindl. and *M. pygmaeus* Grant), all of these with predominantly magenta or reddish corollas, except for the diminutive, yellow-flowered *M. pygmaeus.*

In addition, the *Mimulus guttatus* DC complex (in section *Simiolus*) is well represented throughout the CRB. Although none of these species are rare or endangered,

their extreme diversity of form surely encompasses considerable genetic variation. The *same* general scenario *exists* for *M. Zewisii* Pursh (section *Erythranthe*), which is prevalent along montane streams and subalpine meadows east of the Cascade Range, as well as *M. nanus* Hook. and Am. and *M. cusickii* (Greene) Piper (in section *Eunanus*), *two* extremely widespread and variable taxa frequenting xeric pumice or basalt soils in much of the western CRB, most common after ample winter precipitation.

The distribution of endemic *Mimulus* species in the CRB is primarily centered in north-central to northeastern Oregon, on thin-soiled basalt shelves or cliffs, in or along the drainages of the Columbia, Snake, and John Day Rivers and their immediate tributaries. This pattern of edaphic endemism contrasts with that of California, where species are often restricted to granitic or calcareous substrates (Grant, 1924; Munz, 1959; Thompson, 1993). These basalt-obligate taxa include all of the rare, related species in the *M. washingtonensis* complex. Eastern Wallowa County, Oregon and nearby Idaho's portion of Hell's Canyon exhibit the most interesting and diverse *array* of localized *Mimulus* taxa. However, other endemics and extremely rare species are sporadically scattered across the entire region, from the base of the Oregon Cascades to western Idaho (although not much in Washington), with little phytogeographic affinity. This may be due in part to the fact that rare CRB species that are not members of *the* yellow-flowered *M. washingtonensis* group are generally considered distantly related within the genus.

The ownership of the vast majority of *rare Mimulus* habitat and populations within the CRB is federal, and almost entirely within Oregon. There are no privately owned or other non-federal lands that could conceivably play an important role in the conservation of this genus, including both rare and common taxa (except possibly for *M. ampliatus* -- see Section 2.). It is interesting to note that every National Forest or BLM District within the CRB in Oregon has, or is suspected to have, populations and suitable habitat for one or more *rare Mimulus* species, with the Wallowa-Whitman National Forest and the Hell's Canyon NRA probably harboring the most diversity in the genus. Other areas of above average endemism or diversity for *Mimulus* include the Prineville District of the BLM and the Winema/Fremont National Forest complex along the California-Nevada border. Table 1. in Section 2., identifies major species of *Mimulus* in the CRB, including all of the rare or sensitive species to be treated individually in this report (with narratives following Table 1.).

2. Major Species Groups and Individual Species Treatments

Selected widespread species of *Mimulus* from the CRB have been identified and grouped together for the purpose of this assessment. These groupings are based on shared habitats and ecological requirements, and include most common species with potential for

use as ecological indicators of local environmental conditions. These species are listed below in Table 1. Sensitive species given individual assessments (defined in the first paragraph of Section 1.) are also listed and summarized in Table 1. All species and species groups are discussed in more detail in this section, following the table.

Table 1. Groups and Individual Species Treated in this Report.

Taxonomic Groups (Representative Common Taxa):	*Overview*
Mimulus guttatus/M. nasutus	Common species distributed throughout most of the CRB at lower to mid elevations; extremely widespread on a broad range of mostly moist to wet habitat types
Mimulus lewisii/M. tilingii	Common species at middle to higher elevation in mountain ranges east of the Cascades; along cold stream margins and lakes to wet meadows
Mimulus moschatus/M. floribundus	Common but local species distributed in areas of vernal moisture at lower to middle elevations; in well-drained soils of open forests, rangelands, drying streambeds, and cliffs
Mimulus nanus/M. cusickii	Common species forming discrete patches in open or disturbed areas of extremely well-drained volcanic soils, at lower to higher elevations in range, forests, and subalpine barrens; extremely xeric-adapted
Mimulus primuloides/M. breviflorus/M. breweri	Common but locally distributed species, typically of moist lower or middle elevation (or occasionally higher) areas, in moist to wet meadows, or bogs (for *M. primuloides*)

Individually Assessed Taxa:	*Overview:*
Mimulus ampliatus (= M. ***washingtonensis*** subsp. ***ampliatus)***	Recently re-discovered Idaho endemic; ***only*** sensitive species of ***Mimulus*** from the CRB not known in the state of Oregon; considered imperiled in Idaho (IDFG, 1994).
Mimulus clivicola	Considered sensitive (federal 3C) in Idaho, Oregon, and Washington (ONHP, 1993; WNHP, 1994) -- recent work shows the species to be most common in north-central Idaho, but not currently known in Washington (Lorain and Moseley, 1989, 1990)
Mimulus evanescens	Recently discovered mid-elevation' range/riparian species in the process of being published (Meinke, 1995); two extant sites globally, but historically more widespread according to herbarium collections; expected to be listed as a federal candidate in California, Oregon, and Idaho in the near future
Mimulus hymenophyllus	Extremely narrow endemic found west of Hell's Canyon (Meinke, 1983, 1991; Meinke and Carlson, 1995) and perhaps along the lower Grande Ronde River in Oregon, possibly occurs in Idaho as well; currently a federal candidate (C2)
Mimulus jepsonii	Regional endemic occurring along the east base of the Cascades, extending from central Oregon into northern California; not a federal candidate but sensitive in USFS Region 6 (Meinke 1992, 1993a, 1995a)

Mimulus jungermannioides	Regional endemic in north-central Oregon on riverine cliffs, populations isolated and sporadic (Meinke, 1991); historically known from a single collection from the Columbia River Gorge in Washington; currently a federal candidate (C2)
Mimulus Zatidens	Disjunct in Lake County, Oregon, known from one site in the CRB (Shelly, 1986); should be considered endangered in Oregon, although it is more common and not sensitive in central California (ONHP, 1993); not a federal candidate
Mimulus patulus	Local endemic in extreme northeast Oregon in drainages west of the Snake River; recent work has greatly increased the number of known sites, but the species is still considered very rare (Meinke and Carlson, 1995a); currently a federal candidate (C2)
Mimulus pulsiferae	Scarce species occurring along or near the east base of the Cascades (Meinke, 1991); considered sensitive in Washington (WNHP, 1994) but secure in Oregon (ONHP, 1993)
Mimulus pygmaeus	Regional endemic, from Lake County, Oregon into northeastern California; once considered very vulnerable (Lassen National Forest, 1991) and currently a C2 federal candidate -- recent work from the 1993 field season (Meinke et al., 1994) indicates this species is locally common and recommends downlisting to federal Category C3

Mimulus suksdorfii	**Common** in Oregon but peripheral in Washington **(WNHP, 1994),** where sensitive; not a federal candidate
Mimulus tricolor	Extremely rare and local species in the CRB, found in south-central Oregon (Meinke et al., 1994); also rare in western Oregon but apparently common in much of California (ONHP, 1993); not a federal candidate
Mimulus washingtonensis	**Localized** John Day River system (Oregon) endemic (Meinke 1991, 1993) **-- *see also M. ampliatus*;** historically **known** from Washington; currently a state and federal candidate **(C2),** but recent inventories suggest downlisting to federal Category C3 may eventually be appropriate **(Umatilla** NF and Prineville BLM, personal communications)

GROUP ASSESSMENTS:
REPRESENTATIVE COMMON SPECIES

Taxon Group:

Mimulus guttatus/Mimulus nasutus ecotype complex

Criteria Used For Assessment:

This is the most widespread species complex in ***the*** genus, ***with Mimulus guttatus*** by far the most visible and common species. Various **ecotypes** of ***M. guttatus*** occur throughout the entire CRB at most elevations and in virtually all **mesic** to aquatic habitats below high montane. The species is particularly common in most riparian areas, along ditches, in disturbed and undisturbed meadows, on wet cliffs, and in all manner of seepage or moist microsites in lower to mid-elevation range and dry forest habitats. As such, it seems a logical species to **include** as a barometer plant for wetland and riparian conditions.

Associated Cover Type(s):

CRB: Water; Agricultural Land Use; Mixed Grass-Agriculture-Shrubland; **Seral** Shrubland **Herbaceous.** ***SAF***: Potentially all cover types below Engelmann **Spruce-**

Subalpine Fir and Whitebark Pine. ***SRM***: Potentially all cover types except Salt Desert Shrub.

Within the above cover types this species group occurs in standing water, seepage zones, springs, drying watercourses, along ditches, in wet and often disturbed meadows, among damp rocks, riparian areas, etc.

General Geographic Range Within CRB of Oregon/Washington/Nevada:

Distributed in favorable microsites throughout the CRB.

Sensitivity to Disturbance:

Although seemingly thriving in wet disturbed situations, ***M. guttatus*** is nonetheless vulnerable to heavy grazing (it is very palatable) and drought. The disappear&e of populations which are not naturally re-introduced over time (e.g., 2-3 years) is a possible indicator of deteriorating range conditions in riparian and spring habitats. The species does reasonably well in all but the most degraded sites.

Population Trends:

No studies of population trends in this common species are available. Anecdotal observations suggest it is holding its own throughout the CRB, but is occasionally extirpated locally as a result of changes in hydrology or excessive grazing or substrate intensive land use. The species is a very prolific seeder (as are most monkeyflowers), and is generally quite capable of reestablishing populations locally or via immigration from nearby sites.

Dispersal Mode and Requirements:

Dispersal for ***Mimulus guttatus*** and its relatives is almost exclusively via water (see Waser et al. 1982), at least at lower elevations. Upper elevation ecotypes may have seed wind-dispersed to some degree, but running water probably plays a role in the seed dispersal and migration of all populations.

Members of this species group are both self- and insect-pollinated (Harris, 1979). Although outcrossing is not mandatory for seed set, genetic vigor is presumably maintained by at least occasional outcrossing. Pollen dispersal is probably local except in rare cases where honeybees or hummingbirds visit large-flowered plants.

Usefulness as Bioindicator:

Mimulus guttatus is a potential indicator of changes in the hydrologic regime of lower elevation sites in the CRB, as well as an indicator (by it's disappearance) of deteriorating conditions in and around riparian areas, waterholes, springs, etc. The presence of this species complex is not necessarily an indication of a healthy, diverse community, but is always an indication of well above average soil moisture at some point in the growing season.

Taxon Group:

Mimulus lewisii/Mimulus tilingii

Criteria Used For **Assessment:**

These species are common, middle to upper elevation **taxa** found in wet meadows, near lake margins, and in and along running water within **shrubby** or forested habitats.

Associated Cover Type(s):

CRB: Subalpine herbaceous. ***SAF:*** Engelmann Spruce-Subalpine Fir; Whitebark Pine; White Fir; Western Larch; Grand Fir; Western White Pine; Aspen; Lodgepole Pine; Pacific Douglas-Fir; Douglas-Fir-Western Hemlock.

Mimulus lewisii occurs from low **montane** to subalpine habitats, in a range of perennially moist or aquatic sites, often near open or running water but also in meadows, near snow melt zones, or along well-drained ditches adjacent to mountain roads. ***Mimulus tilingii*** tends to occur in similar habitats but at consistently more subalpine to alpine elevations, nearly always in cold, running, typically unpolluted water, or along the edges of cold lakes or bogs.

General Geographic Range. Within CRB of Oregon/Washington/Nevada:

One or both species is locally common in suitable sites above 1700 meters from the east slope of the Cascades east throughout the CRB (sporadic in southeastern Oregon and adjacent Idaho).

Sensitivity to Disturbance:

Both species (particularly ***M. lewisii***) will respond favorably to (or will at least tolerate) limited disturbances. Examples include activities associated with ski facilities and the creation and maintenance of drainage ditches along gravel roadways. Extreme disturbances, however, as in the case of ***M. guttatus***, will evidently eradicate populations.

Population Trends:

No known studies on the demography of either species in the CRB have been completed. Casual observation by many observers, however, suggests that both species are represented by numerous, healthy populations across the **mesic** higher elevations of the CRB. Both species are excessively common in the Cascades and the northern mountains of Oregon and adjacent Idaho.

Dispersal Mode and Requirements:

As with many perennial ***Mimulus*** species, both of these depend heavily on running water to disperse their seeds. Evidence of this is often observed in ***Mimulus Zewisii,*** which commonly migrates along the ditches of higher elevation roads in the Blue and **Wallowa** Mountains (and undoubtedly elsewhere). ***Mimulus tilingii*** is confined to

subalpine and alpine areas and it is less commonly subjected to disturbance. It likewise utilizes running water to disperse seeds and will expand its patches by vegetative propagation. The tough white rhizomes may also break off and be dispersed longer distances by water. Roth species are principally outcrossed and require pollinators (hummingbirds or large bees, rarely flies) to effect pollen dispersal.

Usefulness as Bioindicator:

These species could be considered high elevation counterparts to the lower elevation *Mimulus guttatus* group, and are obvious indicators of considerable soil moisture or perennial streamflow. Disruption of montane or alpine meadow hydrology could be indicated by shifts in population *structure* of *these* taxa, especially *in M. Zewisii,* which is much more apt to frequent sites also frequented by humans. Changes in water quality might also be reflected by such population shifts, as could increasing levels of recreational activities around montane lakes and streams that are popular as camping and fishing destinations.

Taxon Group:

Mimulus moschatus/Mimulus floribundus

Criteria Used For Assessment:

These are closely related (Grant, 1924), common species that occupy comparable habitats in the lower to middle elevation dry forest and open range ecosystems.

Associated Cover Type(s):

SAF: Interior Douglas-Fir; Western Red Cedar-Western Hemlock; Oregon White Oak; Cottonwood-Willow; Interior Ponderosa Pine. *SRM:* Potentially occurring in all the SRM cover types in the CRB except Salt Desert Shrub.

Roth species are inhabitants of sandy to volcanic, well-drained soils at lower to occasionally middle elevations, usually in open areas with ample vernal moisture. Plants will continue flowering as long as the soils are moist but quickly die back or senesce as substrates dry out. Typical microsites include drying streambeds, sandy spots in meadows, desert springs, seeps along cliffs or among boulders, and sandy or gravelly banks of rivers, creeks, or reservoirs.

General Geographic Range Within CRB of Oregon/Washington/Nevada:

Roth species occur commonly throughout the CRB in Oregon, Washington, and Nevada, although less frequently in the northern half of Washington. They are restricted to lower elevations with hot summer temperatures, or (in the case of *M. moschatus*) extending into dry, mixed coniferous forests at middle elevations (up to 3000 meters farther south in the Nevada Great Basin).

Sensitivity to Disturbance:

Both species occur in a wide range of sites, from pristine to heavily impacted. These taxa are extremely fecund, typically producing many thousands of seeds per plant. They are excellent colonizers and can withstand grazing pressure (the foliage is probably undesirable as forage due to the extremely viscid hairs). They are sensitive to moisture levels and populations will fluctuate considerably during swings in annual precipitation (especially for the annual ***M. floribundus***).

Population Trends:

There have been no studies undertaken on the demography of these species. Scattered observations by the author over the last 15 years indicate both species are very widespread and locally abundant in suitable habitat.

Dispersal Mode and Requirements:

These species often disperse seeds via running water, although populations of both taxa are not necessarily restricted to microsites near perennial water sources (suggesting that localized dispersal by wind is also likely -- seeds are dust-like and probably easily wind-blown when dry). Gene flow may be primarily via seed dispersal since both species can readily self-pollinate (especially the flowers of ***M. floribundus)*** -- floral morphology that promotes autogamy makes outcrossing a secondary consideration in these species.

Usefulness as Bioindicator:

Mimulus moschatus and M. ***floribundus*** are often encountered in sites where moisture routinely occurs but is at a premium. A continuous presence of robust populations of these taxa suggest that riparian areas or springs are in at least reasonable condition (as far as the herbaceous flora goes) and that soil moisture is dependable. Their presence does not necessarily indicate, however, that grazing levels are optimal or not impacting native riparian vegetation. Elimination of populations over time suggests that sites are deteriorating or that the local hydrology is undergoing a shift towards drier conditions, either through continued natural drought, overuse of available water, or a combination of these factors.

Taxon Group:

Mimulus nanus/M. cusickii

Criteria Used For Assessment:

These are closely related, very common annuals occurring in pristine as well as disturbed situations in xeric microsites of the CRB (in contrast with most other abundant monkeyflowers in our area, which prefer moist to wet habitats).

Associated Cover Type(s):

CRB: Barren. ***SAF:*** Engelmann Spruce-Subalpine Fir; Whitebark Pine; Interior Douglas Fir; White Fir; Western Larch; Grand Fir; Western White Pine; Lodgepole Pine; Interior Ponderosa Pine; Sierran Nevada Mixed Conifer. ***SRM:*** Potentially in all the SRM cover types except Chamise Chaparral and Salt Desert Scrub.

Populations of ***Mimulus nanus are*** especially widespread and will occur in dry microsites well into harsh alpine areas and throughout a variety of open, dry forest types. However, this species (and ***M. cusickii*** exclusively) is far more common in xeric sagebrush/bunchgrass/bitterbrush habitats. Neither species is associated with springs or vernal moisture, and will bloom well into the heat of summer (as late as September) on the driest of volcanic or other sandy substrates.

General Geographic Range Within CRB of Oregon/Washington/Nevada:

One or both species occur throughout most of the lower two-thirds of the CRB west of the Rocky Mountains.

Sensitivity to Disturbance:

Neither species appears particularly vulnerable to disturbance. Roth apparently maintain large seed banks which can result in massive spring/summer blooms after wet winters. ***Mimulus nanus***, in particular, is commonly observed forming large monospecific patches along highways east of the Cascades in volcanic cobbles and pumice substrates. It is also encountered in other disturbed areas, including many developed recreational sites near the Cascade Mountains, and is often abundant after fires on national forests in central Oregon. Although quite resilient and seeming to favor moderate disturbance, both species are expected to be vulnerable to excessive habitat alteration. For example, neither ***M. nanus*** or ***M. cusickii*** will remain common in heavily overgrazed range or in clearcuts where the substrate has been extensively altered or seeded.

Population Trends:

Many populations are known for these species throughout most of the CRB. Although no monitoring studies have been implemented due to the frequency of the species, observations over the last decade indicates that both taxa remain exceedingly abundant in many areas, and are consistently occurring in stable or even increasing numbers along numerous roads and developments (especially near the Cascades for ***M. nanus***).

Dispersal Mode and Requirements:

Neither species occurs near open water, so wind is apparently the primary dispersal agent. Vehicles may also aid in dispersal of seeds shed along roadways. Roth species are often found near or on ant mounds, suggesting another local dispersal method.

Roth are usually bee-pollinated (but are nominally autogamous), and generally require insect visitation for effective pollen/gene flow and reproduction.

Usefulness as Bioindicator:

These species are representative of the high desert/dry forest herbaceous flora. Although apparently not especially sensitive to disturbance, they are common taxa whose decline in any given area might signal a general deterioration of range or forest conditions. Unlike most other CRB monkeyflowers they are not indicative of moist conditions.

Taxon Group:

Mimulus primuloides/Mimulus breviflorus/Mimulus breweri

Criteria Used For Assessment:

This is a trio of species occurring locally in a range of moist to wet meadow habitats at lower to upper elevations. These are probably the most exclusively "meadow" species in the genus, although many other monkeyflowers will occur in meadow habitats.

Associated Cover Type(s):

CRB: Subalpine herbaceous. *SAF:* Engelmann Spruce-Subalpine Fir; Whitebark Pine; Interior Douglas-Fir; White Fir; Western Larch; Grand Fir; Western White Pine; Aspen; Lodgepole Pine; Western Red Cedar-Western Hemlock; Pacific Douglas-Fir; Douglas-Fir-Western Hemlock; Interior Ponderosa Pine; Sierra Nevada Mixed Conifer. *SRM:* Probably within any of the SRM cover types (except Saltbush Scrub) inasmuch as they occur within a matrix that includes one or more of the SAF types.

Since these widespread species are montane and occur in meadows for the most part, the surrounding cover types are quire variable. Within the meadows the species occur in dryish to wet microsites (in order, from *M. breweri* to *M. primuloides),* generally in very open or exposed areas.

General Geographic Range Within CRB of Oregon/Washington/Nevada:

Widespread throughout montane *areas* of *the* CRB, *with Mimulus primuloides* becoming less frequent in the drier ranges of southeastern Oregon and southern Idaho.

Sensitivity to Disturbance:

There is less opportunity to evaluate potential sensitivity of these species since there are comparably fewer major disturbances in the habitats they occupy. Grazing activities in montane meadows is prevalent throughout the CRB, however, and have reduced populations of all three taxa in parts of eastern Oregon (Meinke, unpubl.). It is likely that among the commoner monkeyflower species in the CRB, these three are the

most sensitive to habitat disruption, based on the fact that they are seldom observedin communities with any significant exotic component.

Population Trends:

Not known, since there have been no specific studies on the abundance or demography of these taxa in Oregon, Washington, or Nevada. Casual observation over the last 15 years suggests that their populations, while locally distributed due to comparatively narrower habitat requirements, are nonetheless abundant and widespread on a range-wide basis (although populations of the tiny annuals *M. breviflorus* and *M. breweri* are often inconspicuous).

Dispersal Mode and Requirements:

A combination of wind and flowing water disperse the seeds of these species. *Mimulus primuloides* also produces vegetative propagules (turion-like bulbils) that may spread by stolons or become detached and disperse via running water (Douglas, 1981). This species is principally outcrossed (although self-compatible), based on greenhouse observations (Meinke, unpubl.), and requires bees to most effectively set seeds (although it reproduces very efficiently by vegetative means). The other two taxa are annuals, highly self-pollinated, and do not require pollinators to effect gene flow.

Usefulness as Bioindicator:

As species common to relatively undisturbed meadow habitats in the CRB, populations of these taxa (along with other common meadow natives) may be useful in monitoring conditions of these ecosystems, and are probably good indicators of meadow biodiversity. *Mimulus primuloides* is particularly prevalent in sensitive boggy sites, which rarely have any exotic taxa, and it's disappearance from a meadow might signal hydrologic shifts or overgrazing. The other taxa are often components of the Scarce annual flora indigenous at moderate to higher elevations, and their presence and continuation at sites (as opposed to exotic annuals) could be considered an indicator of relatively healthy conditions for the drier, herb-dominated meadows.

INDIVIDUAL SPECIES ASSESSMENTS: CANDIDATE OR SENSITIVE TAXA

Taxon:

Mimulus ampliatus (= *M. washingtonensis* subsp. *ampliatus*)

Criteria Used For Assessment:

Sensitive species (USFS Region 6); imperiled in Idaho (IDFG, 1994)

Associated Cover Type(s):

SRM: Bluebunch Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass; Ponderosa Pine-Grassland; possibly others -- most sites for the species are historic and habitats are poorly documented.

General Geographic Range Within CRB of Oregon/Washington/Nevada:

This taxon is not actually recorded from the focus-area of this report, although it possibly occurs in Wallowa County, Oregon. It is currently recorded in Nez Perce, Idaho, and Lewis counties, all in western Idaho (Bob Moseley, Idaho Dept. of Fish and Game, personal communication). Included here for the sake of completeness, this is the only sensitive *Mimulus* taxon in the CRB not specifically known to occur in Oregon.

Sensitivity to Disturbance:

Unknown; this annual is presumably is very sensitive to competition with introduced weeds that are widespread through its range and habitat., Sites near Hell's Canyon are small and infested with annual exotic grasses. Populations probably require vernal moisture (either trapped precipitation or seepage -- the latter is reported on historic specimen labels from the Lake Waha area in Nez Perce County, Idaho).

Population Trends:

Unknown; this taxon is still very poorly understood and has been collected only a handful of times. It is much rarer and probably more vulnerable than the related ***Mimulus washingtonensis*** subsp. ***washingtonensis,*** which occurs to the west in Oregon's John Day River drainage. This is probably the only monkeyflower where private lands could perhaps play a significant role in conservation efforts. Historic collections from Lake Waha in Nez Perce County, Idaho suggest that populations may have once been locally plentiful there. Today much of this area is privately owned for vacation homes and is heavily posted, limiting access for inventory.

Dispersal Mode and Requirements:

Unknown; probably comparable to ***Mimulus washingtonensis*** populations in the John Day River area (see discussion for that taxon).

Usefulness as Bioindicator:

As populations of this species are relocated they may be good indicators of changes in local hydrology' or increases in annual grasses. Considering the scarcity of populations, any that are located during future surveys may also be good indicators of unique native habitat that has managed to stay unscathed from livestock grazing.

Taxon:

Mimulus clivicola

Criteria Used For **Assessment:**

Sensitive species (USFS Region 6; BLM); 3C federal candidate

Associated Cover Type(s):

SAF: Interior Douglas-Fir; White Fir; Grand Fir; Interior Ponderosa Pine. ***SRM:*** Bluebunch Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass; Idaho Fescue- Slender Wheatgrass; Ponderosa Pine-Grassland.

This is an annual monkeyflower of rocky,-talus outcrops or gravelly, mineral soils, within a matrix of dry coniferous forest and patchy bunchgrass, often with species of ***Lomatium, Scutellaria, Penstemon, Phacelia, Achillea, Sedum, Clarkia, Arabis,*** and ***Allium.***

General Geographic Range Within CRB of Oregon/Washington/Nevada:

The species is a regional endemic, from the Hell's Canyon area (on the upper slopes and adjacent mountains) in Wallowa County, Oregon and possibly extreme southeast Washington, north through Idaho to Shoshone County, near the western Montana border.

Sensitivity to Disturbance:

Mimulus clivicola is relatively tenacious, as most monkeyflowers in section ***Eunanus*** arc, and may even require moderate disturbance. It is evidently capable of reseeding itself in disturbed sites, but severe logging or road-building could possibly result in local extirpation.

Population Trends:

Recent work in Idaho (Lorain and Moseley, 1990) indicates this monkeyflower is not as rare as was once considered. However, as an annual species, there are no specific studies that accurately reflect the long-term population trends of the species. Evidence from other species with comparable life histories, such as the annual ***M. jepsonii*** (see Meinke, 1992, 1993a, 1995a), suggests that this species probably retains a significant seed bank from which to recolonize sites.

Dispersal Mode and Requirements:

Dispersal of seeds is primarily via wind; local dispersal is possibly accomplished by ants, in the same fashion as ***Mimulus nanus*** (see earlier discussion). Pollen dispersal is by small native bees, based on field observations in northeastern Oregon. The species is capable of limited self-pollination (demonstrated in greenhouse studies; Meinke, unpubl.), but seed set is more dependable and gene flow is expected to be enhanced if flowers are visited by insect pollinators.

Usefulness as Bioiudicator:

Representative of mid-elevation annual flora in rocky, talus sites in Oregon, where grazing has had minimal impact and associated native species are plentiful. Populations

are not associated with above average surface soil moisture during the flowering season, although the subsurface substrate is usually moist during at least the early reproductive stages.

Taxon:

Mimulus evanescens

Criteria Used For Assessment:

Considered extremely vulnerable throughout it's range (Meinke, 1995); will be recommended for addition to federal candidate and USFS and BLM sensitive species lists.

Associated Cover Type(s):

SRM: Western Juniper-Big Sagebrush-Bluebunch Wheatgrass (for extant populations; based on herbarium records, historic sites for the species are probably from a broader range of cover types, but the label information on these older collections is not sufficient to evaluate this).

Occurs in drying pools, along streambeds, adjacent to pond margins, in wet areas near boulders, etc. Associated herbs include species of ***Phacelia, Linanthus, Collomia, Collinsia, Allium, Microsteris, Plagiobothrys,*** and ***Trifolium.***

General Geographic Range Within CRB of Oregon/Washington/Nevada:

Scattered but very rare annual (based on herbarium work; Meinke, 1995) recorded across much of the southern CRB, extending from extreme northeastern California into southwestern Idaho.- Currently extant in the CRB only in Lake County, Oregon. There are a total of roughly ten historic sites known from several counties in central and southeastern Oregon and adjacent Idaho (Meinke, 1995).

Sensitivity to Disturbance:

This diminutive annual is speculated to have vanished from much of it's former range due to pressure from grazing on riparian habitats (Meinke, 1995).

Population Trends:

Unknown; the population in California has been extant for at least six years, while the one in Oregon was only just discovered. The latter consisted of thousands of plants, collectively producing potentially millions of seeds. However, it occurred along a large reservoir that has yearly fluctuations in water levels and is exposed to grazing and recreational activities -- it has not been re-visited by botanists since 1994.

Dispersal Mode and Requirements:

Based on habitat and herbarium label data, seed dispersal is probably often accomplished via water flow. Plants are entirely self-pollinating (Meinke, 1995) and do not require insect pollinators to effect pollen or gene flow.

Usefulness as Bioindicator:

The species is an indicator of moist soil conditions, although this would generally be evident from the habitat. Any large populations discovered would be of note, suggesting that grazing or other disturbances were not impacting the site too severely and that the local herbaceous flora was comparatively rich.

Taxon:

Mimulus hymenophyllus

Criteria Used For Assessment:

Sensitive species (USFS Region 6); federal candidate

Associated Cover Type(s):

SAF: Interior Douglas Fir; Interior Ponderosa Pine; Grand Fir. ***SRM:*** Idaho Fescue-Bluebunch Wheatgrass.

This unusual species occurs only on rock walls and steep, vertical, shaded cliffs above thickets dominated by species of ***Physocarpus, Amelanchier, Ribes,*** and ***Rosa,*** within steep draws along perennial cold water creeks; populations occur as part of a species-rich cliff community of ferns, bryophytes, and herbs, including species of ***Penstemon, Thelypodium, Saxifraga, Poiystichum, Adiantum, Marchantia, Bolandra, Selaginella, Heuchera, viola, Sedum, Arabis, Tonella,*** and ***Stellaria.***

General Geographic Range Within CRB of Oregon/Washington/Nevada:

Mimulus hymenophyllus is a narrow endemic restricted to the Horse and Cow Creek drainages in eastern Wallowa County, Oregon (Meinke, 1983; Meinke and Carlson, 1995). Unvouchered reports place the species across the Snake River in Idaho County, Idaho (within Hell's Canyon), and possibly on shaded cliffs along the lower Grande Ronde River of extreme southeastern Washington just west of the Snake River (Peter Zika, personal communication).

Sensitivity to Disturbance:

The species is a delicate, annual herb adapted to an obligate existence on vertical rock walls; removal of adjacent forest would open the overstory, with the increased sunlight and temperature representing possible threats to plant growth and to seed dispersal (*see* below). ***Mimulus hymenophyllus*** is dependent on trickling springs to replenish the seeps on the cliffs -- populations are likely to be very sensitive to changes in soil moisture.

Popuiation Trends:

Populations of ***Mimulus hymenophyllus*** are small and fluctuate yearly with available moisture. No demographic studies have been completed for this species, but the

populations did not appreciably change overall from 1982 until the last visit by the author in 1990. The remote locality for all known sites for the species make it extremely unlikely that any human-caused disturbance has resulted in any decrease in population numbers.

Dispersal Mode and Requirements:

Mimulus hymenophyllus is routinely visited by native bees, but is capable of self-pollination as a last resort, based on greenhouse work (Meinke, unpubl.). Pollen dispersal is probably very local judging by the small species of bees visiting flowers. Plants disperse seeds onto cliff surfaces in an unusual form of autochory, wherein fruiting pedicels become negatively phototropic after fertilization and turn towards dark crevices in the rock prior to capsule dehiscence (Meinke, 1983). While some seeds are lost to gravity, many manage to get "planted" on the cliffs in mid-summer, and germinate in the fall or following, spring.

Usefulness as Bioindicator:

This species is a strong indicator of seepage, and may represent part of a rare association of species now confined to cool, shaded refugia in side canyons off the Snake River -- there ***are*** no other northwestern ***Mimulus*** species comparable to this peculiar taxon. The diversity of plant species in these isolated canyons is especially rich, even for northeastern Oregon. Populations would be worth monitoring for changes, in the unexpected event of local logging (or perhaps a devastating fire) in the drainages to the immediate west of the Snake River.

Taxon:

Mimuius jepsonii

Criteria Used For Assessment:

Sensitive species (USFS Region 6)

Associated Cover Type(s):

SAF: Interior Douglas Fir; Lodgepole Pine; Interior Ponderosa Pine. ***SRM:*** Ponderosa Pine-Grassland (rare).

This annual species is almost entirely restricted to the more or less sterile understory of lodgepole pine forests, in the open or partially shaded, within moderately to poorly drained soils. It has few herbaceous associates, including ***Collinsia*** and ***Collomia.***

General Geographic Range Within CRB of Oregon/Washington/Nevada:

Mimulus jepsonii extends from Deschutes County, Oregon, south into northern California, along the east flank of the Cascade Mountains -- it continues well into northern California.

Sensitivity to Disturbance:

Populations tolerate disturbances such as trampling (as at recreation sites; Meinke, 1995a), low to moderately intensive road construction and subsequent vehicle use, logging activities, etc. Not unlike it's close relative ***Mimulus nanus***, ***this*** species occurs in large patches (of hundreds or even thousands of individuals in wet years), often in association with natural or human-caused disturbance, such as at Diamond Lake on the Umpqua National Forest. Unlike the other showy, pink or reddish-flowered annual monkeyflowers in the CRB (except perhaps ***M. clivicola),*** this species does not grow in xeric sites, but prefers soils that retain moisture into the summer (Meinke, 1992, 1993a). As with most ***annual*** monkeyflowers east of the Cascades, ***Mimulus jepsonii*** evidently buffers itself from environmental heterogeneity and substrate disturbance by maintaining a dormant seed bank. This assumption is based on the significant fluctuations observed in population size between years, which are apparently related more to winter precipitation than to the size of the prior year's seed crop.

Population Trends:

No monitoring projects have been implemented for this species that have yet yielded any meaningful demographic data, although plots were set up in 1994 at several locations (Meinke, 1995a). Repeated visits (from 1991 to 1995) to the largest known populations for the species in Oregon, near Diamond Lake and Davis Lake in the Cascades, indicate little change in average population size. However, this does not reflect any potential changes in the seed bank.

Dispersal Mode and Requirements:

Mimulus jepsonii disperses seeds primarily via wind and gravity. Like ***M. nanus*** and ***M. clivicola,*** this species has also been observed on or near ant mounds, raising the possibility of dispersal by foraging ants. What makes this group of monkeyflowers so attractive to ants is unknown, but the insects may actually be instrumental in localized gene flow in some areas. ***Mimulus jepsonii*** is genetically self-compatible and facultatively autogamous (Meinke, 1992, 1993a, 1995a), but seed set is enhanced if insects (small native bees) effect pollination. Pollen flow is also probably very local, judging by the foraging behavior and flight patterns of the floral visitors.

Usefulness as Bioindicator:

This species is one of the very few annual species of any genus that seems closely tied to the lodgepole pine forest types (at least in the CRB). It is also a species generally tolerant of moderate disturbance, and in fact is probably dependent on natural disturbance and the creation of forest gaps to facilitate population growth (Meinke, 1995a). As such, its disappearance from forest areas may signal undesirable changes in the forest understory

that may also negatively affect other organisms (e.g., fungi, invertebrates, etc.) that co-exist in this rather unusual habitat for an annual angiosperm.

Taxon:

Mimulus jungermannioides

Criteria Used For Assessment:

Sensitive species (USFS Region 6, BLM); federal candidate

Associated Cover Type(s):

SRM: Bluebunch Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass; Antelope Bitterbrush-Bluebunch Wheatgrass.

Mimulus jungermannioides is a functional perennial (with annual ramets) that inhabits vertical basalt cliffs overlooking river or streambank areas or washes, with ***Alnus, Amelanchier, Rosa, Ribes, Celtis, Dipsacus, Cirsium, Rhus,*** and/or ***Clematis*** species as common riparian associates. This ***Mimulus*** is part of an interesting "hanging garden" community of plants in vertical seepage zones, that include species of ***Penstemon, Thelypodium, Aquilegia, Poa,*** and at least two other monkeyflowers ***(M. floribundus*** and ***M. guttatus).*** Populations occur in shaded as well as open and sunny sites.

General Geographic Range Within CRB of **Oregon/Washington/Nevada:**

Virtually ***an*** Oregon endemic, ***Mimulus jungermannioides*** is known sporadically from widely scattered sites along the low elevation portions of major river drainages and immediate tributaries in the north-central part of the state (from the Deschutes River east to the Umatilla, including the eastern Columbia River Gorge). Possibly still extant in extreme southern Washington (Jimmy Kagan, personal communication), but probably extirpated there for the most part due to impounding of the Columbia River.

Sensitivity to Disturbance:

Mimulus jungermannioides is another cliff obligate heavily dependent on seepages to maintain populations, and any reduction of local water tables could severely impact the species. The plants, while technically perennial, have little opportunity to develop a seed bank, and evidence shows populations are potentially vulnerable to extinction after one or two failed reproductive years (Meinke, 1984, 1991) -- see discussion under ***"Dispersal Modes"*** below. Populations are also at risk due to road building or widening in some areas. Many of the sites for this species (through riverine canyons) coincide with convenient routes for roads, and are occasionally blasted to facilitate traffic.

Population Trends:

There are no demographic data available for this species. Long-term observations by the author, however, indicate little change in population sixes over the last decade with

chances for population expansion very slim. This is due to the limited cliff surface available for new plants at any given site and the improbability of successful long-distance dispersal to suitable, uncolonized rock walls, which are often hundreds of meters or even many kilometers away.

Dispersal Mode and Requirements:

The species produces copious amounts of easily germinated, non-dormant seed yet is dependant on vegetative reproduction to persist, through specialized adaption to it's vertical habitat (Meinke, 1984, 1991). Plants produce narrow stolons in late summer in response to declining photoperiods, the tips of which creep into fissures and crevices in the rock. When they contact moist soil in sufficient darkness, an imbricated turion (a bulb-like structure with overlapping leaf scales) is formed, which overwinters deep in the rock face after the parent plant dies. These starch-rich turions then bolt in the spring, in response to rising temperatures and seepage flow. Although plants flower and produce many fruits (often via insect pollination), nearly all plants produced in nature originate vegetatively (Meinke, 1984). This leads to considerable between-population variation and within-population sameness, due to the isolated nature of sites coupled with the lack of gene flow and recombination resulting from cloning (Messinger and Meinke, unpubl.). Long-distance dispersal may rarely be accomplished by seed or turions floating down rivers, and this may explain the one and only collection of the species (the type specimen, as luck would have it) from Washington, on sand in the Columbia River Gorge. Finally, by relying on vegetative propagules, *M. jungermannioides* avoids the dangers of depending on tiny, easily lost seeds to annually replenish populations. However, the species has little if any opportunity to persist beyond one or two failed reproductive years if seeps dry up, since populations seem largely incapable of maintaining a perennially dormant bank of seeds or buds.

Usefulness as Bioindicator:

Since this species is dependent on perennial seeps in an otherwise very arid ecosystem, disappearance of populations would certainly be an indication of at least local depletion of ground water. The species may represent a remnant of a pre-Hypsithermal plant community, adapted to a much wetter overall climate, that retreated to dripping cliffs as the CRB became more arid during the post-Pleistocene. The potential for rare or relict invertebrate species to be associated *with* these *Mimulus-dominated* seeps is unknown, and may be worthy of investigation.

Taxon:

Mimulus latidens

Criteria Used For Assessment:

Sensitive species (BLM)

Associated Cover Type(s) [in the CRB]:

SRM: Big Sagebrush.

The species is known from a single localized occurrence in a vernally moist site with other spring annuals, including species of ***Collinsia, Descurainia, Collomia, Phacelia, Draba, Idahoa,*** and ***Navarretia.***

General Geographic Range Within CRB of **Oregon/Washington/Nevada:**

The species is known in the CRB only from a single population in Lake County, Oregon (Shelly, 1986). It is otherwise common at lower elevations from California south, occurring in the Central Valley to extreme northern Mexico. The peripheral site in Oregon is noteworthy due to it's far northern range and sagebrush habitat, as well as the fact it occurs at a much higher elevation than any other known populations.

Sensitivity to Disturbance:

Unknown; however, cattle seem to have been grazing at the site for many years, and there is no reason to believe the species was not coexisting with grazing at the site before it's relatively recent discovery.

Population Trends:

Unknown; the population persisted for several years into the early 1990's, but it's current status has not been recently reported.

Dispersal Mode and Requirements:

This is a self-pollinating species that retains seed inside inflating fruiting calyces that envelop the dehisced capsule. Seeds are slowly released as the dried plants shake in the breeze, and are presumably carried locally by flowing water or blown about by the wind. It is suspected that migratory waterfowl may have originally carried the seed to Oregon from a more southerly population (the Lake County area is along a major flyway), although it is remarkable to think that a spring annual species from lower elevation California could have come pre-adapted to the harsh Great Basin climate of southeastern Oregon.

Usefulness as Bioindicator:

This species has too local a distribution in the CRB to indicate much.

Taxon:

Mimulus patulus

Criteria Used For Assessment:

Sensitive species (USFS Region 6); federal candidate

Associated Coyer Type(s):

SRM: Bluebunch Wheatgrass; Ponderosa Pine-Shrubland; Ponderosa Pine Grassland; Idaho Fescue-Bluebunch Wheatgrass.

Mimulus patulus occurs in the mosaic of bunchgrass and/or sparse conifer stands along the northeast slope of the Wallowa Mountains uplands, just west of Hell's Canyon. It is located in or near moist, occasionally shrubby microsites of basalt substrate with ***various*** species of ***Astragalus, Lomatium, Allium,*** and ***Delphinium,*** often with a significant weedy. component dominated by annual bromes and fescues:

General Geographic Range Within CRB of Oregon/Washington/Nevada:

The species is now believed to be restricted to eastern Wallowa County, Oregon, although historic collections have been confirmed from extreme southeast Washington and adjacent Idaho. It is possible the species still exists in underbotanized areas of those states, although many of the historic sites are now underwater due to various Snake River impoundments.

Sensitivity to Disturbance:

Mimulus patulus is another of the basalt endemic annual monkeyflowers having an association with vernal seeps. Not restricted to cliffs ***per se,*** it typically occurs at the base of outcrops or on shallow soils overlying basalt bedrock or shelves along slopes. These sites typically do not have enough flow to attract cattle as water sources, but the associated greener and more lush vegetation often make for a natural congregating area for livestock. Moreover, the sites are often not so rocky that introduced weeds are excluded (as they often are on the harsher habitats of monkeyflowers ***like Mimulus washingtonensis***, or the obligate cliff species). Recent inventory (Meinke and Carlson, 1995a) has resulted in the discovery of more populations in the last two years on the Wallowa-Whitman National Forest (Hells Canyon NRA), but all are small and potentially vulnerable to grazing or spring development.

Population Trends:

There are no demographic data for this species. Until 1993, only two tiny populations were known to be extant.

Dispersal Mode and Requirements:

Mimulus patulus is a highly self-fertile, autogamous annual that cannot outcross due to within-bud pollination (Meinke, 1991). Seeds of the species are apparently distributed locally by wind, and only rarely by flowing water (at least in observed populations).

Usefulness as Bioindicator:

As a rare indigenous annual of natural seeps and springs in an otherwise bunchgrass dominated cover type, presence or absence of this species may be indicative of

deterioration of moist sites subject to grazing pressure and invasion by various exotic weeds.

Taxon:

Mimulus pulsiferae

Criteria Used For Assessment:

Sensitive species -- peripheral in Washington (WNHP, 1994)

Associated Cover Type(s) [in the CRB]:

SAF: Interior Douglas Fir; Lodgepole Pine; Interior Ponderosa Pine; Oregon White Oak. *SRM:* Antelope Bitterbrush-Bluebunch Wheatgrass; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Ponderosa Pine Grassland.

A species of vernal pools or other similarly moist areas within dry forests at middle elevations (in the CRB), usually with an array of other annuals including ***Trichostema, Linum, Juncus, Psilostrophe, Collinsia,*** and ***Navarretia;*** occurring in well-drained volcanic soils.

General Geographic Range Within CRB of Oregon/Washington/Nevada:

The species extends intermittently from southern Washington south to Douglas County, Oregon, mostly along the eastern foothills of the Cascade Mountains. Crossing the Cascades around Douglas County, the species extends south into the northern Sierra Nevada of California on the west side of the Cascade-Sierran axis.

Sensitivity to Disturbance:

Populations of ***Mimulus pulsiferae will*** tolerate moderate disturbance, and have been observed in Oregon growing along logging roads, on moist roadbanks, in partial cuts (sheltered under standing trees), and at the edge of graveled parking lots. The species requires vernal moisture, however, and populations have disappeared after slash bums and sheep grazing on the Deschutes National Forest (Meinke, unpubl.). Aside from such major impacts directly on populations, the species does not appear especially vulnerable and has a broad ecological amplitude as long as soil moisture is not limiting.

Population Trends:

No formal demographic studies have been completed for this annual species, which has dormant seeds that probably result in some level of seed storage in the soil. However, informal monitoring of several sites in Oregon have shown the species to remain essentially constant over the last decade and to fluctuate remarkably little over the years. This may be due to the more consistent precipitation (relative to most of the CRB) that laps over from the nearby high Cascades. In general, patches of ***M. pulsiferae are*** less dense than any of the other rare annuals described in this report.

Dispersal Mode and Requirements:

Seeds are readily shed from cylindrical fruiting calyces and are dormant at maturity. They are probably locally dispersed by spring runoff or occasionally small brooks, although the species does not typically frequent the edges of running or open water while in flower and fruit. Although highly autogamous, ***M. pulsiferae*** will outcross if visited shortly after corolla expansion, either by native solitary bees or more commonly small, hovering beeflies. Pollen dispersal by these vectors is undoubtedly very local.

Usefulness as Bioindicator:

The habitat for ***Mimulus pulsiferae*** is too general, and populations are too sparse and scattered, for this species to indicate much more than better than average soil moisture.

Taxon:

Mimulus pygmaeus

Criteria Used For Assessment:

Sensitive Species (USFS Region 6; BLM); federal candidate

Associated Cover Type(s) [in the CRB]:

SAF: Interior Douglas-Fir; Interior Ponderosa Pine. *SRM:* Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Ponderosa Pine Shrubland; Ponderosa Pine-Grassland.

Mimulus pygmaeus typically occurs in moderately to poorly-drained ecotonal areas in silver sage and low sage communities, or in associated scab or rocky meadows. It is typically associated with species requiring considerable spring moisture, including various members of ***Ranunculus, Juncus, Lomatium, Navarretia, Collinsia, Plagiobothrys, Hesperochiron,*** and ***Polygonum.***

General Geographic Range Within CRB of Oregon/Washington/Nevada:

Recent studies (Meinke et al., 1994) indicate this tiny annual species is actually widespread and locally very common (evident in wet years like 1993) in south-central Oregon, from Lake County west to Jackson County. Populations of ***Mimulus pygmaeus*** extend well south into the transmontane Sierra Nevada of northeastern California.

Sensitivity to Disturbance:

Mimulus pygmaeus appears indifferent to moderate grazing, possibly because the low sage-silver sage associations are not as vulnerable to disturbance as many deeper soiled range sites. Although the species was thought extremely rare prior to 1993, surveys that year uncovered numerous large populations that sprouted from a large reservoir of presumably dormant seeds in the soil, some with millions of individuals (Meinke et al., 1994). These sites were virtually all in grazed areas, but there were few

other disturbances evident. In general, the sites were in good condition (i.e., with comparatively few exotics), so this cannot be considered evidence that the species resists all perturbations. Major soil movements (such as pipeline construction or a series of roads) is likely to be detrimental. Livestock probably ignore the species as forage, due to its extremely small size.

Population Trends:

Contrasting 1993 with the previous decade or so, it might be tempting to state that trends for the species are headed up. In all probability, however,. the seeds were there all along, and the successive years of drought simply kept surveyors from appreciating the true extent of the local populations (above and below ground).

Dispersal Mode and Requirements:

Very localized seed dispersal is the rule for this species. Capsules remain attached to the parent plants, and dehisce only after soaked in water for several days -- as a result, the species cannot reproduce well without pooled water or heavy precipitation (such as from a heavy downpour or dripping snowbank). Seeds are quite dormant at maturity, but germinate after prolonged soaking in near freezing water (Meinke, unpubl.). Since the plants are so small, entire individuals probably act as dispersal units, floating down creeks or temporary runoff gushers. Although more or less chasmogamous, flowers are believed to be entirely self-pollinated (in the bud), based on the position and maturation rates of floral organs.

Usefulness as Bioindicator:

Mimulus pygmaeus is representative of the spring herbaceous flora associated with low sage and silver sage habitats along the southwestern edge of the CRB. It's presence in abundance is indicative of a reasonably healthy community of native forbs, and of a substrate capable of storing a significant seed bank. The species is also an indicator of poor to moderate soil drainage, particularly when associated with silver sage.

Taxon:

Mimulus suksdorfii

Criteria Used For Assessment:

Sensitive species -- peripheral in Washington (WNHP, 1994)

Associated Cover Type(s) [in the CRB]:

CUB: Subalpine Herbaceous. *SAF:* Engelmann Spruce-Subalpine Fir; Whitebark Pine; Interior Douglas-Fir; Interior Ponderosa Pine. *SRM:* Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Mountain Big Sagebrush; Wyoming Big Sagebrush.

The species occurs in dry or occasionally moist herbaceous communities within sagebrush-steppe or dry forest, or occasionally to subalpine slopes. It has a very broad distribution and is actually rather common over much of it's range outside of Washington. It commonly co-occurs with species of ***Ipomopsis, Collomia, Calochortus, Penstemon, Kelloggia, Castilleja, Lithophragma,*** and ***Festuca.***

General Geographic Range Within **CRB** of Oregon/Washington/Nevada:

From Yakima County, Washington south and east through much of the CRB into California, Nevada, Arizona, and Wyoming.

Sensitivity to Disturbance:

There arc no existing biological or ecological studies for ***Mimulus suksdorfii***. Based on casual field observation, the species is commonly found in semi-disturbed or natural open sites in the shrub-steppe, sometimes in dry, sandy pockets. Since it is an annual species of cold winter climates, it probably has dormant seeds and develops a seed bank (based on information known for similar species), but this is uncorroborated It is expected the species would fare poorly only after major habitat altering disturbances that removed or heavily churned the topsoil, and that it may benefit from wildfires that open the shrub cover.

Population Trends:

There are no demographic studies available for this miniature monkeyflower. Herbarium records, however, show this to be a commonly collected species outside of Washington, despite the fact it is so inconspicuous. This suggests that populations are not declining, but there are no data to back this up.

Dispersal Mode and Requirements:

Mimulus suksdorfii almost certainly disseminates seeds via wind and gravity -- the species is rarely found near open water, so this can be discounted as a routine mode of dispersal. The plants are presumably self-pollinated due to the tiny corolla size. However, the petals are reflexed rather than partially closed (as in many of the small, autogamous annuals in the genus, such as ***M. patulus*** and ***M. breviflorus***), and limited outcrossing might be possible. Any pollen dispersal by this means would almost certainly be extremely local since the pollinators would have to be tiny bees or flies.

Usefulness as Bioindicator:

Distribution and habitats for this species are too broad for it to be of any practical use as a bioindicator.

Taxon:

Mimulus tricolor

Criteria Used For Assessment:

Sensitive species (USFS Region 6); considered peripheral in Oregon (ONHP, 1993)

Associated Cover Type(s) [in the CRB]:

SAF: Interior Douglas-Fir; Interior Ponderosa Pine. ***SRM:*** Western Jumper-Big. Sagebrush-Bluebunch Wheatgrass; Ponderosa Pine Grassland.

Populations occur in wet depressions along rivers, watering holes, or vernal pools in sagebrush or open forest cover types, with various graminoids and annual herbs. These include species of ***Downingia, Psilostrophe, Poa, Plagiobothrys, Juncus,*** and ***Navarretia.***

General Geographic Range Within CRB of Oregon/Washington/Nevada:

The species is restricted to northwestern Lake and eastern Klamath counties, Oregon in the CRB, but extends west to the Willamette Valley and south well into cismontane California.

Sensitivity to Disturbance:

Mimulus tricolor develops extensive seed banks, evidenced by mass occurrences of the species in 1993, at Lake County sites that had produced only a handful of plants over the previous several years (Meinke et al., 1994). While livestock had heavily utilized the area prior to this major bloom, the population seemed largely unaffected. However, timing of cattle grazing is probably crucial, and ideally should occur only after fruits have been set, to facilitate replenishment of the seed pool. The species is very dependent on a pooled water source (in the spring at least), and any actions which destroy or alter this type of habitat (i.e., construction, spring enhancement or other drainage actions, excessive trampling, etc.) are likely to locally eradicate the species.

Population Trends:

There are no current demographic. studies for this species, yet field observation over at least the last seven years have shown CRB populations to remain consistently at the known localities. However, as mentioned earlier, these populations can fluctuate dramatically in size and area covered, indicating that the seed bank can stay viable for at least several years. As with ***M. pygmaeus,*** this species is probably in much better shape at the localities it occupies than was previously thought. However, unlike M. ***pygmaeus, M. tricolor*** is predominantly a westside species occurring at the periphery of it's range, and is accordingly a much rarer and potentially more vulnerable speciesin the CRB.

Dispersal Mode and Requirements:

The capsules of ***Mimulus tricolor are*** bone-hard and mostly indehiscent at maturity, opening only upon lengthy exposure to water (Meinke et al., 1994). The species cannot reproduce without pooled water for the capsules to soak in. Seeds are dispersed by water, but the dispersal distance may not be great unless precipitation is ample enough to flood vernal pools or depressions. Seeds commonly remain in the opened capsule and

germinate more or less simultaneously, with the result being clumps of seedlings growing together and competing for resources. Pollination apparently results in considerable outcrossing, based on floral morphology, and flowers are visited by a range of semi-social and solitary native bees, occasional bumblebees, and a few beeflies. Pollen dispersal is presumably fairly local due to the isolated nature of patches and the foraging habits of the dominant pollinators species.

Usefulness as Bioindicator:

In the few areas where this species grows in the CRB, it could be used as an indicator of an interesting and scarce vernal pool community. While cattle do not seem to seriously affect populations, this observation can only be considered conjectury at this point in the absence of long-term monitoring. Ideally, sites where the species occurs or is discovered could be set aside as rare examples of vernal pool communities east of the Cascades Mountains. There is very little information on the dynamics of North American vernal pools outside of California.

Taxon:

Mimulus washingtonensis (= M. washingtonensis subsp. ***washingtonensis)***

Criteria Used For Assessment:

Sensitive species (USFS Region 6; BLM); federal candidate

Associated Cover Type(s):

SAF: Interior Douglas-Fir; Interior Ponderosa Pine. ***SRM:*** Bluebunch Wheatgrass; Antelope Bitterbrush-Bluebunch Wheatgrass; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Ponderosa Pine Grassland; Idaho Fescue-Bluebunch Wheatgrass.

Populations of this species occur on moist basalt scab or thin-soiled basalt gravels overlying bedrock, within a range of dry forest and range cover types that intermix in the John Day River country of east-central Oregon. Associated species are few on the basalt substrate, and include occasional individuals of ***Asclepias, Streptanthus, Astragalus,*** and ***Allium*** species, as well as introduced ***grasses*** such as ***Bromus tectorum.*** Populations of ***Mimulus washingtonensis*** are often found associating with species of the nitrogen-fixing cyanobacterium (blue-green alga) genus ***Nostoc.***

General Geographic Range Within CRB of Oregon/Washington/Nevada:

The species is now considered endemic to the John Day River drainage of east-central Oregon, in interior Grant, Wheeler, Morrow, and Umatilla Counties. Historic collections from along the Columbia (in Oregon and Washington) are believed to have been waifs washed down river as seeds (Meinke, 1991). These sites are now underwater due to Columbia River dams. The specific epithet notwithstanding, there are no verified

collections of the species from the state of Washington, outside of those few from along the shores of the Columbia recorded by Suksdorf (at Bingen) around the turn of the century.

Sensitivity to Disturbance:

Any activity that disrupts the potential for spring runoff or seeps to vernally moisten sites will impact the species. Field observations in 1993, as with ***M. pygmaeus***, revealed a tremendous apparent seed bank for ***M. washingtonensis***. Numerous large populations were located across the range of the species, which had formerly been considered quite rare and vulnerable. Livestock use is common in the area, but the habitat for the species is generally too harsh and lacking in forage to attract many cattle. Greenhouse studies show the species to be a poor self-pollinator (Meinke, 1993), and disturbance of native ground-nesting bees (the principal floral visitors) may reduce seed set. Research has also shown that ***M. washingtonensis*** may compete for pollinators (and rather poorly at that) with the often weedy native monkeyflower ***M. guttatus*** where the two species closely overlap (Meinke, 1995b). ***Mimulus guttatus*** may increase with disturbance.

Population Trends:

No demographic data have been specifically recorded for ***Mimulus washingtonensis***. However, general BLM and USFS surveys since 1992 (and casual observations by the author since 1982) indicate that the species is locally common and widespread regionally. Populations clearly are represented by many dormant seeds below ground; however, quantitative data on seed pools for this and other ephemeral ***Mimulus*** in the CRB are lacking.

Dispersal Mode and Requirements:

Seeds are locally dispersed by wind and temporary winter and spring runoff along basalt channels, and then occasionally into streams and rivers (as suggested by the historic collections along the Columbia River). Pollinators are mostly small, semi-social and solitary bees (Meinke, 1995b), and pollen dispersal is probably less than ten meters in most cases.

Usefulness as Bioindicator:

Populations of ***Mimulus washingtonensis*** are strong indicators of sterile sites with vernal moisture or temporary spring runoff. The presence of an extensive population suggests that disturbances have been minimal over the years at the site, permitting the build-up of a thin soil layer and a significant ***seed*** bank. ***Mimulus washingtonensis*** commonly co-exists with a pair of sensitive milkvetchs, i.e., two local varieties of the basalt endemic ***Astragalus diaphanus*** (the ***var. diurnus*** being listed as threatened under Oregon state law).

3. Preferred Successional Stages or Vegetation Structural Classes for Mimulus

Table 2. Estimated Range of Successional Stages or Vegetation Structural Classes for Groups and Individual Species of ***Mimulus*** evaluated in Section 2. (Note: ***Codes for range and forest structural stages, from USFS-supplied forms, are given parenthetically).***

Taxonomic Groups	*Stage or Class Description*
Mimulus guttatus/M. nasutus (all forest and range structural stages except OFM and OFS)	Occurring in a broad range of structural classes, from open shallow-soiled herb-dominated layers to closed canopy forests; ecotypes in this complex occupy a wide range of primary to secondary successional niches, from cracks in cliffs and freshly scoured bedrock, to openings in mature forests and along established rivers
Mimulus lewisii/M. tilingii (SI;SEO;OH;CH;OLMS)	Found within the initial meadow-herb layer, with seedlings often establishing in primary or early secondary successional sites along rushing streams, on wet talus/gravel, or near high elevation lake margins
Mimulus moschatus/M. floribundus (SI;SEO;OH;OLMS;OTS)	These are typically primary to early successional species, establishing in microsites such as drying river beds or rocky outcrops; occasionally within or under herb dominated, shrubby, or dry forest microsites
Mimulus nanus/cusickii (SI;SEO;UR;YF;OH;OLMS;OTSj	Limited to mainly early primary successional niches, typically on bare or nearly bare volcanic substrates (especially basalt cobbles and pumice); in bare soil, under herb/shrub dominated or open-canopied forest layers

Mimuius primuloides/M. breviflorus/M. breweri (SEO;OFM;OH;CH;OLMS;OTS)	***M. primuloides*** is a colonizer of bogs and wet, disturbed streambanks, ranging from an open meadow herb layer to margins of closed canopy forest; the two annual species are generally limited to herb/shrub-dominated meadow layers, tending to be present in early primary or secondary successional stages, seldom under canopies
Candidate or Sensitive Taxa Individually Assessed:	***status:***
Mimuius ampiiatus* (= *M. washingtonensis* subsp. *ampiiatus) (OH; OLMS)	Primary or early secondary successional niches (based on evidence from only a few label collections and extant sites); on thin-soiled basalt substrates within a herb/shrub-dominated vegetative layer
Mimuius clivicola (SI;UR;YF;OF;OH;OTS)	Primary or more often early secondary successional species; typically associated with forest herb or shrub-steppe layers near or under open forest canopies, but also recorded from forest gap areas, roadsides, banks, and relatively open talus slopes
Mimuius evanescens (OH;OLMS)	Early secondary successional species, preferring wet areas with established organic soil base in an herb-dominated stratum, within a shrub-steppe layer (based on two extant sites and limited herbarium data)
Mimuius hymenophyiius (YF;OFM;OTS)	Primary successional species; a basalt cliff obligate growing in crevices with scant organic soil; in herb layer on the cliffs, under an associated open forest canopy

Mimuius jepsonii (SI;SEO;UR;YF;OFM)	Late primary or secondary successsional species, occurring in well-developed forest soil with little associate herb layer; open to nearly closed lodgepole (rarely mixed with ponderosa pine) canopy
Mimuius jungermannioides (OLMS;OTS)	Primary successional species; ***Mimuius jungermannioides*** is a basalt cliff obligate growing in crevices, usually with scant organic buildup outside the cliff cracks; occurs exclusively within the herb stratum on the rock walls, often with an associate shrub-steppe and/or low riparian layer nearby
Mimuius latidens (OH;OLMS)	Known from a single locality in the southern CRB; apparently only in the low herb layer within the sagebrush shrub-steppe
Mimuius patulus (OH;OLMS;OTS)	Typically a species of late primary or early secondary successional microsites, only known from thin-soiled basalt substrates; commonly within a well-developed herb layer (frequently including many exotics), sometimes located within dense shrub-steppe or bushy riparian/spring vegetation at cliff bases
Mimuius pulsiferae (SI;SEO;UR;YF;OFM;OH)	Late primary or secondary successional annual species, occurring in well-developed forest soils with a considerable associated herb layer (usually vernal pool species); sites usually within an open (to nearly closed) ponderosa pine or mixed coniferous canopy (in CRB)

Mimuius pygmaeus (OH; OLMS)	Early to mid secondary successional species, requiring wet areas with well-established organic soil base in an annual and perennial herb-dominated layer within a shrub-steppe matrix; rarely occurring under open forest canopies of mixed conifers (in CRB), frequently occurring along narrow shrub-meadow ecotones
Mimuius suksdorfii (SI;SEO;UR;YF;OH;OLMS;OTS)	Late primary or secondary successional species, usually occurring in well-developed range or forest mineral soils (sometimes in loose, sandy pockets in sagebrush zones of Washington), with associated annual and perennial herb layer in open to nearly closed shrub-steppe layer, or open dry forest
Mimuius tricolor (OH;OLMS;OTS)	Early to mid secondary successional species, preferring moist to wet areas with an established organic soil base in an annual herb-dominated stratum; drying pool areas within a shrub-steppe or open forest matrix (based on the few general areas of occurrence of the species within the CRB)
Mimuius washingtonensis (OH)	A species of late primary or early secondary successional microsites, virtually always occurring in thin-soiled basalt substrates or on exposed bedrock (a recently discovered site in Crook County, Oregon an exception; Ron Halvorson, personal communication); usually with poorly developed herb layer within the shrub-steppe or open coniferous-grassland/shrub layer

4. Species Occurrences by Successional Stages or Vegetation Cover Types

Herbarium collections, site reports, and many status surveys generally do not give enough information to accurately reflect particular species occurrences within specific *cover types.* Intelligent guesses could be made in some eases, based on provided community information or lists of associate species. However, the many 'inevitable errors or misinterpretations would compromise the validity of the EEMP model. If this information is considered important,' field work to ground-truth selected localities with respect to Bailey's Ecoregion Map or the SAF/SRM cover types would be required.

5-6. Key Environmental Correlates and Functions of ***Mimulus*** (Grouped **Taxa)**
(Information provided in U.S. Forest Service specified format)

Species or Species Group: ***Mimulus guttatus/M. nasutus*** complex
Province and/or Section: All' Life Form(s): **4/5**
Key Environmental Correlates:

1. Standing water or wet soil during growing season
   Suitable Categories (Categorical):
   1. Impoundments, ditches, or other man-made waterways
   2. Steams, lakes, rivers, and other natural bodies of water
   3. Wetlands
   4. Springs and seepage zones
   Applies Seasonally? No
2. Open canopies
   Suitable Categories (Categorical):
   1. Rangeland sites
   2. Forest sites
   3. Agricultural sites
   Applies Seasonally? No
3. Flowing water for seed dispersal
   Suitable Categories (Categorical):
   1. Streams, creeks, rivers
   2. Runoff and flood channels
   3. Flooding pools
   4. Cliff seepage
   Applies Seasonally? Yes
   Which Seasons? Spring and summer
4. Pollinators to promote seed set and gene flow in large flowered ecotypes
   Suitable Categories (Categorical):

1. Native bees
2. Horseflies
3. Hummingbirds (rarely on large-flowered forms)
4. Sphinx moths

Applies Seasonally? Yes
Which Seasons? Spring and summer

Key Ecological Functions (***Mimulus guttatus/M. nasutus*** complex):
1. Food and nutrition for pollinating and phytophagous insects
2. Primary producers in *many* wetlands
3. Local bank stabilization (perennial forms only)

Threats (***Indicate*** *High,* ***Medium,*** *or* ***Low*****):**

Change in **Fire** Regimes - Low
Grazing - Low
Mining - Low
Exotics - **Low**
Development - **Low**
Timber Harvest - Low
Roads (explain) - Low

Key Assumptions:
Habitat and ecological functions/correlates may differ outside the **CRB**.
Dispersal:

Pollinators - Bees; flies; sphinx moths; rarely hummingbirds
Dispersal Mode - Wind and water
Requirements for Dispersal - Best dispersal accomplished by flowing water

Trend: Stable to increasing in many areas
Key Unknowns and Monitoring or Research Needs:--
Taxonomic and genetic studies of this complex outside the **CRB** have shown it to be rich in genetic diversity and a wide **array** of ecotypes. Evaluation of this in our area would be **in** the interest of overall investigation and conservation of biodiversity on public lands, but admittedly impractical.
Degree of Confidence in Knowledge of Species: High

Species or Species Group: ***Mimulus lewisii/M.*** *tilingii*
Province **and/or** Section: All **Life** Form: 4
Key Environmental Correlates:

1. Saturated soil or open water

Suitable Categories (Categorical):
1. Marshes or **wetlands**
2. Springs or seeps
3. Lake margins

4. streams
Applies Seasonally? Yes
Which **Seasons?** Spring and summer

2. Running water for seed dispersal
Suitable Categories (Categorical):
1. streams
2. **Snowmelt** runoff channels
3. Lakes.
4. Montane ditches
Applies Seasonally? Yes
Which Seasons? Summer and **fall**

3. Moderately well-drained substrate
Suitable Categories (Categorical):
1. Granite-based
2. Basalt- or pumice-based
3. Mixture of silt and cobbles
4. Sandy
Applies Seasonally? No

4. Effective pollinators
Suitable Categories (Categorical):
1. Native bees
2. Hummingbirds **(*M. Zewisii only)***
3. Occasional flies
Applies Seasonally? Yes
Which Seasons? Summer

Key Ecological Functions **(*Mimulus lewisii/M. tilingii*):**

1. Bank stabilization of higher elevation streams and runoff channels
2. **Primary** producers in many montane and subalpine meadows/wetlands
3. Food and nutrition for pollinating and phytophagous insects

Threats *(Indicate High, Medium, or **Low**)*:

Change in **Fire** Regimes - Low
Grazing - Low
Mining - Low
Exotics - Low
Development - **Low**
Timber Harvest - Low
Roads (explain) - Low

Key Assumptions:

Habitat and ecological functions/correlates for this species group may differ in areas outside the CRB.

Dispersal:

Pollinators - Native bees; flies; occasionally hummingbirds (*M. lewisii*)

Dispersal Mode - Wind and water

Requirements for Dispersal - Flowing water ideal for seed dispersal

Trend: Stable or increasing in many areas

Key Unknowns and Monitoring or Research Needs:

Relatively little is know about the functions of montane wetlands and their component species. Various *Carex* and other dominant wetland taxa, like *M. lewisii*, would benefit from additional study of their roles in wetlands and potential interactions within their habitats.

Degree of Confidence in Knowledge of Species: High

Species or Species Group: *Mimulus moschatus/M. floribundus*

Province and/or Section: All Life Form(s): 4,5

Key Environmental Correlates:

1. Well-drained substrates
   - Suitable Categories (Categorical):
     1. Sand/sandy loam
     2. Fissured bedrock or cliffs
     3. Gravelly dry stream or river bottoms
     4. Basalt cobbles
   - Applies Seasonally? No
2. Sunny, exposed sites
   - Suitable Categories (Categorical):
     1. Forest canopy gaps
     2. Dry riverbeds and sandy riverbanks\bluffs
     3. South and east-slope hillsides\cliffs
     4. Sand dunes
   - Applies Seasonally? No
3. Effective pollinators (for huger-flowered races)
   - Suitable Categories (Categorical):
     1. Native be-es
     2. Native beeflies
   - Applies Seasonally? Yes
   - Which Seasons? Spring and summer
4. Flowing water at some time of the year to facilitate seed dispersal
   - Suitable Categories (Categorical):
     1. Perennial streams/creeks/rivers
     2. Seasonal streams/creeks
     3. Late spring runoff from snowmelt/rainshowers

4. Flood channels
Applies Seasonally? Yes
Which Seasons? Spring **and** summer

Key Ecological Functions *(Mimulus* ***moschatus/M. floribundus*****):**

1. Provides nectar and pollen for foraging insects
2. Provide thousands of seed per plant, possibly gathered by invertebrate seed predators
3. Limited bank and channel stabilization *(M.* ***moschatus)***

Threats (Indicate *High,* ***Medium,*** *or Low):*

Change in Fire Regimes - Low
Grazing - Low
Exotics - **Low**
Development - Low
Timber Harvest - Low
Roads (explain) - Low

Key Assumptions:

Habitat and ecological functions may differ outside the CRB.

Dispersal:

Pollinators - **Bees,** beeflies; often autogamous
Dispersal Mode - Water, wind
Requirements for Dispersal - Flowing water facilitates seed **dispersal**

Trend: Stable to increasing in many areas

Key Unknowns and Monitoring or Research Needs:

Potential for **taxonomic/genetic** variation between **eastside** and **westside** races of these **taxa** may be worth pursuing.

Degree of Confidence in Knowledge of Species: High

Species or Species Group: ***Mimulus nanus/M. cusickii***
Province and/or Section: All Life Form: 5

Key Environmental Correlates:

1. Well-drained; volcanic substrates
   Suitable Categories (Categorical):
   1. Basalt cobbles
   2. Pumice fields
   3. Roadside gravels
   4. Ash or **tuff (some ash/clay ecotypes** in southeastern Oregon)
   Applies Seasonally? No
2. **Xeric** general habitat with sunny exposures
   Suitable Categories (Categorical):
   1. Sagebrush cover types

2. Coniferous forests
3. Bunchgrass steppe
4. Alpine/subalpine barrens

Applies Seasonally? No

3. Summer precipitation to facilitate fruit set

Suitable Categories (Categorical):

1. Thunderstorms
2. Runoff

Applies Seasonally? Yes

Which Seasons? Summer

4. Effective pollinators

Suitable Categories (Categorical):

1. Native solitary and semi-social bees
2. Occasional beeflies

Applies Seasonally? Yes

Which Seasons? Spring and summer

Key Ecological Functions (**Mimulus nanus/M.** cusickii):

1. Major source of food reserves for many species of summer-foraging small, native **bees**
2. Possible major food source for seed foragers, including ants and other invertebrates

Threats *(Indicate High, Medium, or Low):*

Change in fire Regimes - Medium
Grazing - Low
Mining - Low
Exotics - Low
Development - Low
Timber Harvest - Low
. Roads (explain) - Low

Key Assumptions:

Habitat and ecological functions/correlates may differ outside the CRB.

Dispersal:

Pollinators - An array of small, ground-nesting solitary and semi-social bees
Dispersal Mode - Seeds are dispersed by wind, gravity, and ants
Requirements for Dispersal - Open habitat; proximity to ant colonies

Trend: Apparently stable to increasing in **many** areas

Key Unknowns and Monitoring or Research Needs:

It would be interesting to know if ants actually piay a significant role in the dispersal of these species. It would **also be** interesting to know how the plants (especially *M. cusickii)* manage to grow in such nutrient-poor, volcanic sites (**areas** known for extremely low nitrogen levels). **Monkeyflowers** have never been reported as nitrogen fixers, **but** there has been no research on this topic.

Degree of Confidence in Knowledge of Species: High

Species or Species Group: ***Mimulus primuloides/M. breviflorus/M.*** *brewer-i*
Province and/or Section: All Life Form(s): **4/5**
Key Environmental Correlates:

1. Substrate able to retain soil moisture
   Suitable Categories (Categorical):
   1. Bogs (M. ***primuloides*)/streambanks/seeps/moist** meadows
   2. Damp to **dry** meadows
   3. Edges of vernal depressions
   '4. Along runoff channels or ditches along mountain roads (annuals)
   Applies Seasonally? No
2. Exposed in the open or under broken canopy; usually bright, sunny microsites
   Suitable Categories (Categorical):
   1. Forest gaps
   2. Herb/graminoiddominated meadows
   3. Gravelly, herb-dominated slopes
   4. Gopher mounds
   Applies Seasonally? No
3. Summer water source
   Suitable Categories (Categorical):
   1. Thunderstorms
   2. Springs/bogs *(M. **primuloides***)
   3. Substrate depressions with pooled precipitation
   Applies Seasonally? **Yes**
   Which Seasons? Summer
4. Acidic substrates (especially *M. primuloides)*
   Suitable Categories (Categorical):
   1. Bogs
   2. Granite/granodiorite
   Applies Seasonally? No

Key Ecological Functions **(*Mimulus primuloides/M. breviflorus/M. breweri*):**

1. Providers of pollen and nectar for native bee fauna
2. Primary producer in **bog/wetland (*M. primuloides)***
3. Providers of seed for invertebrate foragers (annuals)

Threats (In&ate *High, Medium, or **Low)*:**

Change in Fire Regimes - Low
Grazing - **Low**
Mining - Low

Exotics - Low
Development - Low
Timber Harvest - Low
Roads (explain) - Low

Key Assumptions:
Habitat and ecological functions and correlates may differ outside of the CRB.
Dispersal:
Pollinators - Annual species are autogamous; *M. primuloides* - native bees and flies
Dispersal Mode - Wind; gravity; flowing water (for *M. primuloides*)
Requirements for Dispersal - See above
Trend: Stable to increasing in many areas
Key Unknowns and Monitoring or Research Needs:
Mimulus primuloides is a clonal species, reproducing at least in part by vegetative propagules (Douglas, 1981) which promotes rapid genetic diversification between populations. It would be interesting to study the genetic variation inherent in the species in the CRB.
Degree of Confidence in Knowledge of Species: High

5-6. Key Environmental Correlates and Functions of *Mimulus* (Individual Taxa)

species: *Mimulus ampliatus*
Province and/or Section: Idaho Life Form: 5
Key Environmental Correlates:

1. Basalt substrates
   Suitable Categories (Categorical):
   1. Thin-soiled or bedrock sites within bunchgrass/shrub-steppe
   2. Exposed basalt shelves or cliffs in shrub-steppe or open forest
   3. Basalt cobbles
   Applies Seasonally? No
2. Dependable vernal and summer moisture source
   Suitable Categories (Categorical):
   1. Springs
   2. Seepage zones
   3. Runoff channels
   4. Summer thundershowers
   Applies Seasonally? Yes
   Which Seasons? Winter and spring
3. Effective insect pollinators to maximize seed set
   Suitable Categories (Categorical):
   1. Small. native bees, probably ground-nesting semisocial or solitary species
   2. Bumblebees

Applies Seasonally? Yes
Which Seasons? Spring and summer

4. Potentially negative interactions with exotic species
Suitable Categories (Categorical):
1. Presence of annual weeds (principally bromes)
2. Presence of livestock
Applies Seasonally? Yes
Which Seasons? Spring, summer, and fall

Key Ecological Functions (*Mimulus ampliatus*):
1. Provides food resources for pollinating bees
2. Provides seeds for local seed foraging invertebrates

Threats *(In&ate High, Medium, or Low)*:
Change in Fire Regimes - Medium
Grazing - High
Mining - Low
Exotics - High
Development - Medium (Lake Waha)
Timber Harvest - Low
Roads (explain) - Medium (highway through Lawyers Canyon)

Key Assumptions:
Information on pollinators and seed dispersal are extrapolated based on work on the very similar *Mimulus washingtonensis* from eastern Oregon.

Comments:
This taxon is often referred to *as Mimulus washingtonensis* var. (or subsp.) *ampliatus*, although this taxonomic combination (see Meinke, 1991) has not yet been formally made.

Dispersal:
Pollinators - Presumably small native bees; occasional bumblebees
Dispersal Mode - Seeds are dispersed by wind and locally by water
Requirements for Dispersal - 'Flowing water (seeps, small creeks, runoff, etc.)

Trend:
There are no known long-term demographic studies underway for this taxon; however, the few extant populations are very small and located in areas with a significant exotic floristic component suggesting that populations are, or have been, decreasing in size and numbers over the last several decades (as grazing has increased).

Key Unknowns and Monitoring or Research Needs:
Further inventory is desperately needed for this exceedingly rare taxon. Definitive information on pollination biology, seed germination and viability, response to disturbance, competition with a wide range of exotic species, soil moisture requirements, and habitat characterization are sorely needed.

Degree of Confidence in Knowledge of Species: Medium

species: ***Mimulus*** *clivicola*
Province and/or Section: Wallowas; eastern WA; northern ID Life Form: 5
Key Environmental Correlates:

1. Open sites for colonization
   Suitable Categories (Categorical):
   1. Exposed or eroded banks
   2. Forest gaps (natural or artificial)
   3. Roadcuts/skidtrails
   4. Gravelly mineral-soiled or talus slopes
   Applies Seasonally? No
2. Effective pollinators
   Suitable Categories (Categorical):
   1. Small, native bees (mostly solitary, ground-nesting species)
   2. Possibly small lepidopterans (secondary floral visitors)
   Applies Seasonally? Yes
   Which Seasons? Spring and summer
3. Vernal precipitation
   Suitable Categories (Categorical):
   1. Seepage zones within talus or gravelly substrates
   2. Pooled rainwater
   3. Runoff channels
   4. Snowmeit accumulation
   Applies Seasonally? Yes
   Which Seasons? Winter and spring
4. Elevation
   Suitable Categories (Continuous):
   1. 800 - 1800 meters
   Applies Seasonally? No

Key Ecological Functions **(*Mimulus clivicola*):**
1. Provides food sources to local bee colonies
2. Provides resources to seed collecting insects (ants) and other seed predators
3. Primary provider in herbaceous understory

Threats **(*Indicate*** *High, Medium, or Low):*
Change in Fire Regimes - Medium
Grazing - Medium
Mining - Low
Exotics - Medium
Development - Low

Timber Harvest - Medium
Roads (explain) - Low

Key Assumptions:
Field observations by the author are limited to Oregon populations.

Dispersal:
Pollinators - Small native bees; possibly small butterflies that visited flowers
Dispersal Mode - Seed dispersed by wind, gravity
Requirements for Dispersal - See above

Trend:
Fluctuates, depending on rainfall; some populations have shown one or more years decline since 1989, but monitoring is inconclusive.

Key Unknowns and Monitoring or Research Needs:
Additional knowledge concerning seed bank and germination biologywould be very useful; relocation of the species in Washington a priority.

Degree of Confidence in Knowledge of Species:
Medium over the range of the species; high in Oregon

Species: *Mimulus evanescens*

Province and/or Section: Owyhee/Southeast Oregon Life Form: 5

Key Environmental Correlates:

1. Dependable winter/vernal moisture
   Suitable Categories (Categorical):
   1. Lake, pond, reservoir margin
   2. Stream channel
   3. Pooled precipitation
   4. Seepage
   Applies Seasonally? Yes
   Which Seasons? Winter and spring
2. Moisture-holding substrate
   Suitable Categories (Categorical):
   1. Sandy loam
   2. Sandy silt mixed with rocks
   3. Heavy gravels
   Applies Seasonally? No
3. Open exposed microsites
   Suitable Categories (Categorical):
   1. Beaches/shorelines
   2. Perennially flooded sites (where water usually recedes by late spring)
   3. Low, open-canopied riparian habitat

4. Dried **Streambeds** or runoff channels
Applies Seasonally? No

4. Interaction with exotic species
Suitable Categories (Categorical):
1. Competition with exotic weeds
2. Habitat alteration by livestock
Applies Seasonally? Yes
Which Seasons? Spring and summer

Key Ecological **Functions (*Mimulus evanescens*):**

1. Provide food **resources** for larval seed predators (probably **beetles)**
2. Primary producer by decomposition in temporary wetlands and along wet shorelines

Threats **(*Indicate High, Medium,* *or Low):***

Change in Fire Regimes - Low
Grazing - High
Mining - Low
Exotics - High
Development - Low
Timber Harvest - Low
Roads (explain) - **Low**
Others - Loss of seeds **due to pre-dispersal** predation (Medium); drawdowns or other human-caused reductions in availability of pooled water sources (High)

Key Assumptions:

This information is based on observations at the two extent sites, coupled with data gathered from historic herbarium collections.

Dispersal:

Pollinators - This species is **autogamous**
Dispersal Mode - Seeds released over time **from** inflated fruiting **calyx**; expected to be primarily dispersed by water
Requirements for Dispersal - Flowing water

Trend:

Unknown; populations almost certainly decreasing in size and number based on only two extant sites over an historic range including Idaho, Oregon, northeastern California, and probably adjacent Nevada.

Key Unknowns and Monitoring or Research Needs:

Seed germination biology largely unstudied; basic inventory across historic range may uncover additional sites; ability to compete with exotic weedy species; characterization of habitat and water quality requirements.

Degree of Confidence in Knowledge of Species: High

---

species: ***Mimulus hymenophyllus***
Province and/or **Section:** **Wallowas** Life Form: 5 (rarely 4)
Key Environmental Correlates:

1. Lithic substrate (basalt)
   Suitable Categories (Categorical):
   1. Canyon walls
   2. Overhangs
   3. Cave entrances
   Applies Seasonally? No
2. Dependable winter/vernal moisture
   Suitable Categories (Categorical):
   1. Condensation
   2. Seeps/perched water tables
   3. Summer thundershowers and other precipitation runoff
   Applies Seasonally? Yes
   Which Seasons? Winter, spring, and summer
3. Germination sites
   Suitable Categories (Categorical):
   1. Moist crevices/fissures as germination sites
   2. Cool, humid microsites for seedling growth
   3. Dark
   Applies Seasonally? Yes (in part)
   Which Seasons? Winter and spring
4. Effective pollinators
   Suitable Categories (Categorical):
   1. Small, native, semi-social bees
   2. Medium-sized solitary bees
   Applies Seasonally? **Yes**
   Which Seasons? Spring and summer

Key Ecological Functions **(*Mimulus hymenophyllus*):**
1. Provides resources for pollen gathering bees residing on cliff surfaces
2. Dead plants important source of organic matter for soil development in cliff fissures
3. Dense cliff colonies provide cover/raise humidity for **bryophyte/invertebrate** community

Threats **(*Indicate* *High*, ***Medium***, *or* ***Low*):**
Change in Fire Regimes - Medium
Grazing - Low
Mining - Low
Exotics - Low
Development - Low
Timber Harvest - Medium

Roads (explain) - Low

Others - Pollinator loss (species only moderately successful at selfing) (Medium); lowering of water table (Low)

Dispersal:

Pollinators - Various native bees

Dispersal Mode - Autochory (see Section 2. of this report)

Requirements for Dispersal - Moist, darkened cliff crevices/fissures

Trend:

There are no demographic studies of this species per se; however, the isolated nature of the habitat suggests *M. hymenophyllus* populations are stable. Increase is unlikely due to the fact that the existing cliff habitat is already well colonized.

Key Unknowns and Monitoring or Research Needs:

Although this species has been known for over a decade (Meinke, 1983) we still have only a limited knowledge of it's' geographic range. More intensive surveys near the Snake River in Wallowa County (northeast of the Wallowas) may reveal additional populations, in which case the current state and federal status for the species may need to be reevaluated.

Degree of Confidence in Knowledge of Species: High

Species: *Mimulus jepsonii*

Province and/or Section: East Cascades **Life** Form: 5

Key Environmental Correlates:

1. Volcanic-based substrate

   Suitable Categories (Categorical):

   1. Pumice/ash/clay mix
   2. Pumice/ash/loam mix
   3. Cohesive consistency when moist (doesn't run through your fingers)

   Applies Seasonally? No

2. Associate species

   Suitable Categories (Categorical):

   1. Bare understory/lodgepole overstory
   2. Sparse herb understory/lodgepole overstory
   3. Sparse herb understory/lodgepoleponderosa overstory

   Applies Seasonally? No

3. Soil moisture

   Suitable Categories (Categorical):

   1. Sites with snow pack through March in normal years
   2. Substrate moist below less than 5 cm below surface during flowering
   3. Runoff from asphalt and compacted soil (around Diamond Lake)

   Applies Seasonally?. Yes

Which Seasons? Winter, spring, and summer

4. Insect mutualists

Suitable Categories (Categorical):

1. Pollinators (native bees, flies) improve seed set/increase gene flow between patches
2. Ants aid in local dispersal of seed

Applies Seasonally? Yes

Which Seasons? Spring and summer

Key Ecological Functions **(*Mimulus jepsonii*):**

1. Food resources provided for pollinators (native bees and flies) in a habitat otherwise rather devoid of flowering annuals
2. Food resources provided for foraging ants
3. Possible mycotrophic association (considering the nutrient poor habitat)

Threats **(*Indicate* *High, Medium, or Low):***

Change in Fire Regimes - Medium
Grazing - Medium
Mining - Low
Exotics - Low
Development - Low
Timber Harvest - Medium
Roads (explain) - Low
Others - Habitat stagnation (needs disturbance for populations to flourish) (Medium)

Key Assumptions:

This information is based on the species as it occurs within the CRB.

Dispersal:

Pollinators - Small bees; beeflies
Dispersal Mode - By wind; apparently locally distributed by ants
Requirements for Dispersal - See above

Trend:

Population monitoring is just getting underway for this species. Casual observation over the last five years have shown several key populations to dramatically shift in size, from small to large to small again (typical of many annuals).

Key Unknowns and Monitoring or Research Needs:

Relationship of ants to seed dispersal -- is this necessary or only incidental to normal dispersal? Information on nutrient requirements and soil ecology may also be important.

Degree of Confidence in Knowledge of Species: High

Species: *Mimulus jungermannioides*

Province and/or Section: East Cascades Life Form: 4

Key Environmental Correlates:

1. Lithic substrate (basalt)
   - Suitable Categories (Categorical):
     1. Canyon walls
     2. Overhangs
     3. Cave entrances/ceilings
     4. Rock roadcuts (rare)
   - Applies Seasonally? No
2. Dependable moisture source
   - Suitable Categories (Categorical):
     1. Heavy winter precipitation/springtime percolation
     2. Perched water tables/seeps/springs
     3. Trickling summer runoff from thunderstorms
     4. Condensation
   - Applies Seasonally? Yes
   - Which Seasons? Winter, spring, and summer
3. Suitably dark/moist microsites for vegetative propagule establishment
   - Suitable Categories (Categorical):
     1. Deep fractures and fissures in basalt
     2. Hollowed niches in shallow caves or overhangs
   - Applies Seasonally? No
4. Elevation
   - Suitable Categories (Continuous):
     1. 50-1200 meters
   - Applies Seasonally? No

Key Ecological Functions (*Mimulus jungermannioides*):

1. Dominant plant in unique, mesic cliff community of algae, bryophytes, and other vascular plants in an otherwise xeric environment
2. Decayed plants provide nutrients and organic matter for soil buildup
3. Provides pollen for foraging colonies of native bees

Threats (*Indicate High, Medium, or Low):*

- Change in Fire Regimes - Low
- Grazing - Low
- Mining - Low
- Exotics - Low
- Development - Low
- Timber Harvest - Low
- Roads (explain) - Medium (road construction along I-84 and other local roads and highways may impact some populations)

Others - Hybridization and possible introgression with the weedy native ***Mimulus floribundus*** believed occurring in several populations (Medium); lowering of water table (medium)

Key Assumptions:
This information is based on Oregon populations.
Dispersal:

Pollinators - Small native bees (although vegetative reproduction predominates)
Dispersal Mode - Wind and gravity for seeds; **stoloniferous** runners and turions
Requirements for Dispersal - For turions: darkened, moist crevices for rooting

Trend:
Populations have remained stable over the previous decade (this is based on casual observations of most populations at least three or four times in the last ten years)
Key Unknowns and Monitoring or **Research** Needs:
Important from a biodiversity perspective is understanding the extent of genetic diversification that has arisen between isolated populations of this unique species. The extent and nature of potential hybridization would also be valuable knowledge.
Degree of Confidence in Knowledge of Species: High

Species: ***Mimulus latidens***
Province and/or Section: **Owyhee/southeast** Oregon Life Form: 5
Key Environmental Correlates:

1. Ample winter/spring moisture for germination
   Suitable Categories (Categorical):
   1. Winter snowpack
   2. Spring/winter thunderstorms (pooled precipitation)
   Applies Seasonally? Yes
   Which Seasons? Winter and spring
2. Interactions with exotic species
   Suitable Categories (Categorical):
   1. Weedy annual grasses and other species
   2. Livestock
   Applies Seasonally? Yes
   Which Seasons? Spring, summer, and fall
3. Elevation
   Suitable Categories (Continuous):
   1. Ca. 1700 meters
   Applies Seasonally? No
4. Habitat
   Suitable Categories (Categorical):

1. Vernal depressions
2. Sagebrush-dominated

Applies Seasonally? No

Key Ecological Functions **(*Mimulus latidens*):**

1. Primary producer in sagebrush vernal pool habitat
2. Provides seeds and foliage for phytophagous insects

Threats **(*Indicate* *High*, *Medium*, *or* *Low*):**

Change in Fire Regimes - Low
Grazing - Medium
Mining - Low
Exotics - High
Development - Low
Timber Harvest - Low
Roads (explain) - Low
Others - Drainage or any other alteration impacting water retention of substrate at the site where the only population of this species in the CRB occurs

Key Assumptions:

This information is based on a single population within the CRB; the species is scattered throughout much of California at lower elevations.

Dispersal:

Pollinators - None needed (species autogamous)
Dispersal Mode - Seeds retained in an inflated fruiting calyx and scattered over time as dried plants shake in the wind (seeds locally dispersed by wind and water)
Requirements for Dispersal - Wind and/or local flowing water

Trend:

Unknown; there are no demographic studies of this species in progress.

Key Unknowns and Monitoring or Research Needs:

Further inventory may reveal additional populations of this oddity in southeast Oregon. How and why it came to be in Lake County, and how it has managed to persist in what is a vastly different habitat/climate than the rest of the species experiences in California, are interesting questions.

Degree of Confidence in Knowledge of Species: High

---

species: ***Mimulus patulus***

Province and/or Section: Wallowas Life Form: 5

Key Environmental Correlates:

1. **Substrate (basalt-based)**

Suitable Categories (Categorical):

1. Thin-soiled scab
2. Cliffs, cliff bases

3. Lithic runoff channels

Applies Seasonally? No

2. Suitable winter/vernal moisture

Suitable Categories (Categorical):

1. Winter snowmelt
2. Perched watertables, seeps, springs
3. Vernally wet, thin-soiled basins that support shallow pools
4. Early season thunderstorms

Applies Seasonally? Yes

Which Seasons? Winter and spring

3. Possible mutualisms

Suitable Categories (Categorical):

1. Populations commonly co-occur with *Nostoc* (blue-green alga)

Applies Seasonally? Yes

Which Seasons? Spring and summer

4. Interactions with exotic species

Suitable Categories (Categorical):

1. Annual, weedy grasses and other species
2. Livestock

Applies Seasonally? Yes

Which Seasons? Spring, summer, and fall

Key Ecological Functions **(*Mimulus patulus*):**

1. Provides foliage and seeds for phytophagous insects
2. Primary producer in vernally wet basalt sites
3. Part of unique vernal community restricted primarily to seeps within bunchgrass-steppe

Threats ***(Indicate** High, Medium, or Low):*

Change in Fire Regimes - Medium
Grazing - High
Mining - Low
Exotics - High
Development - Low
Timber Harvest - Low
Roads (explain) - Low
Others - Lowering of perched water tables or other restrictions on water (Medium)

Key Assumptions:

Based on occurrences outside of Hell's Canyon, where historic sites are inundated. This species is not listed in the floras except in synonymy; it is recognized as distinct from *M. wushingronensis* based on comparative greenhouse studies (Meinke, 1991).

Dispersal:

Pollinators - Not needed; species strictly autogamous

Dispersal Mode - Locally via wind and trickling water; possibly perennial streams and/or rivers (certainly this was a means of dispersal for historic populations)

Requirements for Dispersal - See above

Trend:

There are no population monitoring plans underway for this species; casual observations and recent surveys suggest the species is more common than previously thought, but that populations are tiny, apparently hemmed in by exotic weeds.

Key Unknowns and Monitoring or Research Needs:

Additional field inventory to ascertain extent of populations in **Wallowa** County, Oregon. Also, an understanding of the possible relationship between this species and blue-green algae colonies (see Meinke, 1993) might be instructive, as well as it's ability to compete .

Degree of Confidence in Knowledge of Species: High

---

species: ***Mimulus pulsiferae***

Province and/or Section: **East Cascades** Life Form: 5

Key Environmental Correlates:

1. Dependable winter/vernal moisture source
   - Suitable Categories (Categorical):
     1. Shallow drainage basins
     2. Melting snowpack
     3. Runoff channels/thundershowers
     4. Roadside ditches (gravel/dirt roads)
   - Applies Seasonally? Yes
   - **Which Seasons?** Winter, spring, and summer
2. Volcanic soils (basalt origin)
   - Suitable Categories (Categorical):
     1. Coarse sandy-loam
     2. Pumice
     3. Basalt gravels
   - Applies Seasonally? No
3. Open microsites
   - Suitable Categories (Categorical):
     1. Forest **gaps/treefall** disturbance
     2. Slumps/slides
     3. **Roadcuts/ditch** banks
     4. Exposed washes (late spring/summer dry)
   - Applies Seasonally? No
4. Effective pollinators
   - Suitable Categories (Categorical):

1. Small native bees
2. Hovering beeflies

Applies Seasonally? Yes

Which Seasons? Spring and summer

Key Ecological Functions (*Mimulus pulsiferae*):

1. Provides nectar and pollen for beeflies and native bee fauna
2. Primary producer in dry forest spring annual community
3. Provides resources for phytophagous insects

Threats (*Indicate High, Medium, or Low*):

Change in Fire Regimes - Medium
Grazing - Medium
Mining - Low
Exotics - Medium
Development - Low
Timber Harvest - Low
Roads (explain) - Low
Others -

Key Assumptions:

This is based on the species distribution within the CRB -- populations occurring in California, especially the Sierra Nevada, have different habitat requirements (including a preference for granitic-based substrates.

Dispersal:

Pollinators - Small native bees (ground-nesting solitary species); beeflies; autogamy
Dispersal Mode - Wind-dispersed; water
Requirements for Dispersal - Running water after seeds are dispersed

Trend:

There are no studies in progress or completed that examine the demography of this species. Casual observation of selected populations in Oregon over the 'last decade show the species to fluctuate annually in population size, but with a generally stable trend.

Key Unknowns and Monitoring or Research Needs:'

The degree to which the species self-pollinates and outcrosses; possible mychorrhizal associations.

Degree of Confidence in Knowledge of Species: High

Species: *Mimulus pygmaeus*

Province and/or Section: East Cascades Life Form: 5

Key Environmental Correlates:

1. Associate shrub cover

Suitable Categories (Categorical):

1. Silver sage dominated

2. Low sage dominated
3. Meadow/sage flats ecotone

Applies Seasonally? No

2. Dependable source of winter/vernal precipitation for optimal germination

Suitable Categories (Categorical):

1. Above average snowfall
2. Heavy late winter/early spring rains
3. Condensation
4. Shorelines/streambanks

Applies Seasonally? Yes

Which Seasons? Winter and spring

3. Interactions with exotic species

Suitable Categories (Categorical):

1. Weedy annual grasses and other species
2. Livestock

Applies Seasonally? Yes

Which Seasons? Spring and summer

4. Open sites for colonization

Suitable Categories (Categorical):

1. Scabland flats
2. Gaps within sagebrush shrub-steppe
3. Cutbanks and slumps
4. Gopher and ant mounds (rare)

Applies Seasonally? No

Key Ecological Functions (*Mimulus pygmaeus):*

1. Provides seeds and foliage to insect foragers and predators
2. Primary producer in vernal annual litter layer along low-silver sage-meadow ecotone

Threats (*Indicate High, Medium, or Low):*

Change in Fire Regimes - Medium
Grazing - Low
Mining - Low
Exotics - Medium
Development - Low
Timber Harvest - Low
Roads (explain) - Low

Key Assumptions:

This information is based on the distribution of the species in the CRB. It also occurs south well into California, in somewhat different habitats on the east flank of the northern Sierra Nevada.

Dispersal:

Pollinators - None needed; the species is highly autogamous

Dispersal Mode - Water; wind

Requirements for Dispersal - Flowing water; capsules require water to dehisce

Trend:

No demographic studies are available for this species; population numbers (above ground) fluctuate widely from very low in most years, to countless millions after especially wet winters (such as 1993). *Mimulus pygmaeus* is probably stable.

Key Unknowns and Monitoring or Research Needs:

Additional field inventory after a second wet winter (perhaps in 1995) should be conducted to corroborate population numbers in 1993; status can be reevaluated at that time.

Degree of Confidence in Knowledge of Species: High

Species: *Mimulus suksdorfii*

Province and/or Section: All Life Form: 5

Key Environmental Correlates:

1. Ample winter/spring moisture for germination/establishment
   - Suitable Categories (Categorical):
     1. Winter snowpack
     2. Spring/summer thundershowers
     3. Pooled precipitation
     4. Runoff channels
   - Applies Seasonally? Yes
   - Which Seasons? Winter, spring, and summer
2. Well-drained substrate
   - Suitable Categories (Categorical):
     1. Coarse basalt gravels/sands
     2. Decomposed granodiorites/granites
     3. Various course sandy loams
   - Applies Seasonally? No
3. Open sites for establishment
   - Suitable Categories (Categorical):
     1. Shrub gaps in sagebrush/bitterbrush/mt. mahogany-steppe
     2. Forest gaps
     3. Treefalls
     4. Slides/slumps/cutbanks
   - Applies Seasonally? No
4. Interactions with exotic species
   - Suitable Categories (Categorical):
     1. Competition with annual weedy grasses and other species
     2. Consumption by livestock

Applies **Seasonally?** Yes
Which Seasons? Spring and summer

Key Ecological Functions **(*Mimulus suksdorfii*):**
1. Provides seed and foliage for phytophagous insects
2. Primary producer in litter layer of forest/steppe annual community

Threats **(*Indicate* *High, Medium, or Law):***
Change in Fire Regimes - **Low**
Grazing - Low
Mining - **Low**
Exotics - **Low**
Development - Low
Timber Harvest - Low
Roads (explain) - Low

Key Assumptions:
Species is not sensitive throughout most of **CRB;** only in Washington.

Dispersal:
Pollinators - Probably none required; plants have floral morphology that implies high rates of **autogamy**
Dispersal Mode - Wind; possibly seed foraging insects such as ants
Requirements for Dispersal - See above

Trend:
Unknown; presumably stable since the species is rather common throughout much of the **CRB.**

Key Unknowns and Monitoring or Research Needs:
None

Degree of Confidence in Knowledge of Species: High

Species: ***Mimulus*** *tricolor*

Province and/or Section: East Cascades Life Form: 5

Key Environmental Correlates:
1. Sufficient winter/vernal/summer precipitation for germination and establishment
   Suitable Categories (Categorical):
   1. Above average snowpack
   2. Spring thundershowers/rain
   3. High rivers/streams from winter runoff
   4. Consistent summer thunderstorms
   Applies Seasonally? **Yes**
   Which Seasons? Winter **and spring**
2. Interactions with exotic species
   Suitable Categories (Categorical):

1. Livestock
2. Annual weedy grasses and other species

Applies Seasonally? Yes

Which Seasons? Summer

3. Substrate/topography adequate for maintaining populations

Suitable Categories (Categorical):

1. Vernal pools
2. Pond/river margins
3. River oxbows
4. Drainage ditches

Applies Seasonally? No

4. Effective pollinators

Suitable Categories (Categorical):

1. Small to medium-sized solitary or semi-solitary native bees
2. Bumblebees
3. Beeflies

Applies Seasonally? Yes

Which Seasons? Spring and summer

Key Ecological Functions (*Mimulus* tricolor):

1. Primary producer in vernal pool/flooded riverside annual community
2. Provides food resources for insect pollinators
3.. Provides food resources for phytophagous insects and rodents

Threats (*Indicate High, Medium, or Low*):

Change in Fire Regimes - Low
Grazing - High
Mining - Low
Exotics - High
Development - Low
Timber Harvest - Low
Roads (explain) - Low
Others - Loss of pollinator habitat for this principally outcrossed spring species, a potential problem where cattle use is moderate to high (Medium)

Key Assumptions:

Based on information for the species in the CRB (at the edge of it's geographic range); *M. tricolor* is common in cismontane California and occasional in western Oregon, in low elevation vernal pools and swales.

Dispersal:

Pollinators - Small to medium native bees; bumblebees; beeflies
Dispersal Mode - Water; capsules must be soaked in order to dehisce
Requirements for Dispersal - Running streams, rivers; flooded fields

Trend:
In the CRB ***Mimulus tricolor*** may be declining, but there are no data to back this up. The habitat is marginal, at best, for the species and has been heavily used by cattle in some areas. Recent changes in management direction for these sites may stabilize and/or increase populations.
Key Unknowns and Monitoring or Research Needs:
Additional inventory in vernal **swales** and pools in Lake and Klamath counties.
Degree of Confidence in Knowledge of Species: High

Species: ***Mimulus*** *washingtonensis*
Province and/or **Section:** East Cascades **Life** Form: **5**
Key Environmental Correlates:

1. Welldrained basalt substrate
   Suitable Categories (Categorical):
   1. Exposed bedrock and shelves
   2. Thin-soiled, barren gravelly slopes
   3. Lithic drainage and runoff channels
   4. **Edges** of rock streambanks
   Applies Seasonally? No
2. Effective pollinators
   Suitable Categories (Categorical):
   1. Small semi-social native bees
   2. Bumblebees (rare)
   3. Syrphid flies
   4. Sphinx moths
   Applies Seasonally? Yes
   Which Seasons? Spring and summer
3. Ample winter/vernal precipitation for optimal germination and establishment
   Suitable Categories (Categorical):
   1. Above average winter snowpack
   2. Heavy spring rains
   3. **Precipitation** remaining pooled for *several* weeks in drainage **channels**
   4. Flowing seeps and springs
   Applies Seasonally? Yes
   Which Seasons? Winter and spring
4. Possible mutualism with blue-green algae
   Suitable Categories (Categorical):
   1.. Presence of nitrogen-fixing ***Nostoc*** *commune* in wet substrate within ***Mimulus*** *washingtonensis* colonies
   Applies Seasonally? Yes

Which **Seasons?** Spring and summer

Key Ecological Functions **(*Mimulus washingtonensis*):**

1. Provides food resources to a wide array of insect pollinators
2. Provides seed and foliage tissue to phytophagous insects
3. Possible mutualism with blue-green algae colonies

*Threats (Indicate High, **Medium,** or Low):*

Change in Fire Regimes - Low
Grazing - Medium
Mining - Low
Exotics - Medium
Development - Low
Timber Harvest - Low
Roads **(explain)** - Low
Others - Competition for pollinators with similar-appearing allopatric species (mainly ***Mimulus guttatus)*** (Medium)

Comments:

This **taxon** is often cited ***as Mimulus washingtonensis*** var. (or subsp.) ***washingtonensis,*** although this name is not yet formally published (it only comes into existence when M. ***ampliatus*** is formally made an **infraspecific taxon** within ***M. washingtonensis) -- see*** Meinke (1991).

Dispersal:

Pollinators - Native bees; syrphid flies; bumblebees; sphinx moths
Dispersal Mode - Seeds scattered by the wind; dispersed locally (and potentially long distances) by water
Requirements for Dispersal - Running water

Trend:

The 1993 field season demonstrated that in wet years this species can be very prolific locally. Formal demographic data have not been collected, but there seems consensus among field workers that the species is at least stable.

Key Unknowns and Monitoring or Research Needs:

Further inventory after a second wet winter would be useful in corroborating the 1993 season, and would **be** valuable in reassessing the status of this endemic.

Degree of Confidence in Knowledge of Species: High

7. Special Habitats

Table **3.** Summary Information on Special Habitat Requirements for Selected Species of *Mimulus* in the CRB. [***The special habitats described below, if located and preserved or restored, would greatly enhance the potential conservation of these taxa.***]

Taxon	*Habitat Description*
Mimulus ampliatus (= *M. washingtonensis* subsp. *ampliatus)*	This species prefers vernal depressions or basalt seeps within bunchgrass and shrub-steppe in western Idaho, free of exotic weeds and livestock grazing; such sites are essentially non-existent now within the range of this taxon, except for cliffs or steep basalt bluffs where cattle and sheep have historically been excluded
Mimulus evanescens	Pristine stream or riverbanks (and sandy riparian sites in general) are the apparently preferred habitats for this species, as well as drying streambeds, margins of ponds or lakes, or significant vernal depressions within the sagebrush-steppe of the lower CRB and adjacent northern Great Basin; such habitats were obviously common in the past, but virtually all have been moderately to severely impacted by open range livestock grazing promulgated by the BLM -- ungrazed sites are now extremely infrequent within this geographic area; the restoration of habitat for *M.* evanescens may be possible if cattle are excluded from sites through exclosures -- however, restoring annual species in highly impacted areas is very problematic

Mimulus hymenophyllus	This cliff endemic frequents fractured basalt cliffs with annual seepage, within a matrix of mixed coniferous forest and. xeric bunchgrass steppe; the forest, its understory of **mesic** forbs and shrubs, and the associated herb communities on the cliff faces are all maintained by cold air drainage from the uplands forming the northeast **flank** of the **Wallowa** Mountains; as long as logging does not take place in these drainages, little needs to be done to maintain these habitats in an essentially undisturbed state due to their isolated location and vertical orientation
Mimulus jungermannioides	This cliff obligate is also restricted to fractured basalt cliffs with annual seepage, adjacent to riparian vegetation of major rivers and tributaries, but within a matrix of xeric bunchgrass and shrub steppe (no coniferous forest); not all population sites for the species fit this habitat description, but the majority of known localities do -- unspoiled examples of this habitat are extremely uncommon due to destruction via road building in canyons, and deterioration of riparian conditions due to grazing by domestic livestock in the upper **CRB** of Oregon; fortunately, populations of this species seem to be resilient to moderate levels of disturbance, as long as the natural hydrology is maintained and cliffs are not disturbed

Mimulus patulus	This species prefers vernal basalt seeps, wet depressions, or moist slopes around springs, within the bunchgrass and shrub-steppe in eastern Wallowa County, Oregon, free of exotic weeds and livestock grazing; such sites are essentially nonexistent now, except for seep zones on steep bluffs or rocky outcrops where cattle and sheep have historically been excluded -- generally, if there is any consistent soil moisture, the increase in local vegetative cover will attract livestock
Mimulus washingtonensis	This annual occurs chiefly on vernal basalt seeps, shallow-soiled runoff channels, or vernally moist basalt gravel slopes, within the ponderosa forest and shrub-steppe in east-central Oregon, free of livestock grazing, with intact cryptogamic crusts containing healthy cyanobacteria populations and thriving native bee colonies; such areas are easily disturbed -- although grazing is not yet a major threat on all sites for the species, cattle trailing and accompanying substrate disturbances potentially disrupt important soil organisms and impact pollinators, with as yet unknown consequences

8. Range Maps for *Mimulus* species in the CRB

Maps for the species covered in this report are provided separately, using registered mylar overlays and a base map of the CRB provided by the U.S. Forest Service.

9. **Conclusions:** Issues for Analysis, Potentially Important Unavailable Data, and Areas of Future Research Concentration

Objectives of the EEMP include:

- assessing general species trends (including historic, current, and potential future trends under various management schemes);
- analyzing the distribution and abundance of species in relation to potential viability effects under a range of planning alternatives; and
- assessing how changes in species will affect the environment.

A major problem faced by the EEMP is that these objectives are largely unobtainable for the vast majority of taxa ***in the CRB,*** even ***those*** such ***as Mimulus*** for which considerable information is available. You simply cannot predict demography, distribution, abundance, or effects of population changes without a reasonable base of ***biological*** information. Unfortunately, except for a handful of economically important species, there are virtually no relevant biological data on the majority of species (plants or animals) being evaluated by EEMP panels and experts.

Vascular plants, arguably the most studied groups of organisms on public lands after major vertebrate species and pathogenic forest fungi, provide a good gauge of where we are in terms of biological knowledge of our native biota. Outside of a few timber species, the handful of shrubs or grasses important for grazers or browsers, and the odd taxonomic group studied by an academic botanist, we are basically ignorant of the life history traits and biotic interactions of an estimated 95% or more of our indigenous taxa. This includes the great majority of sensitive and listed plant species that increasingly affect management actions on Forest Service and BLM lands. If these agencies are required to develop credible models that forecast the fate of species and ecosystems under different management scenarios, then a greater commitment is needed in gathering relevant biological information.

One important issue to consider is that of ***species trends.*** What precisely does this mean? Presumably it refers to demographic projections through time and space for species and/or populations. Yet only a handful of species (rare or otherwise) have monitoring studies in place that are generating the type of year-to-year data that can be analyzed to reasonably predict population direction. And for which species are there reliable pools of information regarding ***historic*** trends? Most of this is guesswork, which reduces any model's accuracy. With long-range prediction being a major goal of this exercise, panelists feel obligated to come to some conclusion concerning the "trends" of

the species they are reviewing, but in general this will be based on gut instinct rather than empirical data.

Another interesting issue relates to the desire to anticipate distribution and abundance of taxa under various planning alternatives (in terms of "potential viability effects"). However, this cannot be accomplished for species lacking documentation of important life history characteristics, specific habitat requirements, and relevant biotic interactions. Other than basic life form (annual, perennial, etc.), information on only two aspects of vascular plant life history is explicitly requested of panelists and experts for the EEMP database, i.e., pollinators and dispersal mechanisms (the latter not distinguished between seed and pollen dispersal), both of which are unlikely to be known about most taxa. Important traits ***not*** specifically requested (although they could, of course, be designated ***as Key Environmental Correlates*** if the panelist so chose) include ***seed biology*** (germination requirements and responses, presence or absence of soil seed banks, seed longevity); ***breeding system*** (this is much more than just knowing the "pollinators" -- is the species genetically self-compatible? Do flowers actually require insects to achieve optimal set seed? Are there specific pollinators required, or are all floral visitors effective at pollination? What habitat requirements might ***these*** insect have); ***ability to reproduce vegetatively*** (is this apt to be enhanced or suppressed under particular disturbance regimes?); ***presence and rates*** *of* ***predation*** (pre- and post-dispersal seed predation, flower and foliage predation); and ***responses to competition*** (especially from the exotic annuals that dominate much of the landscape in the CRB). Obviously, the majority of the above traits will not be known for most species, either -- however, if pollinators and dispersal ability were singled out on EEMP forms, then some of these might also have been included, to encourage panelists to think along the same lines.

In Mimulus, there is a need to establish monitoring protocols for particularly rare or vulnerable species. This is not a straightforward procedure since most of these are annuals, notoriously difficult to monitor accurately from year to year without incorporating data on the below ground individuals in the population (Le., the dormant seed pool). In lieu of a genus-wide demographic study in the CRB (impractical at best), representative species could be selected from a range of life histories (e.g., annual with non-dormant seeds, annual with dormant seeds, perennial, obligate cliff species, species with vegetative reproduction, etc.) and monitored over time. In addition, a set of the most important species (these could be the most sensitive, most typical, or whatever) could be studied with the goal of further substantiating some of the important life history information described in this section. This approach may also be worth considering for other selected major genera in the CRB that presently lack any substantive biological information. Constructing a model based on a handful of well-studied species may be

more desirable than fitting one using data from a large number of poorly understood taxa. Finally, inventory for several monkeyflower species is still incomplete, and a number of areas within the CRB are still underexplored botanically. The following table suggests areas where important data are lacking for specific *Mimulus* taxa in the CRB.

Table *4.* Research *Needs* for *Mimulus* Species in the CRB.

Taxon	*Data or Research Needs*
Mimulus ampliatus* (= *M. washingtonensis subsp. ***ampliatus)***	Additional inventory (concentrating in Idaho and in eastern Wallowa County, Oregon), monitoring plan, possible competition problems, potential dependency on particular pollinators, breeding system (genetic compatibility and inbreeding depression), seed biology and germination requirements (dormant versus non-dormant), and the potential for seed bank development are all important considerations for this imperfectly known and very local taxon (thought extinct until only a few years ago). [Mimulus ampliatus ***is ostensibly closely related to*** M. washingtonensis ***from the John Day River area in east-central Oregon (Meinke, 1991). It would be worth comparing the biology*** *of* ***this taxon with that*** *of* ***the John Day River entity,*** *for* ***which a good &al*** *of* ***ecological information is already available. It might also be valuable to assess the taxonomic relationships*** *of* M. ampliatus ***using techniques other than morphologic comparisons, to further evaluate its uniqueness.]***

Mimulus clivicola	Additional information on the taxon's distribution in Oregon and Washington (but not in Idaho) is needed, as are data on seed germination, seed bank size, pollinator type and their vulnerability to disturbance, and selfing rates in nature. The potential role of ants in the local distribution of seeds would make interesting study.
Mimulus evanescens	This newly discovered annual species (published in 1995) is ***in critical*** need of inventory across the southern CRB, especially on BLM properties -- only one extant population is known in the CRB, and only two globally (the other in nearby California). Areas of focus should include Lake, Hamey, and Malheur counties, Oregon, and adjacent Owyhee County, Idaho. Additional studies are also needed on basic seed biology (augmenting the greenhouse work at OSU), and the ability of populations to persist over time at a given site. Data on competitive abilities in relation to disturbance and the proliferation of exotic-grasses would be valuable information. Vulnerability of the species to flower and seed predators would also be worth investigating. Cryogenic seed banking of existing populations (at the Berry Botanic Garden) is recommended, as new sites for the species are located.

Mimulus hymenophyllus	Although this cliff species is fairly secure, due to its very isolated habitat and distribution, further inventory is warranted. If this results in the discovery of enough additional populations in the remote Snake River country of Wallowa County (and perhaps Idaho and/or adjacent Washington), the species may need to be removed from the sensitive and candidate lists at both the state and federal levels. Genetic studies of this very unusual endemic would help in establishing its level of uniqueness with the genus. Information on pollinator abundance and the species' dependance on insect visitors in the field is mostly lacking. Cryogenic storage of seeds of this species (at the Berry Botanic Garden) is recommended, considering it's extremely narrow distribution.
Mimulus jepsonii	Monitoring studies of several populations of this annual (initiated in 1994 for the Umpqua National Forest) should be continued annually if possible, or at least every three years. Further evaluation of the role disturbance plays in the ecology of this species may be valuable in future assessments of its status in the CRB. The extent to which ants play a role in seed dispersal may also be worth investigating.

Mimulus jungermannioides	Continued studies on the genetic variation between populations of this unique clonal endemic are needed (expected to be supported by BLM in 1995). Further studies on the role of sexual reproduction in population maintenance would also be valuable, and is planned for 1996. Cryogenic seed banking of various'populations (to be prioritized after genetic studies) is recommended. A monitoring plan for selected populations on public lands should be initiated, to keep track of population growth or decline in relation to available water from seeps. The possibility and extent of hybridization with the common species ***M. floribundus*** also needs further investigation -- steps may need to be taken to eradicate the latter common species in any sympatric populations.
Mimulus latidens	This extremely rare peripheral disjunct is a curious species that merits additional inventory in Lake County, Oregon. Artificial seed banking of the Oregon population is recommended considering the unique biogeographic aspects of this highly allopatric occurrence. Taxonomic and genetic comparisons with the rest of the species in California may be instructive.

Mimulus patulus	Recent studies have shown this species to be more common than once believed; further inventory (including areas of nearby Washington and Idaho) would be useful, and may result in a status re-evaluation if new populations continue to be found. The ability of this annual species to withstand competition with other species, especially weedy introductions and aggressive, ecotypes of ***M. guttatus,*** needs investigation. Cryogenic seed storage is recommended for a minimum of five populations.
Mimulus pulsiferae	Further inventory in Washington is needed.
Mimulus pygmaeus	Additional inventory in a reasonably good field year should reveal enough about population size and distribution to substantiate a 1993 recommendation to remove this species from the federal candidate list. Subsequently, sites known to have robust populations should be loosely monitored after each future above-average winter (in terms of precipitation).
Mimulus suksdorfii	Further inventory in Washington is needed.
Mimulus tricolor	Additional inventory east of the Cascades in the southern CRB is required. Populations from the east side need to be artificially seed banked, as they may represent a unique ecotype.

Mimulus washingtonensis	This is a comparatively well-studied species. Various populations should be artificially seed banked to record the genetic variation that may exist between different sites. Vulnerability of pollinators may also need additional study. Sites known to have robust populations should be loosely monitored after each future above-average winter (in terms of precipitation).

10. Assumptions

A final word about assumptions and disclaimers relating to the development of this report. It was generally assumed that data records and reports supplied by state Natural Heritage data bases, herbaria, and other sources are accurate -- where there were reasonable doubts the information was not used. It is also assumed that in some cases, it was acceptable (and necessary) for the author to use best judgement and past experience with related species in developing narratives, dealing with habitat, aspects of species biology, and (especially) species "trends" and cover associations. Insects listed as "Pollinators," for example, are in most cases only confirmed as floral visitors, with experience with related pollination systems suggesting that they are almost certainly effective at pollen transfer and fertilization. Inferences are also made regarding the various presumed "Threats" to species, when hard evidence is lacking but experience suggests that certain land actions do pose a probable hazard. There simply is not very much useful information on most of these species (or many others in our flora, for that matter) in reports or publications that can be readily incorporated into the format specified for the EEMP. Even where previously written material exists, it is virtually always lacking significant information on the biology or habitats of species.

The current vegetation map of the CRB (supplied by the Forest Service) was of minimal value in this project, due to the considerable scale limitations and legend inconsistencies. Here are two (among several) examples of the latter: (1) Vast acreage in southeastern Oregon and northern Nevada are coded bright yellow on the map, yet there is no yellow whatsoever in the legend (i.e., color key) for the SAF or SRM cover types. The yellow is associated with what appears to be Salt Desert Shrub vegetation, but

the significance of this is not clear. (2) Also in the legend, .a non-descript shade of burnt orange is used to denote the Wheatgrass-Needlegrass, Wyoming Big Sagebrush, ***and*** Valley Grassland cover types. Although there may, in fact, be subtle differences between the various burnt oranges on the map, there is no way the average human eye can readily distinguish them (even with a hand lens). This is unfortunate, since burnt orange is the dominant map color in eastern Oregon and southern Idaho.

While some of the information presented here is compiled in various reports and papers (and cited herein), much is not (as alluded to above). Where statements are not attributed to a source, it is to be understood that they represent unpublished observations of the author. It is also understood that information from sources other than the author's papers, reports, unpublished work, and observations shall be appropriately and reasonably cited once or more in the text. Any omission of credit or lack of citation for any facts or conclusions presented herein is purely unintentional.

11. Selected Bibliography (Including Literature Cited and Reviewed in the Text)

Argue, C.L. 1980. Pollen morphology in the genus ***Mimulus*** (Scrophulariaceae) and its taxonomic significance. American Jour. Botany 67:68-87.

_____. 1986. Some taxonomic implications of pollen and seed morphology ***in Mimulus hymenophyllus*** and ***M. jungermannioides*** and comparisons with other putative members of the ***M. moschatus*** alliance (Scrophulariaceae). Canad. Joum. Botany 64: 1331-1337.

Böcher, J. and M. Philipp. 1985. Aspects of the reproductive biology of ***Mimulus repens*** (Scrophulariaceae) at Lake Ellsmere, Canterbury, New Zealand. New Zealand Jour. Botany 23:141-149.

Cronquist, A. 1959. Scrophulariaceae. ***In*** C.L. Hitchcock, A. Cronquist, M. Ownbey, and J. Thompson, Vascular plants of the Pacific Northwest. Univ. of Washington Press, Seattle.

Dole, J. A. 1990. Role of corolla abscission in delayed self-pollination in ***Mimulus guttatus*** (Scrophulariaceae). American Jour. Botany' 77: 1505-1507.

Douglas, D.A. 1981. The balance between vegetative and sexual reproduction of ***Mimulus primuloides*** at different altitudes in California. Jour. Ecology 69:295-310.

Ezell, W.L. 1971. Biosystematics of the ***Mimulus nanus*** complex in Oregon. Unpublished Ph.D. Dissertation, Oregon State Univ., Corvallis.

Grant, A.L. 1924. Monograph of ***the*** genus ***Mimulus.*** Ann. Missouri Bot. Gard. 11:99-***3 8 8 .***

Griffiths, A.J.K., K. Carey, and F.R. Ganders. 1981. Anthocyanin polymorphisms in ***Mimulus guttatus.*** Canad. Jour. Botany 60:1625-1628.

Guerrant, E.O., Jr. 1992. Genetic and demographic considerations in the sampling and reintroduction of rare plants. ***In*** P. Fiedler and S. Jain (eds.), Conservation biology: The theory and practice of nature conservation, preservation; and management. Chapman and Hall Publishers, New York.

Harris, J.E. 1979. The pollination ecology and sexual reproductive biology of ***Mimulus guttatus*** along an elevation gradient. Unpublished M.S. Thesis, Univ. of Utah, Salt Lake City.

Heckard, L.R. and R. Bacigalupi. 1986. ***Mimulus shevockii*** (Scrophulariacae), a new species from desert habitat in the southern Sierra Nevada of California. Madroño 32:179-185.

_____ and J.R. Shevock. 1985. ***Mimulus norrisii*** (Scrophulariaceae), a new species from the southern Sierra Nevada. Madroiio 32:179-185.

Hiesey, W.M, M.A. Nobs, and 0. Björkman. 1971. Experimental studies on the nature of species. V. Biosystematics, genetics, and physiological ecology of the ***Erythranthe*** section of ***Mimulus.*** Publ. Carnegie Inst. Wash. 628.

Hitchcock, C.L. and A. Cronquist. 1973. A flora of the Pacific Northwest. Univ. of Washington Press, Seattle.

Holmgren, N. 1984. Scrophulariaceae. ***In*** A. Cronquist, A. Holmgren, N. Holmgren, J. Reveal, and P. Holmgren, Inter-mountain flora. IV. New York Botanical Garden, The Bronx.

IDFG (Idaho Department of Fish and Game). 1994. Rare, Threatened, and Endangered Plant and Animals of Idaho. IDFG Conservation Data Center. Boise, ID.

Kiang, Y.T. 1972. Pollination study in a natural population of ***Mimulus guttaus***. Evolution 26:309-310.

_____. 1973. Floral structure, hybridization, and evolutionary relationship of two species of ***Mimulus.*** Rhodora 75:225-238.

Kruckeberg, A. and D. Rabinowitz. 1985. Biological aspects of endemism in higher plants. Annual Rev. Ecol. Syst. 16:447-479.

Lassen National Forest. 1991. ***Mimulus pygmaeus*** species management guide: summary report.

Lorain, C.C. and R.K. Moseley. 1989. Field investigation of ***Mimulus clivicola*** (bank monkeyflower), a Region 1 Sensitive Species, on the Clearwater and Nez Perce National Forests. Idaho Natural Heritage Program, Idaho Dept. of Fish and Game. Boise, ID.

_____. 1990. Continued field investigations of ***Mimulus clivicola*** (bank monkeyflower). Natural Heritage Section, Idaho Dept. of Fish and Game. Boise, ID.

Meinke, R.J. 1983. ***Mimulus hymenophyllus*** (Scrophulariaceae), a new species from the Snake River Canyon area of eastern Oregon. Madroiio 30:147-152.

_____. 1984. Propagation by turions in a cliff-dwelling ***Mimulus*** (Scrophulariaceae). American Jour. Botany 71,5 (part 2): 178.

_____. 1991. Systematic and reproductive studies of ***Mimulus*** (Scrophulariaceae) in the Pacific Northwest: implications for conservation biology. Ph.D. dissertation. Oregon State Univ., Corvallis.

_____. 1992. Differentiating ***Mimulus jepsonii*** and ***M. nanus*** in south-central Oregon: A problem in applied systematics. Kalmiopsis 2: 10-16.

_____. 1993. ***Mimulus washingtonensis*** on the Umatilla National Forest, USDA Forest Service - Region 6: biological studies and management recommendations for a conservation strategy. Oregon State University, Corvallis.

_____. 1993a. A taxonomic interpretation of ***Mimulus jepsonii*** on the Deschutes, Umpqua, Winema, and Fremont National Forests in south-central Oregon. Oregon State University, Corvallis.

_____. 1995. ***Mimulus evanescens*** (Scrophulariaceae): a new annual species from the northern Great Basin. Great Basin Naturalist 55:249-257.

_____. 1995a. Population biology of ***Mimulus jepsonii*** in disturbed and undisturbed sites: project set-up, data collection, and analyses for 1994 and 1995. Oregon State University, Corvallis.

_____. 1995b. (in prep.). Reproductive ecology of the rare xerophytic annual ***Mimulus washingtonensis*** (Scrophulariaceae). American Jour. Botany.

_____, S. Gisler, M. Carlson, M. Peterson, and M. Kirkland. 1994. Investigations into the conservation status of ***Mimulus pygmaeus*** and ***M. tricolor*** (Scrophulariaceae) on the Winema and Fremont National Forests. Oregon Department of Agriculture. Salem, OR.

_____ and M. Carlson. 1995. ***Status report*** for ***Mimuius hymenophyllus***. Prepared under Section 6 of the U.S. Endangered Species Act for the U.S. Fish and Wildlife Service. Oregon Dept. of Agriculture. Salem, OR.

_____ and M. Carlson. 1995a. Status report for ***Mimulus patulus***. Prepared under Section 6 of the U.S. Endangered Species Act for the U.S. Fish and Wildlife Service. Oregon Dept. of Agriculture. Salem, OR.

Munz, P.A. 1959. A California flora. Univ. of California Press, Berkeley.

Oregon Natural Heritage Program. 1993. Rare, threatened, and endangered plants and animals of Oregon. Portland, OR.

Peck, M.E. 1961. A manual of the higher plants of Oregon. Ed. 2. Binfords and Mort, Portland, OR.

Pennell, F. 1951. Scrophulariaceae. ***In*** L.R. Abrams, Illustrated flora of the Pacific states. III. Stanford Univ. Press, Stanford, CA.

Ritland, C. and K. Ritland. 1989. Variation of sex allocation among eight taxa of the ***Mimulus guttatus*** species complex (Scrophulariaceae). American Jour. Botany 76: 1731-1739.

Ritland, K. 1989. Genetic differentiation, diversity, and inbreeding in the mountain monkeyflower ***(Mimulus caespitosus)*** of the Washington Cascades. Canad. Jour. Botany 67:2017-2014.

_____ and F.R. Ganders. 1987. Crossability of ***Mimulus guttatus*** in relation to components of gene fixation. Evolution 41:772-786.

Shelly, S. 1986. Noteworthy collection of ***Mimulus latidens***. Madroño 33: 151.

Thompson, D. 1993. ***Mimulus. In*** J.C. Hickman (ed.), The Jepson Manual: Higher Plants of California. Univ. of California Press. Berkeley.

Vickery, R. 1978. Case studies in the evolution of species complexes in ***Mimulus***. Evol. Biol. 11:405-507.

Waser, N., R.K. Vickery, and M. Price. 1982. Patterns of seed dispersal and population differentiation ***in Mimulus guttatus.*** Evolution 36:753-761.

Washington Natural Heritage Program. 1994. Endangered, Threatened, Sensitive and Vascular Plants of Washington. Washington Dept. of Natural Resources. Olympia, WA.