

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

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

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

The genus *Penstemon* (Scrophulariaceae), often called beardtongues (due to the bristly-hirsute staminode of certain **species**) or more often simply known as penstemons, is a mostly western North American group of showy perennials, including matted, creeping, suffruticose, and even **shrubby** forms. The genus is currently estimated to include from 225 to 250 species (Pennell, 1951; Cronquist, 1959; Munz, 1959; Holmgren, 1984, 1993), and is considered the largest genus of the Scrophulariaceae in North America. This report is intended to provide information on *Penstemon* 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**). The emphasis in this report will be on sensitive 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 vulnerable species compiled by the Oregon and Washington Natural Heritage Programs (ONI-IP, 1993; **WNHP**, 1994). A large number of penstemons have been proposed for protection over the last two decades (particularly in Oregon) -- several of these are now known to be too common and secure in the wild to warrant further consideration (see page 79 in ONHP, 1993; and pages 2-5 in **WNHP**, 1994), and are therefore not included in this review.

On a world-wide basis, the great majority of penstemons occur in western North America, primarily in Mexico and the United States. However, species occur as far south as Guatemala and also northwest along the Pacific Rim to Alaska, Karntchatka, and Japan (Pennell, 1951; **Munz**, 1959; Homgren, 1993). The genus is also reasonably **well**-represented in the Great Plains of the central United States, and extends east into Florida and New England (McGregor et al., 1986). In fact, every state except Hawaii has at least **one** native species of *Penstemon* (Wiley, 1968). Major centers of distribution for the genus in North America, as defined by concentrations of regional and local endemic species, occur in the Pacific Northwest and particularly in the Intermountain West, centered in Utah and adjacent Colorado and Arizona. The genus is quite prone to edaphic endemism outside the CRB, and **taxa** are known to be narrowly restricted to a wide range of substrates, including basalt, shale, sandstone, limestone, gypsum, and sand dunes. Many of the species are spectacular when in flower and are highly prized among

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collectors and horticulturalists. The impressive *size* of '*Penstemon* flowers and inflorescences often makes them important as food resources for many insects (especially pollinating bees and wasps) and birds. Virtually all *taxa* are conspicuous and *showy*-flowered, and are frequently prominent elements of spring and summer floras throughout much of the west.

-*The* genus *Penstemon* is very well marked within the family and most species are reasonably well understood, although not always sharply delimited throughout their geographic ranges (Cronquist, 1959; Holmgren, 1984). Most of the taxonomic studies in the genus are now rather dated (see the series of papers by **Keck**, 1932, 1936, **1937a**, **1937b**, 1938, 1940, 1945; Nelson, 1937; Cloakey and **Keck**, 1939; **Keck** and Cronquist, 1957; Crosswhite, **1967**), and none of these *treated* more than a few species or sections at a time. According to Holmgren (**1984**), roughly half the genus has not yet been covered in any comprehensive systematic study. The best treatments for the genus as a whole are still the regional floristic works by **Pennell** (1951) and Holmgren (1984).

*New* species of *Penstemon* continue to be described at a rather prolific rate (see list of references in Holmgren, **1984**), but mainly in Utah and the surrounding Intermountain Region. There are no recently published new species for the **CRB** area of Oregon and Washington, although *Penstemon floribundus* (**Danley**, 1986) apparently occurs just outside the CRB boundary in **Washoe** County, Nevada.

Evolutionary studies by **Clausen** (1933), Straw (1955 and 1956), Clark (1971), Every (1977), (**Mackanness**, 1977), **Moldenke** (1980), and Wolfe and Elisens (1993) describe examples of speciation and hybridization (some confirmed experimentally) in *Penstemon* from several geographic areas, including Oregon and Washington. The author of this report has also observed apparent instances of natural hybridization, particularly on the Wallowa-Whitman and Umatilla National Forests (including a possible three-way hybrid *swarm* between *P. elegantulus*, *P. pennellianus*, and *P. procerus* on Mt. Emily).

The distribution of endemic *Penstemon* species in the Washington, Oregon, and northern Nevada portion of the CRB is not heavily concentrated in any specific area, although there are regions of relatively higher diversity (discussed below). This pattern contrasts somewhat with that of the nearby lower Intermountain Region (especially in Utah and western Colorado), where species are often very locally restricted by their endemism to certain substrates, especially on sandstone, shale, gypsum, and calcareous outcrops (Holmgren, 1984). The **CRB** has a few edaphically restricted *taxa* (such as *P. janishiae* and its close relation *P. miser*, and perhaps the sand dune species *P. acuminantus*), but these are *endemics* only in the sense that they occur on a specific substrate -- their known distributions are actually rather widespread, if sometimes infrequent, and are expected to become better understood as inventories progress. An unusual and presently unnamed

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penstemon, represented by a series of populations on weathered ash or diatomaceous slopes in eastern Malheur County, Oregon (tentatively designated *Penstemon "nikei"* by local workers -- Jean Findley, BLM, personal communication), may turn out to be the only edaphic endemic penstemon in the region with a truly local distribution, although questions concerning the taxonomic uniqueness of this entity are yet to be resolved.

Several species are so widespread east of the Cascades in Washington and Oregon that usually more than one can be found in **virtually** every **eastside** county. These include *Penstemon duustus*, *P. gairdneri*, *P. eriantherus*, and *P. speciosus* of the low plains and foothills, and *P. humilus*, *P. rydbergii*, *P. procerus*, and *P. attenuatus* **in the** foothills to the higher mountains, ranging along a **xeric** to **mesic** gradient. Most of these have rather broad levels of ecological tolerance, but vary in their responses to disturbances such as grazing, mining, competition with exotics, etc.

Of the specific areas covered in this report, southeastern Oregon (especially the plains and mountains in southern Harney and Malheur counties) exhibits considerable penstemon diversity, despite the lack of many obviously specialized habitats (with the exception of the scattered volcanic ash deposits mentioned above). However, the area is the most poorly studied in the CRB in terms of floristic distribution and abundance. In addition to most of the common species discussed earlier, potentially sensitive **taxa** reported from this region' include *Penstemon perpulcher*, *P. kingii*, *P. seorsus* (also found farther north and west), *P. davidsonii* var. *praeteritus*, and *P. pratensis* (Holmgren, 1984), with the **montane** endemic *P. glaucinus* skirting the **area** to the west, in Lake County.

Another focus of regional diversity **in Penstemon** stretches **along** the east slopes and base of the Cascade Mountains. The only endemic here in Oregon is the localized species *Penstemon peckii*, restricted to a seemingly unspecialized ponderosa pine ecosystem within a narrow elevational band, mostly located in the Camp Sherman area of Jefferson and Deschutes counties (Moldenke, 1980; Field, 1985; ONHP, 1989; O'Neil, 1992; Ingersoll, 1993). *Penstemon washingtonensis*, once considered possibly sensitive but no longer tracked (WNHP, 1994), is another regional Cascadian endemic, found only in the mountains of Chelan and Okanogan counties, Washington. Although not really considered a **Cascade** species *per se*, *Penstemon barrettiae*, a legitimate narrow endemic found on rocks and **cliffs** in the eastern Columbia River Gorge, has affinities with the range, both from a geographic and phylogenetic perspective (Every, 1977). It is a **well-**known and widely cultivated species. Several other more widespread **taxa** are plentiful in or near the Cascades, including *Penstemon cinicola* (common on harsh, volcanic substrates in Oregon), *P. euglacus*, and *P. subserratus* (mostly found in Washington), as well as the showy and **horticulturally** desirable **subshrubs** *P. davidsonii*, *P. fruticosus*, and *P. rupicola*, which frequent rocky ledges, pinnacles, and harsh talus slopes.

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Northeastern Oregon and immediately adjacent Washington is clearly the region in the CRB where *Penstemon* diversity reaches its peak. The number of regional **endemics** in this setting of high mountains and deep canyons is comparatively high,-- the area is also home to a notable group of **disjuncts** and peripherals, as well as a host of common species (Peck, 1961; Cronquist, 1959; **Lodewick** and Lodewick, 1983). Regional and locally endemic **taxa** (not all considered sensitive, however) include the alpine *Penstemon spathulatus* (**in the** Wallowas), and **the** lower montane species *P. pennellianus* (northern Blue Mountains), *P. payettensis* (near **the** Snake River), *P. triphyllus* (**in** lower Hell's Canyon), *P. elegantulus* (along the rim of Hell's Canyon), and *P. fruticosus* var. *serratus* (**in the** mid-elevation Wallowa Mountains). Peripherals include *Penstemon globosus*, *P. confertus*, *P. wilcoxii*, and *P. versustus*. Common **taxa** include all of the region-wide species discussed near **the** top of page 3, **as well as** *P. cusickii* and *P. glandulosus*.

The vast majority of *Penstemon* habitats and populations within the CRB (including the rare and sensitive species) are federally owned. There are no private or other non-federal lands that are likely to play an important role in the conservation of the genus, except possibly for **the** endemic *Penstemon barrettiae*, which occurs in the Columbia Gorge on a mix of ownerships, including state, federal, and private. Federal planning for the gorge area is expected to take this and other rare plants into consideration. 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 *Penstemon* 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 *Penstemon* include the Vale BLM District and the Winema/Fremont National Forest complex along the California-Nevada border.

Table 1., in Section 2. (below), identifies selected major species of *Penstemon* 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**

Several widespread species of *Penstemon* from the CRB have been identified and grouped together for the purpose of this descriptive assessment (except for the sand dune species *P. acuminatus* and *P. cinicola*, which are **treated** separately). These affiliations are based on **shared habitats** and ecological requirements, and groups are comprised of common species with potential for use as ecological indicators of local environmental conditions. These species are listed below in Table 1. Sensitive species from the CRB (defined in the first paragraph of Section 1.) are given individual assessments, and are

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also listed and summarized in Table 1 following the common **taxa**. 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.

<b><i>Taxonomic Groups</i></b> <b><i>(Representative Common Taxa):</i></b>	<b><i>Overview</i></b>
<b><i>Penstemon globosus/P. procerus</i></b> complex/ <b><i>P. attenuatus</i></b> complex/ <b><i>P. rydbergii</i></b> complex/ <b><i>P. confertus</i></b>	Common group of polymorphic <b>taxa</b> distributed throughout most of the CRB, occurring from the foothills to montane elevations; these are typically species of seasonally dry to perennially moist meadows
<b><i>Penstemon richardsonii/P. duustus</i></b> complex/ <b><i>P. triphyllus/P. venustus/P. fruticosus</i></b> complex	Common, herbaceous to suffruticose species found at lower to moderate elevation in foothills and dry ranges east of the Cascades; occurring mostly on cliffs, ledges, dry rocky slopes, and talus, not necessarily associated with sagebrush
<b><i>Penstemon acuminatus</i></b>	A <b>locally</b> distributed species restricted to low elevation sand dunes and other, loose sandy sites; widespread in the sagebrush-bunchgrass steppe zones of the CRB in eastern Washington, Oregon, and Idaho
<b><i>Penstemon cinicola</i></b> complex	A common herbaceous species forming discrete patches in open or disturbed areas generally consisting of extremely well-drained volcanic soils (often cindery or sandy), at lower to mid-elevation in and near the Cascades Range from central Oregon south and east into northern California; extremely <b>xeric</b> -adapted

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<p><i>Penstemon cusickii</i>/<i>P. gairdneri</i>/<i>P. humilus</i> complex/<i>P. eriantherus</i> complex</p>	<p><b>These are common</b> species of dry, open sites, sometimes occurring on scab or tuff, most populations associated with sagebrush across much of the <b>CRB</b> in Washington, and (<b>especially</b>) Oregon <b>and adjacent Idaho</b>; at lower to middle elevations</p>
<p><i>Individually Assessed Taxa:</i></p>	<p><i>O v e r v i e w :</i></p>
<p><i>Penstemon barrettiae</i></p>	<p>A bushy <b>to</b> suffruticose species, <b>endemic</b> to the Columbia River Gorge of Oregon and Washington, <b>occurring</b> on sheer basalt walls, <b>scree</b>, and rock cutbanks; USFS sensitive species and federal <b>candidate</b> (C2); generally considered to be threatened range-wide in Oregon and Washington (ONHP, 1993; WNHP, 1994)</p>
<p><i>Penstemon davidsonii</i> var. <i>praeteritus</i></p>	<p><b>Known from high</b>, rocky slopes in southeast Oregon desert ranges in the CRB; also in adjacent <b>northern</b> Nevada; considered to be sensitive in Oregon by BLM and ONHP (1993) but apparently not tracked in Nevada (Jim Morefield, Nevada <b>Natural</b> Heritage Program, personal communication); not a federal candidate</p>
<p><i>Penstemon duustus</i> var. <i>variabilis</i></p>	<p>Evidently distributed in south-central Washington and adjacent northern Oregon on dry, rocky slopes or <b>outcrops</b>; this is a rather poorly understood <b>taxon</b> considered in need of further review in Oregon (ONHP, 1993); listed as sensitive by the state of Washington (<b>WNHP</b>, 1994); not a federal candidate</p>

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<p><b><i>Penstemon glaucinus</i></b></p>	<p>Regional <b>montane</b> endemic in south-central Oregon above the California-Nevada line, on open slopes or meadows, or within dry forests; considered threatened throughout geographic range (ONHP, 1993), USFS Re-gion 6 sensitive; federal C2</p>
<p><b><i>Penstemon janishiae</i></b></p>	<p>Peripheral species in the CRB, found in southeastern Oregon and adjacent Idaho, then south to central Nevada, generally on barren, clay-ash soils; in need of further review in Oregon (ONHP, 1993); not tracked in Nevada (Jim Morefield, Nevada Natural Heritage Program, personal communication); priority 2 in Idaho (IDFG, 1994); not a federal candidate</p>
<p><b><i>Penstemon kingii</i></b></p>	<p>Localized species in the CRB, reported from extreme southeast Oregon, then ranging to south-central Nevada, on open sagebrush/ juniper plains and slopes; considered in need of further review in Oregon (ONHP, 1993); not tracked in Nevada (Jim Morefield, Nevada Natural Heritage Program, personal communication); not a federal candidate</p>
<p><b><i>Penstemon "nikei"</i></b></p>	<p>Reportedly related <b>to the <i>Penstemon miser-P. janishiae</i></b> group, found on ashy slopes in the sagebrush zone of southeast Oregon near the Idaho border; this unnamed entity is not yet formally tracked in Oregon (ONHP, 1993), but is under scrutiny by the Vale District BLM (Jean Findley, personal communication) pending <b>taxonomic</b> study</p>

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<p><i>Penstemon peckii</i></p>	<p>Regional endemic, found near the east base of the Cascades in central Oregon, <b>typically</b> in dry meadows and open <b>ponderosa</b> pine forests at middle elevations; considered threatened throughout range (<b>ONHP</b>, 1993) and a sensitive species by the USFS Region 6; federal candidate (C2)</p>
<p><i>Penstemon perpulcher</i></p>	<p>A peripheral species apparently in extreme southeastern Oregon, also distributed across southern Idaho, on sagebrush plains in dry, gravelly soils; considered in need of review in Oregon (<b>ONHP</b>, 1993); not tracked in Idaho (<b>IDFG</b>, 1994); not a federal candidate</p>
<p><i>Penstemon pratensis</i></p>	<p>Species of moist meadows, <b>streamsides</b>, and open aspen woodlands, evidently in mountain ranges and foothills of southeastern Oregon from Lake County east, and then extending south into the mountains of adjacent Idaho (Owyhee County) and the Nevada Great Basin to Eureka County; considered in need of review in Oregon (<b>ONHP</b>, 1993); not tracked in Nevada (Jim Morefield, Nevada Natural Heritage Program, personal communication) or in Idaho (<b>IDFG</b>, 1994); not a federal candidate</p>
<p><i>Penstemon seorsus</i></p>	<p>Typically a loose, matted perennial, distributed at lower elevations in sagebrush hills and slopes, scattered across central and eastern Oregon to southwestern Idaho; considered in need of review in both Oregon (<b>ONHP</b>, 1993) and Idaho (<b>IDFG</b>, 1994); not presently a federal candidate</p>

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<i>Penstemon spathulatus</i>	Subalpine to alpine endemic in north-eastern Oregon mountain ranges, on open, often barren slopes and fell-fields; considered in need of continued monitoring (ONHP, 1993); a former federal candidate (3C)
<i>Penstemon wilcoxii</i>	Locally common <b>species</b> in northeastern Oregon, peripheral in southeastern Washington, in wooded sites or thickets, often along <b>streams</b> , extending north into Idaho and Montana; not tracked in those states or in Oregon (ONHP, 1993; IDFG, 1994); recommended for continued monitoring in Washington ( <b>WNHP</b> , 1994); not a federal candidate

GROUP ASSESSMENTS:  
REPRESENTATIVE COMMON SPECIES

**Taxon Group:**

*Penstemon globosus*/P. *procerus* complex/P. *attenuatus* complex/P. *rydbergii* complex/P. *confertus*

**Criteria Used For Assessment:**

This is the most widespread species complex of *Penstemon* occurring predominantly in montane and mid-elevation dry to moist meadows and open, mesic slopes. Various **ecotypes** of these species occur throughout much of the CRB in appropriate habitats.

**Associated Cover Type(s):**

CRB: Subalpine herbaceous. **SAF**: Engelmann Spruce-Subalpine Fir; Whitebark Pine; Interior Douglas-Fir; Western White Pine; Aspen; Lodgepole; Interior Ponderosa Pine. **SRM**: Green **fescue**; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Ponderosa Pine-Shrubland; Mountain Big Sagebrush.

In grassy or herb-dominated meadows, occasionally along thickets or forest-meadow ecotones, in gravelly to sandy mineral soils; typical associates include species of *Eriogonum*, *Carex*, *Polemonium*, *Polygonum*, *Phleum*, *Festuca*, *Lupinus*, and *Arenaria*.

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

Distributed in suitable habitats throughout the CRB, especially prominent from eastern Washington and Oregon east.

### **Sensitivity to Disturbance:**

While populations of these species are common and scattered through many of the mountains of the CRB, they are seldom dominants and are probably vulnerable to drought and heavy grazing (from domestic livestock and big game). How the reproductive dynamics of the species respond to changes in vegetative structure or disruption of natural pollinators is unknown (see below). The disappearance of populations which are not naturally re-introduced over time is a possible indicator of deteriorating montane grazing conditions in herb-dominated meadow habitats. Information **is needed** concerning the reproductive requirements of the species, and how they might respond to reductions in insect pollinators through habitat loss.

### **Population Trends:**

No studies of population trends of these common species are available. Anecdotal observations suggest that as species, they are holding their own throughout the CRB, but populations are occasionally extirpated locally as a result of changes in hydrology, excessive grazing pressure, or substrate disturbances. Observations also suggest that the species are prolific seed producers and are capable of reestablishing populations **locally** or via immigration from nearby sites once disturbances abate. Vegetative spread, especially in *P. procerus*, also plays a role in maintaining populations. There are no available data on rates of establishment, presence of seedbanks, or losses from predation for these species.

### **Dispersal Mode and Requirements:**

Dispersal for these species may occasionally be accomplished by water, at least in meadows with streams or runoff channels. In most cases, however, dispersal is probably via wind. Short-distance dispersal may be facilitated by foraging insects or rodents, and rare long-distance dispersal may be effected by birds such as goldfinches.

Members of this species group are predominantly outcrossed (perhaps exclusively so, although no data are available regarding genetic compatibilities). Pollen dispersal is probably mostly local (by solitary bees; Meinke, **unpubl.**), except in rare cases where honeybees, bumblebees, sphinx moths, or hummingbirds visit the larger-flowered **taxa**.

### **Usefulness as Bioindicator:**

These species are potential indicators of changes in the hydrologic regime of montane meadows in the CRB, as well as indicators (by virtue of disappearance) of deteriorating conditions (usually associated with grazing) in and around moist and **mesic** meadows at middle or higher elevations.

**Taxon Group:**

*Penstemon richardsonii*/*P. duustus* complex/*P. triphyllus*/*P. venustus*/*P. fruticosus* complex

**Criteria Used For Assessment:**

These species are among the most commonly encountered in the CRB, and one or more are widespread at lower elevations throughout rangeland habitats and lower to middle elevation dry forests. They are comparable in their preference for lithic or very rocky-soiled substrates, not uncommonly occurring on sheer rock walls.

**Associated Cover Type(s):**

**SAF:** Interior Douglas Fir; White Fir; Lodgepole Pine; Interior Ponderosa Pine.

**SRM:** One or more species in potentially in all the SRM cover types except Chamise Chaparral and Salt Desert Scrub.

*Penstemon duustus* and *P. richardsonii* are very common on rock walls, cliffs, rocky roadcuts, and other similar habitats throughout the sagebrush/bunchgrass steppe regions of the low elevation CRB in Oregon and Washington. *Penstemon triphyllus* and *P. venustus* have similar requirements. The varieties of *P. fruticosus* are frequent components of rocky sites at moderate elevations in the mountains of the CRB.

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

One or more of these species occurs at low elevations within the sagebrush steppe throughout most of eastern Washington and Oregon (including the Columbia River Gorge).

**Sensitivity to Disturbance:**

All of these species have been observed behaving as colonizers after disturbance, responding to natural events (such as slumps, rockslides, and scoured bedrocks) as well as human-caused perturbations (such as rockwalls blasted for road construction and rocky, graded roadsides). Their palatability to cattle and native ungulates is probably minimal, based on an apparent increased presence in heavily grazed areas (especially for *Penstemon duustus* and *P. richardsonii*). However, this has not been specifically studied. Also unknown is the degree to which the species depend on pollinators that might be impacted by disturbances such as grazing, fire, construction, etc.

**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 all the species are well represented by numerous, healthy populations across the sagebrush and bunchgrass dominated ecosystems of the CRB. Populations are often large and extended.

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Informal monitoring of *Penstemon triphyllus* in the early 1980's indicated the species increased over four years on disturbed roadsides as long as the disturbances were not repeated annually (Meinke, unpubl.). The other species in this group also appear to increase after disturbance, although there are no available data to confirm this. Unknown is how these species are affected by competition in non-disturbed sites and whether their preference for rocks is perhaps a competition avoidance mechanism.

### **Dispersal Mode and Requirements:**

All penstemon species rely principally on wind and gravity to disperse seeds, but these species are especially dependent on breezes to blow seeds up on cliffs and into crevices where seedlings germinate and fulfill early moisture requirements. Many seeds must be lost for each that manages to find a safe site for establishment, especially in *Penstemon richardsonii*, a species almost exclusively found on cliffs but with no obvious means of specialized dispersal. *Penstemon duustus* and *P. triphyllus* are similarly successful on vertical, rocky substrates (although not quite to the degree of *P. richardsonii*).

All the species are probably principally outcrossed (based on observations of floral morphology), and would in any case require pollinators to effect pollen dispersal between plants. Large bees or wasps may be able to move pollen between adjacent populations. However, there is surprisingly little information about the pollination biology of *Penstemon* species in the CRB.

### **Usefulness as Bioindicator:**

These species are indicators of very dry conditions in general, although *Penstemon richardsonii* may occur near seeps in parts of its range. An overabundance of *P. duustus* is a potential indicator of overgrazing, yet sites where this and the other species in this group occur are never very productive from a range management standpoint, even in an undisturbed condition.

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### **Taxon Group:**

*Penstemon acuminatus*

### **Criteria Used For Assessment:**

This species is the only penstemon in the CRB that is essentially a sand dune endemic. Others sand-loving penstemons occur to the south in the Great Basin.

### **Associated Cover Type(s):**

**SRM:** Bluebunch Wheatgrass; Antelope Bitterbrush-Bluebunch Wheatgrass; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass; Big Sagebrush; Salt Desert Scrub.

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This species is restricted to the margins of dunes or other loose, sandy sites, including old riverbeds and terraces. It also is occasionally found in sandy microsites within open grassland or scattered shrub steppe at low elevations (as on the Vale BLM District). Common associates include species of *Stanleya*, *Cryptantha*, *Astragalus*, *Camissonia*, *Oenothera*, *Stipa*, and *Oryzopsis*.

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

From southern Washington south and east across Oregon into southern Idaho.

### Sensitivity to Disturbance:

*Penstemon acuminatus* colonizes open sand dunes and sandy slopes near rivers, and occurs along old river terraces, but does poorly in association with many other perennials. Grazed plants of the species have been observed; the degree of palatability and whether the observed damage was from cattle or other animals is unknown. The species is hairless and almost succulent, and provides what little green forage there is in many extremely dry sandy locations in eastern Oregon. Removal or stabilization of sand would surely prove detrimental to this species. Reduction of pollinator populations may also be a potential problem, although nothing specific is known about the reproduction of this species.

### Population Trends:

Populations observed in eastern Oregon (mostly in Malheur County) have remained reasonably stable during the last decade based on several observations of selected sites since 1980 (Meinke, unpubl.), but there are no plots or other means in place for confirming demographic trends. On a range-wide basis it is difficult to imagine the species is declining. Populations are tied to the existence and distribution of sand dunes (as along the Snake River at Farewell Bend in Oregon and Idaho) and other loose, sandy substrates. The species would surely be impacted if any shift in the dynamics of these systems occurred.

### Dispersal Mode and Requirements:

This species evidently depends primarily on wind to distribute seeds; seeds may be occasionally disseminated via water for populations occurring near rivers. Means of local dispersal might also include foraging insects or birds.

Pollen is dispersed by a range of insect visitors, including large bees (*Bombus* and *Osmia*) and vespine wasps (Meinke, unpubl.).

### Usefulness as Bioindicator:

This *Penstemon* is obviously an excellent indicator of sandy substrates, although one rarely has to depend on the presence of the species to ascertain that. Large vigorous populations, in association with abundant *Oryzopsis* and other psammophytic grasses and forbs, may be considered indicators of locally good range condition and a healthy flora. Sometimes these sites are spared to some degree, even in the most overgrazed areas (such

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as near Grassy Mountain in Malheur County), due to the lack of water, excessive heat. (from reflection), and poor footing experienced by livestock.

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### **Taxon Group:**

*Penstemon cinicola* complex

### **Criteria Used For Assessment:**

This a locally common species (formerly considered sensitive) on the east slope of the Cascades and then occurring sporadically southeast, typically occurring in highly drained volcanic substrates including cinders, pumice, and gravelly sands. It occupies a somewhat unique niche in the CRB for the genus (the related *P. procerus* sometimes occurs in similar, although more **mesic**, sites).

### **Associated Cover Type(s):**

**CRB:** Barren. **SAF:** Interior Douglas Fir; Lodgepole Pine; Interior Ponderosa Pine. SRM: Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Ponderosa Pine-Shrubland; Mountain Big Sagebrush.

Populations of *Penstemon cinicola* frequent dry openings in ponderosa or, more commonly, lodgepole pine forests. Although sometimes in sandy microsites within dry meadows, the species is not associated with **springs** or vernal moisture.

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

*Penstemon cinicola* occurs from Deschutes County south and **eastto** Lake County, Oregon, then south to **Lassen** County, in northeastern California..

### **Sensitivity to Disturbance:**

Populations appear capable of rebounding from disturbances, and will colonize volcanic substrates in dry meadows and lodgepole forests. Plants have been observed growing along roadsides, in tire ruts, and near highway department gravel piles in the Cascades. Long-term responses of the species to continued site disturbance is unknown. Dependence on insects (typically native semi-social to solitary bees) for pollination and **seed** set in *Penstemon cinicola* is also unknown, as is any bearing substrate disturbance may have on the pollination ecology of the species or its pollinators.

### **Population Trends:**

Many populations are known for this species throughout the western CRB in Oregon. Although no monitoring studies have been carried out owing to the high number of sites, observations over the last decade (Meinke, unpubl.) indicate that the species is exceedingly abundant in many local areas, and occurs in apparently stable or even increasing numbers along numerous roads and minor developments (hence it's removal from any sensitive status -- ONHP, 1993).

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### Dispersal Mode and Requirements:

The species does not normally occur near open water, so wind is apparently the primary dispersal agent. Vehicles may also aid in the dispersal of seeds shed along well-traveled roadways. Observations (Meinke, unpubl.) suggest that *Penstemon cinicola* is bee-pollinated (apparently ground-nesting solitary bees; rarely bumblebees or syrphid flies), and that the species probably requires insect visitation for effective pollen/gene flow and reproduction.

### Usefulness as Bioindicator:

This species is representative of the high desert and dry forest herbaceous flora that inhabits central Oregon's **volcanic** soils near the Cascades -- it should be considered indicative of lower than average soil moisture conditions. Although apparently not especially sensitive to substrate disturbance, *Penstemon cinicola* is a locally common species whose decline in any given area might signal a general deterioration of range or forest understory conditions.

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### Taxon Group:

*Penstemon cusickii*/*P. gairdneri*/*P. humilus* complex/*P. eriantherus* complex

### Criteria Used For Assessment:

Common species group characterizing sagebrush ecosystems, including open scabland sites.

### Associated Cover Type(s):

**SRM:** Bluebunch Wheatgrass; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass; Ponderosa Pine-Shrubland; Ponderosa Pine-Grassland; Mountain Big Sagebrush; Wyoming Sagebrush; Wheatgrass-Needlegrass.

These are arguably the most common, widespread species of *Penstemon* in Washington and Oregon occurring within the lower to middle elevation sagebrush zones (although microsites for **the various** species may or may not actually have *Artemisia* as an immediate associate). Populations are **generally** found in gravelly or rocky sites, as along ridges, in the foothills, along the base of talus slopes, etc. Common associate genera include *Eriogonum*, *Erigeron*, *Castilleja*, *Phacelia*, *Sitanion*, *Allium*, *Lomatium*, *Poa*, *Stipa*, *Arabis*, *Ranunculus*, *Collomia*, *Lithophragma*, *Phlox*, *Lewisia*, *Astragalus*, and *Leptodactylon*.

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

Widespread throughout the sagebrush plains and foothills of the CRB in Oregon, Washington, and Nevada, occasionally extending to mid-elevations on open mountain slopes but avoiding the higher ranges.

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### **Sensitivity to Disturbance:**

There is little opportunity to evaluate the potential sensitivity of these species since there are no demographic or other monitoring studies in place. Grazing activities in sagebrush ecosystems are prevalent throughout the CRB, however, and may have reduced populations of all four **taxa** in parts of eastern Oregon and Idaho. The species are seldom seen in highly grazed habitats (Meinke, unpubl.). However, grazing might just as easily have a negligible effect in some cases, since the species often occur on rocky sites that are generally less attractive to livestock than adjacent deeper-soiled areas where forage is more plentiful. The proclivity of populations to occur on rocky soils probably make them somewhat less susceptible to many substrate disturbances – populations of *P. cusickii* and *P. humilus*, for example, have been observed thriving on fire breaks with minimal soil development, and those of *P. eriantherus* along eroded trails. However, potential interactions among seedlings of these species and the ubiquitous, grazing facilitated weeds (such as cheatgrass) that dominate even the stonier sagebrush ranges in the CRB are unknown. Likewise, the reproductive dynamics of these species, including any dependencies on native pollinators (and their sensitivity to disturbance), is largely unstudied.

### **Population Trends:**

Population trends are not **specifically** known, since there have been no specific studies on the abundance or demography of these **taxa** in Oregon, Washington, or Nevada. Casual observation by the author over the last 15 years suggests that their populations are nonetheless still abundant and widespread on a rangewide basis.

### **Dispersal Mode and Requirements:**

Wind and gravity are the only expected modes of seed dispersal for these species. Local seed dispersal might be facilitated by foraging insects or rodents. Native bees have been observed visiting flowers and presumably dispersing pollen for **all** species except *P. eriantherus*, which probably has a similar pattern of visitation based on floral morphology.

### **Usefulness as Bioindicator:**

As species common to sagebrush habitats in the CRB, populations of these **taxa** (along with other common herbaceous natives) may be useful in monitoring conditions of these ecosystems, and are good indicators of rangeland biodiversity. These **taxa** are components of the spring flora indigenous to the heavily impacted (by **grazing**) lower to middle elevation sagebrush country. Their long-term presence, as part of an herb-rich understory (as opposed to a layer of mostly exotic annuals), could be considered one indicator of relatively healthy conditions for certain ranges. Concentrations of populations on the rockiest or least productive sites (from a range perspective) could be an indication of excessive grazing.

INDIVIDUAL SPECIES ASSESSMENTS:  
CANDIDATE OR SENSITIVE TAXA

**Taxon:**

*Penstemon barrettiae*

**Criteria Used For Assessment:**

Sensitive species (USFS Region 6); federal candidate

**Associated Cover Type(s):**

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

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

Distributed in the Columbia River Gorge (and up the Klickitat River) in Hood River and Wasco counties, Oregon, and Klickitat County, Washington. This species has one of the most restricted geographic ranges of CRB penstemons (Every, 1977; Alverson and Sheehan, 1986).

**Sensitivity to Disturbance:**

The species is insulated from most disturbances by growing primarily on vertical cliffs or rocky outcrops. If cliff habitats or other suitable rocky sites are destroyed or severely altered, populations may be unable to return. Plants will occur on lithic **roadcuts** or around **railway** tunnels, however, so re-colonization is **certainly** possible in some instances (Alverson and Sheehan, 1987; Meinke, unpubl.). Starts have also been transplanted with reasonable success on high basalt walls by Berry Botanic Garden staff in the 1980's (Julie Kierstead, personal communication), but the effort required is probably more than can be expected on a routine basis. Plants may require moisture sources such as trapped precipitation or even seepage, and any change in hydrology on the **cliffs** would presumably impact such populations. Nothing is known concerning seedling dynamics of this species in nature, or reproductive requirements in **general** (such as breeding system details, etc.)

**Population Trends:**

There are no quantitative demographic studies completed or in progress for this species. Although known from a limited area, populations are not noticeably declining, but are apparently not expanding either (based on casual observations over the last decade), except where disturbance offers limited opportunities for colonization (Alverson and Sheehan, 1987). As sites are occasionally lost or depleted by imprudent construction actions or zealous collectors (this is a highly prized, widely cultivated species in the United States and abroad), some populations will likely lose ground, barring efforts at site restoration.

**Dispersal Mode and Requirements:**

Wind and gravity are the only expected dispersal agents for this species. There is no other obvious means by which the populations maintain themselves on cliff surfaces. Native bees have been observed to transport pollen, including bumblebees (Alverson and Sheehan, 1986) and various solitary species, as well as incidental syrphid and **beeflies** (Meinke, unpubl.).

**Usefulness as Bioindicator:**

Populations of *Penstemon barrettiae* are indicators of basalt substrates.

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**Taxon:**

*Penstemon davidsonii* var. *praeteritus*

**Criteria Used For Assessment:**

Sensitive species (BLM)

**Associated Cover Type(s):**

SRh4: Bluebunch Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass; Wyoming Big Sagebrush.

This is a low, **shrubby** penstemon of high elevation rocky or talus **outcrops**, or gravelly, mineral soils, within a matrix of dry patchy bunchgrasses, low thickets, aspen clones, and/or subalpine herb-dominated slopes; it often occurs with species of *Cymopterus*, *Phacelia*, *Arabis*, *Cercocarpus*, *Stipa*, *Castilleja*, *Phlox*, *Ceanothus*, *Melica*, and *Ivesia*.

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

This is a regional endemic, from high mountains in southern Hamey and Malheur counties, Oregon to north-central Nevada in Humboldt County (Cronquist, 1964).

**Sensitivity to Disturbance:**

This **taxon** is probably resilient to moderate disturbances, growing on very rocky substrates, and is capable of reseeding **itself** in moderately disturbed sites. Considering the remote habitats, chances of extirpation from intense disturbance seem slim. Cattle commonly graze the areas where the species has been observed; the effects (if any) on reproduction and recruitment is unknown.

**Population Trends:**

Unknown; presumably secure since the populations are generally on very stable substrates in relatively remote areas. Grazing is locally widespread within the range of the **taxon**, but mature plants are apparently ignored by cattle, who tend to ignore vegetation occurring on rocky substrates that afford unstable footing. Potential impacts on pollinators are unstudied.

**Dispersal Mode and Requirements:**

Dispersal of seeds is primarily via wind; local dispersal possibly accomplished by foraging insects 'or rodents. Pollen dispersal is apparently by large and small native solitary bees, bumblebees, and rarely hummingbirds, based on field observations in southeastern Oregon (Meinke, unpubl.).

**Usefulness as Bioindicator:**

The species is representative of high-elevation rocky outcrops.

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**Taxon:**

*Penstemon duustus* var. *variabilis*

**Criteria Used For Assessment:**

Sensitive species (BLM)

**Associated Cover Type(s):**

**SRM:** Bluebunch Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Big Sagebrush.

Plants occur in crevices in lava flows, on rocky outcrops, talus slopes, roadcuts, and bare, often disturbed microsites, often in association *with* species of *Chrysothamnus*, *Opuntia*, *Stanleya*, *Lomatium*, *Thelypodium*, and *Mentzelia*.

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

Populations extend from extreme southern Washington, from Klickitat County, to east-central Oregon in Grant County (Keck, 1940; ONHP, 1993; WNHP 1994).

**Sensitivity to Disturbance:**

There have been no specific studies of *Penstemon duustus* and disturbance, but observations across much of Oregon suggest that all varieties of the species are able to colonize barren sites such as roadcuts, exposed bedrock, dry cliffs, etc.

**Population Trends:**

There have been no studies of the demography of this or any other variety of *Penstemon duustus*. Observations suggest that typical *P. duustus* is not declining in the CRB, but possibly increasing in overgrazed and drought-stricken areas. Whether this apparent trend holds for *the var. variabilis* is unknown, but there is no evidence that the *infraspecific taxa* of this species have different ecological requirements. This may be worth investigating further.

**Dispersal Mode and Requirements:**

Seed dispersal of this species is probably entirely accomplished by wind and gravity, although local dispersal may be facilitated by rodents, birds, or foraging insects. Pollinators of this species have been reported as moths (Keck, 1940), but there are no

current observations of this. Small bees have been observed collecting pollen (Meinke, unpubl.)

**Usefulness as Bioindicator:**

The species is an indicator of desiccated soil conditions, although this would generally be evident from the habitat.

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**Taxon:**

*Penstemon glaucinus*

**Criteria Used For Assessment:**

Sensitive species (USFS Region 6); federal candidate

**Associated Cover Type(s):**

**SAF:** Interior Ponderosa Pine; Lodgepole Pine; Whitebark Pine.

This species generally occurs within or adjacent to middle to high elevation coniferous forests, in shallow, often sandy/loamy, volcanic soils, sometimes along rocky points or ridgelines, occasionally in stony meadows. Associates include species of *Arctostaphylos*, *Castilleja*, *Holodiscus*, *Arenaria*, *Lomatium*, *Viola*, *Lupinus*, *Haplopappus*, *Artemisia*, and *Eriogonum* -- for a more complete listing see Popovich (1990).

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

Mid- to high-montane areas of southern Lake and adjacent Klamath counties, in south-central Oregon near the southwest border of the CRB.

**Sensitivity to Disturbance:**

The species is a tenacious perennial herb that may benefit from moderate levels of timber harvest or other disturbances, including fire, as populations reportedly spread once ground cover is removed (Vincent and Vincent, 1980). Accordingly, populations may be limited by fuel build-ups promoted by fire suppression. Moreover, the relative lack of seedlings reported (Popovich, 1990; Bob Wooley, USFS, personal communication) may also be related to fire suppression. Local Forest Service botanist Steve Popovich (1990) is less sure about the role of disturbance in the ecology of the species, noting that "very few plants were found in disturbed areas" during his inventories. This is in contrast with observations by the author of this report (Meinke, unpubl.) and a later Forest Service botanist (Bob Wooley, USFS, personal communication), who have witnessed populations of the species in other than pristine sites (including around slash bum piles, along road margins, and in areas cleared of vegetation). There are no long-term demographic data to evaluate the likelihood of populations persisting and expanding in disturbed sites, or their requirements in terms of light, competition, recruitment of seedlings, germination biology, or reproduction (including the maintenance of soil seed banks).

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### Population Trends:

Populations of *Penstemon glaucinus* have been observed and studied (although not rigorously monitored) by several botanists over the last 15 years (Vincent and Vincent, 1980; Popovich, 1990; Vander Schaaf, 1990; Wooley, 1993). Numerous populations have been discovered since the species was initially considered very rare in the mid-1970's (Siddall and Chambers, 1978) -- currently between 120,000 and 200,000 plants are estimated to exist (Popovich, 1990; Meinke, unpubl.). Whether or not populations are increasing or declining is unknown, since there are no precise demographic studies in progress. However, observations suggest that the species is holding its own in many parts of its limited range, and that it fares well under disturbance regimes that periodically open the forest canopy or reduce associate vegetative cover.

### Dispersal Mode and Requirements:

Dispersal of seeds is primarily via wind, with local dispersal possibly accomplished by foraging insects or rodents. Pollen dispersal is accomplished by large and small native bees, based on field observations, including *Bombus* and *Osmia*, and occasionally sphinx moths (Meinke, unpubl. ; Bob Wooley, USFS, unpubl.).

### Usefulness as Bioindicator:

Current local distribution of *Penstemon glaucinus* may be a possible indicator of past fire patterns, considering the apparent tendency of the species to move in after disturbance clears the terrain. *Penstemon glaucinus* occasionally co-occurs with *Castilleja chlorotica*, another localized federal candidate species.

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### Taxon:

*Penstemon janishiae*

### Criteria Used For Assessment:

Sensitive species (BLM)

### Associated Cover Type(s):

**SRM:** Bluebunch Wheatgrass; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Wyoming Big Sagebrush; Idaho Fescue-Bluebunch Wheatgrass.

This species is almost entirely restricted to moderately to poorly drained soils derived from weathered ash or ash/clay deposits. It has few herbaceous associates on these open, often barren slopes. These usually include species of *Allium*, *Asclepias*, *Castilleja*, *Mentzelia*, *Cymopterus*, *Phacelia*, *Mimulus*, and *Leptodactylon*.

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

This tufted perennial extends from southern Hamey and Malheur counties, Oregon, south across northeastern California and central Nevada.

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### **Sensitivity to Disturbance:**

Tolerance to disturbance for the species is unknown. Since populations are edaphically restricted, conventional wisdom suggests that the species might not fare well after major substrate disturbances (such as mining), which have the potential to remove large amounts of soil and upend soil horizons. One time moderate surface disturbances may not be a problem, however, if the top soil were merely “rearranged” as opposed to completely removed or inverted. This scenario assumes seeds are available on-site or somewhere close at hand for local immigration purposes. Repeated surface perturbations, as from annual all-terrain vehicle racing, would probably limit population recovery. There have been few studies of the abilities of edaphic **endemics** to re-colonize sites after disturbance, in relation to increased competition or changes in soil hydrology or chemistry, and none are known to have been completed for this **taxon**. Also unknown is the potential for soil surface disturbances to impact populations of any necessary **pollinators**.

### **Population Trends:**

No monitoring projects have been implemented for *Penstemon janishiae*. Moreover, the species has not been under review long enough for much anecdotal information about trends to accumulate.

### **Dispersal Mode and Requirements:**

As with most of the beardtongues, *Penstemon janishiae* disperses seeds primarily via wind and gravity, with many presumably lost as **they** are blown off the requisite ash/clay substrates. Pollen flow is also probably very local, judging by the foraging behavior and flight patterns of the floral visitors (mostly solitary bees and small syrphid flies) observed on the related species *Penstemon miser* (Meinke, unpubl.), which is morphologically comparable and occurs in similar sites.

### **Usefulness as Bioindicator:**

This species is restricted to weathered ash and ash/clay outcrops, and it may conceivably be used in the future as an indicator of one or more specific minerals (such as **zeolitic** deposits). Evidence of this species at a site may also signal the presence of additional edaphically restricted **taxa**, including moisture-sensitive **spring annuals** (such as *Chaenactis cusickii*) that are not present every year above ground.

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### **T&on:**

*Penstemon kingii*

### **Criteria Used For Assessment:**

Sensitive species (BLM)

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### Associated Cover Type(s):

**SRM:** Bluebunch Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass.

Populations inhabit dry foothills, sagebrush plains, and montane slopes at moderate to high elevations, often **with** species of *Castilleja*, *Calochortus*, *Stipa*, *Collomia*, *Crepis*, *Cercocarpus*, and *Holodiscus*.

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

*Penstemon kingii* is known in Oregon only from southern Malheur County, and then south through central Nevada in the Great Basin, as far as northern Nye County.

### Sensitivity to Disturbance:

Completely unknown; this species is currently under review and just coming to the attention of federal land managers, and is evidently not tracked in Nevada. Presumably it will be found to face at least the routine difficulties often resulting from grazing-associated habitat alterations, including competition with exotic annuals and shifts in patterns of vegetative cover.

### Population Trends:

There are no demographic data available for this species, or as yet any anecdotal reports on population trends.

### Dispersal Mode and Requirements:

Seed dispersal of this species is probably entirely accomplished by wind and gravity, although local dispersal may be facilitated by rodents, birds, or foraging insects. Pollination requirements are unknown, but probably are comparable to other species of *Penstemon* occurring in sagebrush ecosystems (i.e., pollen primarily transferred by suites of small to large native bees).

### Usefulness as Bioindicator:

Too little is currently known about *Penstemon kingii* in the CRB to speculate on any indicator roles.

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### Taxon:

*Penstemon "nikei"*

### Criteria Used For Assessment:

This unpublished epithet represents a series of populations (possibly related to *Penstemon miser*) with possibly unique morphological traits that are being tracked by the Vale District of the BLM (Jean Findley, BLM, personal communication).

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

**SRM:** Wyoming Sagebrush; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass.

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Populations are localized on barren or eroded slopes, predominantly in ash or ash/diatomite substrates, within the sage-scrub.

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

Populations are known in the CRB only from **Malheur** County, Oregon, where they are scattered in appropriate sites in the northeastern and east-central part of the county; distribution outside of Oregon and the **CRB** is unknown.

### **Sensitivity to Disturbance:**

Unknown; however, cattle have been grazing in the vicinity of populations for many years, and there is no reason to believe they were not more or less co-existing with livestock before their relatively recent discovery by botanists. In actuality, cattle probably avoid the hot barren slopes inhabited by "*P. nikei*," since these sites afford little in the way of forage or shade. A greater potential threat comes **from** any activities that would directly impact the barren slopes the plants inhabit, possibly including mining or all-terrain vehicle traffic. The latter, although not as potentially devastating to the habitat as mining, could be equally detrimental if it was a consistent and repeated activity (thereby not permitting re-colonization to take place). Of course, basic understanding of the biology of *Penstemon* "*nikei*," and how this relates to its ability to return to impacted habitats, is completely unstudied.

### **Population Trends:**

Unknown -- however, in lieu of mining or other significant substrate disturbances, it is difficult to imagine any great shift in population size for this or any other edaphically restricted perennial herb in the CRB.

### **Dispersal Mode and Requirements:**

Dispersal of seeds is primarily via wind, with local dispersal possibly accomplished by foraging insects or rodents. Seeds that are dispersed to sites away from the ashy slopes are probably permanently lost to the populations. Pollen dispersal is most likely accomplished by various native bees and potentially 'sphinx moths, based on field observations of the morphologically and ecologically similar *Penstemon miser* (Meinke, unpubl.).

### **Usefulness as Bioindicator:**

*Penstemon* "*nikei*" is restricted to ash and or diatomaceous outcrops and, as with *P. janishiae*, populations may conceivably be used in the future as indicators of one or more commercially viable minerals (such as zeolites). Evidence of this species at a site may also signal the presence of additional edaphically restricted **taxa**, including several potentially sensitive spring annuals that are not visible above ground except in years of higher than average rainfall.

## MEINKE: EASTSIDE ECOSYSTEM MANAGEMENT PROJECT: *PENSTEMON*

### **Taxon:**

*Penstemon peckii*

### **Criteria Used For Assessment:**

Sensitive species (USFS Region 6); federal candidate

### **Associated Cover Type(s):**

**SAF:** Interior Ponderosa Pine. **SRM:** Ponderosa Pine-Shrubland; Ponderosa Pine Grassland.

*Penstemon peckii* occurs in exposed dry meadows, or under an open or partially closed canopy of mixed coniferous forest usually dominated by ponderosa pine, in disturbed or undisturbed substrates. Soils are gravelly-loamy to rocky, predominantly volcanic in origin. The understory sites for the species may be sparse and open, while populations located in the drier meadow habitats typically have numerous associates, including species of *Carex*, *Phacelia*, *Prunella*, *Potentilla*, *Arctostaphylos*, *Berberis*, *Calochortus*, *Mimulus*, *Agropyron*, *Stipa*, and *Lupinus*.

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

The species is a regional endemic, restricted to open forests along the east flank of the Cascades in central Oregon, in Deschutes and Jefferson counties. Older reports of the species from the Mt. Hood area are almost certainly erroneous (Ken Chambers, OSU, personal communication), and were possibly based on *Penstemon humilus*.

### **Sensitivity to Disturbance:**

There is no question that *Penstemon peckii* appears to respond well to limited disturbances, such as forest thinning operations that mildly scarify the soil (Pogson, 1979; Greenleaf, 1980; Field, 1985; Meinke, unpubl.), although complete removal of the overstory may have at least a short-term deleterious impact on populations (Pogson, 1979). The larger question is how the species responds to the major disturbances associated with logging over many years. Intuition (based on these earlier studies and observations) suggests that the species will fare well under all but the most rigorous disturbance regimes, and even then, populations may persist or eventually be replenished by natural processes. A striking example of this is given by Greenleaf (1980), in which she cites a report of a population of *P. peckii* apparently thriving in a formerly disced field planted to wheat years earlier.

The primary habitat for *P. peckii* is not remarkable or unusual in any noticeable way, and the species exists as a series of more or less contiguous "metapopulations" over most of its limited range. This undoubtedly facilitates immigration as disturbed areas come and go, and should buffer the species from reasonable logging activities. *Penstemon peckii* can apparently maintain a limited seed bank, although the dynamics of this are not well understood (Cheryl Ingersoll, OSU, personal communication).

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### Population Trends:

Populations of *Penstemon peckii* appear to be stable in most areas of its range, possibly increasing in open areas and meadows not subject to continuous disturbance.

### Dispersal Mode and Requirements:

Dispersal of seed is probably via wind and gravity, although some water-mediated dissemination may occur in meadows (such as near the Metolius River) or along snowmelt channels. Local animal and insect foragers may also conceivably play a minor role. Pollinators are reported to include native solitary bees (*Osmia*), which are prolific in the area (Pogson, 1979; Andy Moldenke, OSU, personal communication), as well as bumblebees and occasional syrphids and beeﬂies (Meinke, unpubl.).

### Usefulness as Bioindicator:

The current distribution of *Penstemon peckii* populations may be indicative of past disturbance patterns that opened or removed forest and meadow cover, including fires.

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### Taxon:

#### *Penstemon perpulcher*

### Criteria Used For Assessment:

Sensitive species (BLM)

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

SRh4: Bluebunch-Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass; Western Juniper-Big Sagebrush-Bluebunch Wheatgrass.

Populations are distributed on loamy to sandy sagebrush-dominated hills and plains, at lower to middle elevations, with species of *Allium*, *Lomatium*, *Astragalus*, *Thelypodium*, *Arabis*, *Collomia*, *Stipa*, *Phlox*, and *Erigeron* (in Idaho; Oregon associates not observed).

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

The species may extend from southeastern Oregon, in Malheur County, south and east through Idaho to Bingham County. The putative occurrence of *P. perpulcher* in Oregon is debated, based on the potential for misidentification due to its similarity to the common related species *P. speciosus* (Robin Lodewick, personal communication with Scott Sundberg, OSU Herbarium). However, the OSU Herbarium has a specimen in its collections identified by Noel Holmgren as *P. perpulcher*, collected near Vale in northern Malheur County.

### Sensitivity to Disturbance:

Unknown; possibly sensitive to competition with exotic annual grasses and other range weeds.

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### Population Trends:

No formal demographic studies have been completed for this species, inasmuch as it has only recently been added to the list of **taxa** needing a status review.

### Dispersal Mode and Requirements:

Seeds are probably locally dispersed by wind, possibly also by foraging insects or small birds or mammals. Pollen dispersal is unknown, but may be similar to that of the related species *Penstemon payettensis*, which is visited by small bumblebees and solitary bees (possibly *Osmia* -- Meinke, unpubl.).

### Usefulness as Bioindicator:

Not enough is known about this species to speculate on its potential as an indicator.

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### Taxon:

*Penstemon pratensis*

### Criteria Used For Assessment:

Sensitive Species (BLM)

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

**SAF:** Aspen. **SRM:** Western Juniper-Big Sagebrush-Bluebunch Wheatgrass.

The species typically grows in moderately to poorlydrained meadows, **mesic** shrub-steppe flats, or along meandering streams, within middle to high elevation sagebrush-dominated communities or open aspen woodland. Associates reportedly include species of *Castilleja*, *Aquilegia*, *Ranunculus*, *Alopecurus*, *Carex*, *Allium*, *Phacelia*, *Hesperochiron*, and *Lewisia*.

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

This mesophytic perennial is reported from mountain ranges of southern Lake, Hamey, and Malheur counties, and then southeast through Owyhee County, Idaho to as far south as Eureka County, Nevada.

### Sensitivity to Disturbance:

Populations of this meadow species are probably never major components of the communities they inhabit, and are probably vulnerable to drought and heavy grazing (from domestic livestock and potentially big game). How the reproductive dynamics of the species respond to changes in vegetative structure or disruption of natural pollinators is unknown. The disappearance of *Penstemon pratensis* populations (those which are not naturally re-introduced over time after disturbance) is a possible indicator of deteriorating montane grazing conditions in herbaceous or low shrub-dominated meadow habitats, or aspen understories.

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**Population Trends:**

There have been no monitoring studies implemented for this species, and no anecdotal observations are available.

**Dispersal Mode and Requirements:**

Localized seed dispersal is probably the rule for the dry meadow populations of this species, while plants adjacent to streambanks may disperse seeds longer distances via flowing water. Pollen dispersers are for the most part unstudied, but include **medium-sized** solitary bees (such **as** *Osmia*) and sphinx moths (observed on a single visit to southeastern Oregon), and possibly smaller semi-social species and bumblebees, which have been noted on the closely related *Penstemon rydbergii* in northeastern Oregon (Meinke, unpubl.).

**Usefulness as Bioindicator:**

*Penstemon pratensis* is probably an indicator of localized wetlands, or at least of sites with some potential for above average water storage during the growing season.

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**Taxon:**

*Penstemon seorsus*

**Criteria Used For Assessment:**

Sensitive species (BLM)

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

**SRM:** Western Juniper-Big Sagebrush-Bluebunch Wheatgrass; Wyoming Big Sagebrush; Bluebunch Wheatgrass; Idaho Fescue-Bluebunch Wheatgrass.

This species occurs in the dry, rocky soil of ridgelines, stony slopes, and other similarly well-drained sites, at middle elevations in sagebrush-dominated communities. It commonly co-occurs with species of *Ipomopsis*, *Collomia*, *Calochortus*, *Castilleja*, *Leptodactylon*, *Lithophragma*, and *Eriogonum*.

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

. Populations are known from Owyhee County, Idaho, north and west through much of the CRB in Oregon to Jefferson County. The range of this species is apparently not at all continuous, however, with herbarium records indicating a very sparse and scattered distribution.

**Sensitivity to Disturbance:**

There are no known biological or ecological studies for *Penstemon seorsus*. Based on casual field observation, the species is commonly found in comparatively less disturbed locations in the shrub-steppe, i.e., sites that may be somewhat less susceptible to grazing-related damage due to their rocky substrates (which provide poor footing and less optimal

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forage conditions). 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 very well benefit from wildfires that open the low shrub cover. How grazing activities might impact potential pollinators is unknown, as is important information on seed bank and germination dynamics, and relationships with potential exotic competitors (especially after substrate disturbance or fire).

### **Population Trends:**

There are no demographic studies available for this *penstemon* species. Over the last decade, casual observations of selected populations in southeastern Oregon indicate no evident change in population status (Meinke, unpubl.), but there are no data to substantiate this.

### **Dispersal Mode and Requirements:**

*Penstemon seorsus* disperses seeds via wind and gravity -- the species is never found near open water, so this can be discounted as a routine mode of dispersal. The dispersal of pollen may be facilitated by small native bees (*Dialictus*) and syrphid flies observed visiting flowers (Meinke, unpubl.); undoubtedly other insects, such as small bumblebees, forage on the flowers of this species as well.

### **Usefulness as Bioindicator:**

As a species widespread (if not common) in sagebrush habitats in the Oregon portion of the **CRB**, populations of *Penstemon seorsus* (along with other common herbaceous natives) may be valuable in monitoring the long-term conditions of these ecosystems, and may be useful indicators of rangeland **biodiversity**. This species is one component of the spring flora indigenous to the heavily impacted (by grazing) middle elevation sagebrush country in the CRB. The continuous presence of *Penstemon* populations, as part of an herb-rich understory (as opposed to a layer of mostly exotic annuals), could be considered one indicator of relatively healthy conditions for certain ranges. Concentrations of small populations only on the very rockiest or least productive sites (from a range management perspective) could be an indication of excessive grazing.

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### **Taxon:**

*Penstemon spathulatus*

### **Criteria Used For Assessment:**

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

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

**CUB**: Alpine tundra; Subalpine Herbaceous. **SAF**: Whitebark Pine; Engelmann Spruce-Subalpine Fir, **SRM**: Green Fescue.

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Populations occur high in the mountains along rocky ridgelines, on grassy promitories, and near loose talus slopes and slides, avoiding areas where snow lies late in the spring and summer. Associates include species of *Erigeron*, *Castilleja*, *Monardella*, *Stipa*, *Carex*, *Draba*, *Silene*, and *Ribes*.

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

The species is restricted to the **Wallowa** and Blue Mountains of Baker, Union, **Wallowa**, and possibly Grant counties, in' northeast Oregon.

### **Sensitivity to Disturbance:**

Although populations of this rare species have been **known** for many years there have been **no** comprehensive conservation studies, probably because populations are relatively safe, isolated high on the alpine slopes. They may come into contact with the occasional back country hiker, but the majority of populations exist in a virtually pristine environment (especially compared to what most other penstemon species in the CRB have to contend with). In the unlikely event populations were subjected to significant disturbance it is unknown how they would respond. A likely scenario, however, would have the species and its associates slowly but eventually **re-colonizing** disturbed sites, since the invasive exotics that inundate the lower elevation ecosystems of the region are largely missing at higher elevations. Local disruption of pollinators may be a rare problem in heavily visited alpine basins or summit areas -(e.g., Mt. Howard).

### **Population Trends:**

There are no current demographic studies for this species -- field observations off and on over at least the last 15 years have shown populations to remain apparently constant and thriving at the known localities (Meinke, unpubl.).

### **Dispersal Mode and Requirements:**

**Seeds** of *Penstemon spathulatus* are probably locally dispersed by wind, possibly also by foraging insects or small birds or mammals (such as pikas, known to hoard seeds of all kind). Pollen dispersal is accomplished in part by native solitary bees that may nest in holes situated at the very base of plants (Meinke, unpubl.). Flies (mostly tachinids) also play a potentially significant role in pollen dispersal and fertilization of this, and many other, alpine species.

### **Usefulness as Bioindicator:**

Populations of *Penstemon spathulatus* might be monitored as an indicator of increased recreational pressure in some areas of the Eagle Cap Wilderness. Presumably, if this species (and some of the other locally plentiful but restricted **endemics** of the area) begins to decline, it could serve as a warning to the Forest Service that the wilderness is being enjoyed by a few too many.

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**Taxon:**

*Penstemon wilcoxii*

**Criteria Used For Assessment:**

Sensitive species (USFS Region 6 - Washington)

**Associated Cover Type(s):**

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

Populations of this species occur on dry slopes within shrub cover, or more often in moist, often partially deciduous woods or scrambling thickets, at moderate elevations in rocky soils of the foothills and on lower montane slopes. Vegetative associates include species of *Ceanothus*, *Castilleja*, *Pteridium*, *Alnus*, *Salix*, *Lomatium*, *Calochortus*, *Lathyrus*, *Spiraea*, *Rosa*, *Symphoricarpos*, *Amelanchier*, and *Bromus*.

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

*Penstemon wilcoxii* is relatively common and widespread throughout the mountains of extreme western Montana, northern and central Idaho, and southwest to northeastern Oregon. The species exists peripherally in southeastern Washington, occurring sporadically north from the Oregon border to Whitman County.

**Sensitivity to Disturbance:**

Any activity that disrupts the potential for spring runoff, seeps, or streams to moisten sites and maintain mesic conditions could impact this species. Livestock pasturing is common in areas corresponding with several known populations in Oregon, but the habitat for the species is not as well known by the author in Washington. Plants in Oregon were observed to be trampled and consumed, possibly by cattle, elk, or deer, and this may also be occurring in Washington.

**Population Trends:**

No demographic data are known to have been specifically recorded for *Penstemon wilcoxii* in any region of the CRB. Over six years, during the early 1980's, populations in Wallowa County, Oregon appeared to remain stable, based on qualitative observation only.

**Dispersal Mode and Requirements:**

Seeds are most likely locally dispersed by wind, as well as temporary winter and spring runoff along small brooks and runoff channels. Floral visitors observed in Oregon, included mostly native semi-social and solitary bees, bumblebees, and occasional syrphid flies (Meinke, unpubl.).

**Usefulness as Bioindicator:**

Populations of the species are indicators of sites with established moisture or extensive spring runoff. Large, vigorous populations with a range of age classes suggest

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that disturbances from grazing have been minimal over the years at the site, thereby permitting the build-up of a significant forb community,

3. Preferred Successional Stages or Vegetation Structural Classes for *Penstemon*

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

<i>Taxonomic Groups</i>	<i>Stage or Class Description</i>
<p><i>Penstemon globosus</i>/<i>P. procerus</i> complex/<i>P. attenuatus</i> complex/<i>P. rydbergii</i> complex/<i>P. confertus</i> (OH;CH;OLMS;OTS)</p>	<p>Mostly secondary successional or late seral to climax species (i.e., climax when occurring in heavy thatch build-up: that stabilize meadows); presence of the species requires the buildup of relatively deep (although may be rocky) organic or mineral soil base; populations occur under broken canopies, along meadow-forest ecotones or in exposed herblands</p>
<p><i>Penstemon richardsonii</i>/<i>P. duustus</i> complex/<i>P. triphyllus</i>/<i>P. venustus</i>/<i>P. fruticosus</i> complex (may be associated with any type except closed canopies, as long as exposed rock is available; most common in OLMS; OTS;SI;SEO)</p>	<p>Primary successional to early seral species; these are mostly basalt cliff or wall obligates, or sometimes occur on exposed bedrock, scree, or very thin soils overlying rock; loose organic soil buildup is extremely scant; species often associated with adjacent low shrub layer or open canopy</p>
<p><i>Penstemon acuminatus</i> (OH)</p>	<p>This is considered a primary successional species, since most populations occur with very few vegetative associates, on unstable sandy substrates; populations might be considered indicative of “climax” if dunes are stabilized; never occurs under a closed or broken canopy</p>

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<p><i>Penstemon cinicola</i> (SI;SEO;YF;OH;OLMS)</p>	<p>Early to mid-seral to early secondary species, occurring mostly on a range of more or less bare to sparsely vegetated volcanic-based substrates, sometimes persisting in <b>well-established</b> dry meadows; when in forests, plants grow under open or broken canopies</p>
<p><i>Penstemon cusickii</i>/<i>P. gairdneri</i>/<i>P. humilus</i> complex/<i>P. eriantherus</i> complex (SI;SEO;OH;OLMS;CLMS;OTS)</p>	<p>Generally secondary to potentially climax group of species from sagebrush steppe or nearby open, dry forest (i.e., may be part of climax association when occurring in species-rich <b>herb/shrub</b>-steppe not impacted by grazing or recent fire); may be considered early to mid-seral in some situations (especially <i>P. humilus</i>); in usually rocky substrates with mostly moderate development of organic or mineral soils; under open or partially closed canopies</p>
<p><b>Candidate or Sensitive Taxa Individually Assessed:</b></p>	<p><b>status:</b></p>
<p><i>Penstemon barrettiae</i> (OH;OLMS;OTS)</p>	<p>Primary successional to early seral species; mostly basalt cliff, talus, or vertical wall obligate, or on very thin soils overlying rock; loose organic soil buildup extremely scant at most sites; populations are associated with adjacent low shrub layers and open canopies</p>
<p><i>Penstemon davidsonii</i> var. <i>praeteritus</i> (OH;OLMS;OTS)</p>	<p>Primary successional to early seral species; mostly basalt outcrop obligate, occasionally on very thin soils overlying rock; loose organic soil buildup extremely scant; associated with adjacent low shrub layers, herb-dominated slopes, and open canopies</p>

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<p><i>Penstemon duestus var. variabilis</i> (OH; OLMS; OTS)</p>	<p>Primary successional to early <b>seral</b> species; mostly basalt cliff, talus, or vertical wall obligate, or on very thin soils overlying rock, sometimes the first plants on rocky roadcuts; loose organic soil buildup extremely scant; associated with adjacent low shrub layers and open canopies</p>
<p><i>Penstemon glaucinus</i> (SI;SEO;OH;OLMS[bar])</p>	<p>This is a mid-seral to early secondary species, occurring exclusively on a range of more or less bare to partially vegetated, volcanic-based substrates; when in forests, usually growing under open or broken canopies with sparse understories</p>
<p><i>Penstemon janishiae</i> (OH;OLMS)</p>	<p>Could be considered a primary successional species, since populations occur with few associates on barren, deep-soiled, ash/clay outcrops; might just as easily be considered indicative of an edaphically restricted “climax” community since these ash/clay slopes are relatively stable, and are populated mainly by species that are specifically adapted to their harshness</p>
<p><i>Penstemon kingii</i> (OH;OLMS)</p>	<p>Probably best described as a secondary to potentially climax species of <b>mesic</b> sagebrush steppe (i.e., climax when occurring in rich herb/shrub-steppe that has not been impacted by grazing or recent fire), although information on this <b>taxon</b> is still very scant; populations are expected in rocky substrates with good to moderate development of organic or mineral soils; occurring under open or partially closed canopies</p>

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<p><i>Penstemon "nikei"</i> (OH;OLMS)</p>	<p>These populations might best be described as primary successional, since populations occur with few associates on barren, deep-soiled, ash/clay outcrops; however, they might just as easily be considered indicative of an edaphically restricted "climax" community since the ash/clay slopes are relatively stable, and populated mainly by species adapted to harsh sites, whose populations shift little from year to year</p>
<p><i>Penstemon peckii</i> (SI;SEO;OFS[shr/grs/bar];OH)</p>	<p>Mostly mid to. late seral species, but will colonize relatively soon after disturbance and maintain relatively vigorous populations under broken canopies as well as in adjacent grassy meadows; requiring buildup of relatively deep (although may be rocky) volcanic sandy/loam soil base; under broken canopies, along meadow-forest ecotones, or in exposed meadows</p>
<p><i>Penstemon perpulcher</i> (OH;OLMS)</p>	<p>Probably a late seral to potentially climax species of sagebrush steppe or nearby open forest (i.e., climax when occurring in rich herb/shrub-steppe not impacted by grazing or recent fire); in usually rocky substrates with moderate development of organic or mineral soils; under open or broken canopies</p>
<p><i>Penstemon pratensis</i> (SI[htr];OH;CH;OLMS)</p>	<p>Evidently a secondary successional or late seral to climax species (i.e., climax when occurring in heavy thatch build-ups that stabilize meadows); plants require buildup of relatively deep organic soil base; under broken canopies along forest ecotones, or in exposed meadows</p>

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<p><i>Penstemon seorsus</i> (OH; OLMS; CLMS; OTS)</p>	<p>Generally secondary to potentially climax species of sagebrush steppe or nearby open, dry forest (i.e., climax when occurring in rich herb/shrub-steppe not impacted by grazing or recent fire); commonly inhabits rocky substrates (especially along ridges), with mostly weak to moderate development of organic or mineral soils; may be under open or somewhat closed canopies of low to medium shrubs</p>
<p><i>Penstemon spathulatus</i> (OH;OLMS)</p>	<p>Generally best considered a member of a climax community of grasses and forbs in alpine or subalpine fell fields and herb-dominated slopes; populations occur on rocky sites with weak to moderate mineral/organic soil development</p>
<p><i>Penstemon wilcoxii</i> (UR;OH;CH;OLMS;CLMS;OTS; CTSM)</p>	<p>Mostly secondary successional or late <b>seral</b> species (in Oregon -- data are unavailable for Washington) in a range of transitional habitats; associated with the buildup of relatively deep (although may be rocky) organic or mineral soil base; populations observed under more or less broken canopies along meadow-forest ecotones, within thickets, or in exposed herblands</p>

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 cases, based on community information or lists of associate species provided with past records. However, the many inevitable errors or misinterpretations would compromise the validity of the EEMP model.

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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/Functions of *Penstemon* (Grouped Taxa)**

(Information provided in U.S. Forest Service specified format)

**Species or Species Group:** *Penstemon globosus/P. procerus/P. attenuatus/P. rydbergii/P. confertus*

**Province and/or Section:** All

**Life Form:** 4

**Key Environmental Correlates:**

1. Moist soil during growing season

**Suitable Categories (Categorical):**

1. Summer precipitation
2. Boundary areas of streams other natural bodies of water
3. Seasonal wetlands

**Applies Seasonally? Yes**

**Which Seasons?** Winter, spring, and summer

2. Open canopies

**Suitable Categories (Categorical):**

1. Rangeland sites
2. Forest sites

**Applies Seasonally? No**

3. Flowing water for seed dispersal

**Suitable Categories (Categorical):**

1. Streams, creeks, rivers
2. Runoff and flood channels

**Applies Seasonally? Yes**

**Which Seasons?** Spring and summer

4. Pollinators to promote seed set and gene flow

**Suitable Categories (Categorical):**

1. Native bees (various solitary species and *Bombus*)
2. Sphinx moths
3. Hummingbirds (rare)

**Applies Seasonally? Yes**

**Which Seasons?** Spring and summer

**Key Ecological Functions (*Penstemon globosus/P. procerus/P. attenuatus/P. rydbergii/P. confertus*):**

1. Food and nutrition for pollinating and phytophagous insects
2. Primary producers in meadows and wetlands
3. Local bank stabilization

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**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 and correlates may differ outside the CRB.

**Dispersal:**

**Pollinators** - Solitary and bumblebees; sphinx moths; rarely hummingbirds

**Dispersal Mode** - Wind and water

**Requirements for Dispersal** - Best dispersal accomplished by flowing water

Trend: Apparently stable to increasing in many areas

**Key Unknowns and Monitoring or Research Needs:**

The taxonomy of some of these **taxa** is still poorly understood -- further evaluation of this in our area serve the interest of promoting the conservation of biodiversity on public lands. Relationships between these **taxa** and grazing may also be worth investigating, to determine their potential value as range condition indicators.

**Degree of Confidence in Knowledge of Species:** Medium

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**Species or Species Group:** *Penstemon richardsonii/P. duustus/P triphyllus/P. venustus/P. fruticosus*

**Province and/or Section:** All

**Life Form:** ' 4

**Key Environmental Correlates:**

1. Lithic substrates

**Suitable Categories (Categorical):**

1. Rocky margins of old stream or runoff channels

2. Scree slopes, rock walls, and outcrops

3. Thin soils overlying fissured bedrock

4. Rocky roadcuts or other disturbed rock surfaces

**Applies Seasonally?** No

2. Windy sites for seed dispersal

**Suitable Categories (Categorical):**

1. Open slopes

2. Dry flats

3. Reduced vegetative cover

**Applies Seasonally?** No

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3. Well-drained substrate

**Suitable Categories (Categorical):**

1. Rock crevices and fissures
2. Basalt cobbles
3. Mixture of rock and gravels

**Applies Seasonally? No**

4. Effective pollinators

**Suitable Categories (Categorical):**

1. Native bees
2. Moths (reported for *Pensremon duesrus*)
3. Occasional flies

**Applies Seasonally? Yes**

**Which Seasons? Summer**

**Key Ecological Functions (*Penstemon richardsonii*/*P. duustus*/*P. triphyllus*/*P. venustus*/*P. fruticosus*):**

1. Provide litter and roots that contribute to primary soil development in rocky sites by decomposition and rock fracturing
2. Primary producers in **xeric**, lithic environments
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 and correlates may differ outside **the** CRB.

**Dispersal:**

**Pollinators -** Native bees; rarely **flies**; possibly moths (*P. duustus*)

**Dispersal Mode -** Wind

**Requirements for Dispersal -** Open sites

**Trend:** ' Apparently stable or increasing in many areas.

**Key Unknowns and Monitoring or Research Needs:**

Relatively little is know about the functions of lithic plant communities and their component herbaceous species. Knowledge concerning potentially dependent insect species would be valuable. The taxonomy of these species, especially *P. duustus*, is not well understood.

**Degree of Confidence in Knowledge of Species:** High

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**Species or Species Group:** *Penstemon acwninatus*

**Province and/or Section:** All except East Cascades/HLP

**Life Form:** 4

**Key Environmental Correlates:**

1. Well-drained substrates

**Suitable Categories (Categorical):**

1. Sand dunes
2. Sandy gravels
3. Sandy dry stream or river bottoms

**Applies Seasonally? No**

2. **Sunny**, exposed sites

**Suitable Categories (Categorical):**

1. Open ground within shrub-steppe
2. Along dry riverbeds and sandy riverbanks\bluffs
3. South and east-slopes
4. Sand dunes

**Applies Seasonally? No**

3. Effective pollinators

**Suitable Categories (Categorical):**

1. Native bees
2. wasps
3. Honeybees (rare)
4. Flies (rare)

**Applies Seasonally? Yes**

**Which Seasons? Spring and summer**

4. Seasonal precipitation to promote growth and reproduction

**Suitable Categories (Categorical):**

- 1 Thundershowers

**Applies Seasonally? Yes**

**Which Seasons? Spring and summer**

**Key Ecological Functions (*Penstemon acuminatus*):**

1. Provides nectar, pollen, and seeds for foraging insects
2. Primary producer on exposed sandy soils or on sand dunes
3. Stabilization of sand **dunes** and loose, sandy banks

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

**Change in Fire Regimes - Low**

**Grazing - Low**

**Exotics - Low**

**Development - Low**

**Timber Harvest - Low**

**Roads (explain) - Low**

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**Others** - Honeybees displacing native pollinators (Low)

**Dispersal:**

**Pollinators** - Native bees and wasps; possibly honeybees near cultivated areas

**Dispersal Mode** - Water, wind

**Requirements for Dispersal** - Flowing water may facilitate seed dispersal

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

**Key Unknowns and Monitoring or Research Needs:**

Studies pursuing the role this species plays in the dune ecosystem would be valuable. Potential areas of research might include seed germination biology; seed bank dynamics; role of the species in stabilization and succession on loose sandy sites; and relationships with native insect fauna.

**Degree of Confidence in Knowledge of Species:** High

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**Species or Species Group:** *Penstemon cinicola*

**Province and/or Section:** East Cascades/HLP

**Life Form:** 4

**Key Environmental Correlates:**

1. Well-drained, volcanic substrates

**Suitable Categories (Categorical):**

1. Basalt cobbles or sands
2. Pumice fields
3. Roadside volcanic gravels
4. Ash soils

**Applies Seasonally? No**

2. **Xeric** general habitat with sunny exposures

**Suitable Categories (Categorical):**

1. Lodgepole cover types
2. Mixed-coniferous forests (with ponderosa pine)
3. Dry; early successional meadows
4. Shrub-steppe

**Applies Seasonally? No**

3. Summer precipitation to facilitate reproduction

**Suitable Categories (Categorical):**

1. Thunderstorms

**Applies Seasonally? Yes**

**Which Seasons?** Summer

4. Effective pollinators

**Suitable Categories (Categorical):**

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

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**Applies Seasonally?** Yes

**Which Seasons?** Spring and summer

**Key Ecological Functions (*Penstemon cinicola*):**

1. Major source of food reserves for species of summer-foraging hymenopterans
2. Possible food source for seed foragers, including ants and other invertebrates
3. Primary producer on early to **mid-seral** volcanic substrates

**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

**Other** - Off road vehicles (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; occasional bumblebees and syrphid flies

**Dispersal Mode** - Seeds are dispersed primarily by wind and gravity

**Requirements for Dispersal** - Open habitat

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

**Key Unknowns and Monitoring or Research Needs:**

It would be interesting to know how this species manages to grow in what must often be **nutrient-poor** sites (basalt substrates can have very low nitrogen levels) -- a possible relationship between *Penstemon cinicola* and soil organisms might be worth pursuing. Also of interest is the pollination and seed biology of the species, including information on seed bank presence and longevity.

**Degree of Confidence in Knowledge of Species:** Medium

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**Species or Species Group:** *Penstemon cusickii*/*P. gairdneri*/*P. humilus*/*P. eriantherus*

**Province and/or Section:** All

**Life Form:** 4

**Key Environmental Correlates:**

1. Moderate to well-drained substrates

**Suitable Categories, (Categorical):**

1. Gravelly to rocky slopes
2. Ridgelines
3. Coarse, sandy microsites
4. Old, rocky streambeds

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**Applies Seasonally? No**

2. Exposed in the open or under broken canopy; usually bright, sunny microsites

**Suitable Categories (Categorical):**

1. Dry forest gaps
2. Herb/graminoiddominated steppe
3. Low shrub (generally *Artemisia*) canopy

**Applies Seasonally? No**

3. Growing season precipitation

**Suitable Categories (Categorical):**

1. Thunderstorms
2. Snowmelt

**Applies Seasonally? Yes**

**Which Seasons? Spring and summer**

4. Dependable pollinators

**Suitable Categories (Categorical):**

1. Native bees
2. Occasional flies
3. Occasional sphinx moths

**Applies Seasonally? Yes**

**Which Seasons? Spring and summer**

**Key Ecological Functions (*Penstemon cusickii*/*P. gairdneri*/*P. humilus*/*P. eriantherus*):**

1. Providers of pollen and nectar for native bee fauna
2. Primary producer in low and big sagebrush ecosystems
3. Providers of tissue seed for invertebrate predators

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

**Climate 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 -** Native bees (mostly solitary species and bumblebees; occasionally sphinx moths and flies)

**Dispersal Mode -** Wind; gravity; flowing water (for *M. primuloides*)

**Requirements for Dispersal -** See above

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

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**Key Unknowns and Monitoring or Research Needs:**

Relationships between these **taxa** and grazing may **be** worth investigating, to determine their potential **value** as range condition indicators. Details of pollination biology, germination requirements, and seed bank dynamics are unknown.

**Degree of Confidence in Knowledge of Species:** Medium

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

**Species:** *Penstemon barrettiae*

**Province and/or Section:** East Cascades/HLP

**Life Form:** 4

**Key Environmental Correlates:**

1. Lithic substrates

**Suitable Categories (Categorical):**

1. Thin-soiled or bedrock sites
2. Exposed basalt shelves or cliffs
3. Basalt talus or **scree**
4. Disturbed rock substrates (e.g., roadcuts, railroad tunnels)

**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. Elevation

**Suitable Categories (Continuous):**

1. From near sea level to ca. 1000 meters

**Applies Seasonally? No**

**Key Ecological Functions (*Penstemon barrettiae*):**

1. Provides food resources for pollinating bees
2. Primary producer on lithic substrate
3. Facilitates soils development via decomposition and substrate fracturing by roots

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**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** (construction that blasts cliff surfaces)

**Other - Quarrying for gravel/rock (Medium); horticultural collecting (Low)**

**Dispersal:**

**Pollinators -** Presumably small native bees and bumblebees

**Dispersal Mode -** Seeds are dispersed by wind and locally by water

**Requirements for Dispersal -** Flowing water (seeps, small creeks, runoff, etc.);  
crevices for establishment

**Trend:**

There are no long-term demographic studies underway for this **taxon**; although extant populations are often very small, in Oregon they are usually located in microsites without any significant exotic floristic component or other evident hazard. Alverson and Sheehan (1986) corroborate this observation for Washington.

**Key Unknowns and Monitoring or Research Needs:**

Further inventory is needed for this species along the Klickitat River in Washington. Definitive information on pollination biology, seed germination and viability, responses to disturbance, moisture requirements, establishment ecology, and habitat characterization are needed to ensure the success of any future transplantation efforts.

Degree of Confidence in Knowledge of Species: High

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species: *Penstemon davidsonii* var. *praeteritus*

Province and/or Section: Owyhee

Life Form: 4

**Key Environmental Correlates:**

1. Open, lithic sites for colonization

**Suitable Categories (Categorical):**

1. Exposed or eroded rocky slopes
2. Rock outcrops and pinnacles
3. Gravelly, or talus slopes

**Applies Seasonally? No**

2. Effective pollinators

**Suitable Categories (Categorical):**

1. Small, native **bees** (mostly solitary, ground-nesting species)
2. Bumblebees

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3. Hummingbirds (rare)

4. Occasional flies

**Applies Seasonally? Yes**

**Which Seasons?** Spring and summer

3. Summer precipitation

**Suitable Categories (Categorical):**

1. Seepage zones within tams or gravelly substrates

2. Snowmelt accumulation

3. Runoff channels

**Applies Seasonally? Yes**

**Which Seasons?** Spring and summer

4. Elevation

**Suitable Categories (Continuous):**

1. 2000-3000 meters

**Applies Seasonally? No**

**Key Ecological Functions (*Penstemon davidsonii* var. *praeteritus*):**

1. Provides food sources to local montane bee colonies

2. Promotes soil development on rocky substrates through decomposition and fracturing of rocks with roots

3. Primary producer on lithic substrates

**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:**

Field observations by the author are limited to Oregon populations.

**Comments:**

The report of this **taxon** from Malheur County (observed by the author in 1990 in the Trout Creek Mountains) is apparently a county record.

**Dispersal:** .

**Pollinators** - Small native bees (solitary species and *Bombus*); rarely hummingbirds

**Dispersal Mode** - Seed dispersed by wind, gravity

**Requirements for Dispersal** - Available fissures for establishment

**Trend:**

Unknown (there are no demographic studies in progress), although populations are almost surely stable, considering the isolation of sites and **difficult** terrain.

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**Key Unknowns and Monitoring or Research Needs:**

Nothing is known concerning the details of pollination, germination, or establishment; potential impacts from livestock on seedling recruitment, browsing, and elimination of pollinators may require investigation.

**Degree of Confidence in Knowledge of Species:** High

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*species:* ***Pensremon duesrus var. variabilus***

**Province and/or Section:** East Cascades/HLP

**Life Form:** 4

**Key Environmental Correlates:**

1. Open, lithic sites for colonization

**Suitable Categories (Categorical):**

1. **Exposed** or eroded rocky slopes
2. Rock walls and cliffs
3. Talus and scree
4. Rocky cutbanks and roadsides

**Applies Seasonally?** No

2. Effective pollinators

**Suitable Categories (Categorical):**

1. Small, native bees (mostly solitary, ground-nesting species)
2. Potentially moths (Keck, 1940)
3. Small bumblebees

**Applies Seasonally?** Yes

**Which Seasons?** Spring and summer

3. Summer precipitation to promote growth and reproduction

**Suitable Categories (Categorical):**

1. Thunderstorms
2. Runoff channels and temporary seeps

**Applies Seasonally?** Yes

**Which Seasons?** Spring and summer

4. Germination safe sites

**Suitable Categories (Categorical):**

1. Cliff crevices and fissures with minimal soil accumulation
2. Vernal and/or fall soil moisture

**Applies Seasonally?** Yes

**Which Seasons?** Spring and fall

**Key Ecological Functions (*Penstemon duustus var. variabilus*)**

1. Provides food sources to local bee colonies
2. Promotes soil development on rocky substrates through decomposition and fracturing of rocks with roots

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3. Primary producer on lithic substrates

**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**

**Others - Possibly quarrying (Low)**

**Key Assumptions:**

Field observations by the author are limited to Oregon populations.

**Dispersal:**

**Pollinators - Small native bees** (solitary species and *Bombus*)

**Dispersal Mode - Seed dispersed by** wind, gravity

**Requirements for Dispersal - Fissures** for germination and establishment

**Trend:**

Unknown (there are no demographic studies in progress), although populations are almost surely stable, considering the apparent preference for rocky (including disturbed) sites.

**Key Unknowns and Monitoring or Research Needs:**

Nothing is known concerning the details of pollination, germination, or establishment; quantitative information on autecology would be valuable -- is this variety just as tolerant of disturbance as other forms of *P. duesrus*? The taxonomy of this group may also need re-evaluation, to consider the need for maintaining this taxon as distinct.

**Degree of Confidence in Knowledge of Species:** High

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**Species:** *Penstemon glaucinus*

**Province and/or Section:** East Cascades/HLP

**Life Form:** 4

**Key Environmental Correlates:**

1. Dependable winter/vernal moisture

**Suitable Categories (Categorical):**

1. Snowmelt

2. Spring rains

3. Thundershowers

**Applies Seasonally? Yes**

**Which Seasons? Spring and summer**

2. Broken canopy or other open habitats

**Suitable Categories (Categorical):**

1. Gaps (fire or otherwise) in lodgepole forest

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2. Gaps (fire or otherwise) in whitebark pine forest
3. Ridgelines in high-elevation shrub-steppe
4. High elevation sagebrush meadows

**Applies Seasonally? No**

3. Pollinators to effect seed set and pollen movement

**Suitable Categories (Categorical):**

1. Solitary bees
2. Bumblebees
3. Hummingbirds (rare)
4. Sphinx moths (rare)

**Applies Seasonally? Yes**

**Which Seasons? Spring and summer**

4. Interaction with exotic species

**Suitable Categories (Categorical):**

1. Potential seedling competition with annual weeds
2. Livestock

**Applies Seasonally? Yes**

**Which Seasons? Spring and summer**

### **Key Ecological Functions (*Penstemon glaucinus*):**

1. Provide food resources for native bee fauna
2. Primary producer by decomposition in montane **understory/high** elevation dry meadow ecosystems
3. Provide tissue and seeds for phytophagous insects

### **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**

**Others - Loss of seeds due to predispersal predation by adult insects and larvae (Medium)**

### **Key Assumptions:**

This information is largely based on observations from **Gearhart** Mountain.

### **Dispersal:**

**Pollinators -** Various species of native solitary bees; bumblebees; rarely hummingbirds/sphinx moths

**Dispersal Mode -** Wind; possibly locally dispersed by foraging insects or rodents

**Requirements for Dispersal -** Open microsites

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**Trend:**

No multi-year demographic plots exist; however, long-term observation of the populations by several workers (see Section 2.) suggest populations are quite stable and will perhaps increase in areas of moderate disturbance.

**Key Unknowns and Monitoring or Research Needs:**

The seed germination biology of the species is unstudied, as is its ability to compete **with** exotic weedy species; characterization of **seral** trends and requirements with respect to disturbance factors are also needed (possibly appropriately address@ via an experimental demographic study, utilizing transition matrix methodology). The pollination biology of this species is likewise unknown.

**Degree of Confidence in Knowledge of Species:** High

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species: ***Penstemon janishiae***

**Province and/or Section:** Owyhee

**Life Form:** 4

**Key Environmental Correlates:**

1. Barren substrate

**Suitable Categories (Categorical):**

1. Weathered ash/clay
2. Possibly tuffaceous slopes

**Applies Seasonally?** No

2. Dependable moisture to promote growth and reproduction

**Suitable Categories (Categorical):**

1. Snowseeps
2. Spring/summer thundershowers

**Applies Seasonally?** Yes

**Which Seasons?** Winter, spring, and summer

3. Associate vegetation

**Suitable Categories (Categorical):**

1. Adjacent to sagebrush-steppe
2. Immediate associates few; usually other edaphically restricted taxa

**Applies Seasonally?** Yes (in part)

**Which Seasons?** Winter and spring

4. Effective pollinators

**Suitable Categories (Categorical):**

1. Small, native, semi-social and solitary **-bees**
2. Medium-sized **bumblebees**
3. Syrphid **flies**
4. Occasional lepidopterans

**Applies Seasonally?** Yes

**Which Seasons?** Spring and summer

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**Key Ecological Functions (*Penstemon janishiae*):**

1. Provides resources for pollen gathering bees residing on volcanic ash/clay substrate
2. Decomposed plants release nutrients in sterile substrate
3. Provide tissue and seeds for phytophagous insects

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

**Change in Fire Regimes** - Low

**Grazing** - Medium (from trampling only)

**Mining** - Low (potentially High)

**Exotics** - Low

**Development** - Low

**Timber Harvest** - Low

**Roads (explain)** - Low

**Others** - ATV traffic (potentially High; currently Low)

**Key Assumptions:**

This information is relevant for the Oregon populations only.

**Dispersal:**

**Pollinators** - Various native bees (solitary and bumblebees); rarely syrphid flies

**Dispersal Mode** - Wind and gravity

**Requirements for Dispersal** - Open microsites

**Trend:**

There are no demographic studies of this species *per se*; the insular nature of the habitat suggests populations are stable (assuming disturbance remains minimal). Significant increase is unlikely **due** to the fact that the sites are isolated and scattered.

**Key Unknowns and Monitoring or Research Needs:**

We have only a limited knowledge of this species geographic range in the CRB. More intensive surveys in southeast Oregon and adjacent Idaho (keyed to substrate type) may reveal additional populations. The ability of edaphic **endemics** such as *P. janishiae* to withstand disturbance is unknown; this information could be important if sites ever become the focus of mineral **prospectors**. Basic biological knowledge concerning pollination, germination, competitive ability, and establishment are unknown.

**Degree of Confidence in Knowledge of Species: High**

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**Species:** *Penstemon kingii*

**Province and/or Section:** Owyhee

**Life Form:** 4

**Key Environmental Correlates:**

1. Well drained substrate

**Suitable Categories (Categorical):**

1. Rocky ridges
2. Gravelly to sandy slopes

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3. Volcanic soils  
**Applies Seasonally? No**
2. Plant associations  
**Suitable Categories (Categorical):**
  1. *Artemisia*-dominated  
**Applies Seasonally? No**
3. Soil moisture to promote growth and reproduction  
**Suitable Categories (Categorical):**
  1. Sites with accumulated winter snow pack
  2. Thunderstorms  
**Applies Seasonally? Yes**  
**Which Seasons? Winter, spring, and summer**
4. Interactions with exotic species  
**Suitable Categories (Categorical):**
  1. Cattle
  2. Competition with annual weedy grasses  
**Applies Seasonally? Yes**  
**Which Seasons? Spring and summer**

**Key Ecological Functions (*Penstemon kingii*):**

1. Food resources provided for pollinators (presumably native bees)
2. Primary producer in low and big sagebrush communities
3. Provide foliage and seeds 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**

**Key Assumptions:**

Assessment of this species is largely based on knowledge of related species occurring in similar habitats.

**Dispersal:**

**Pollinators - Native bees (speculation)**

**Dispersal Mode - By wind; possibly locally distributed by foraging insects**

**Requirements for Dispersal - Open microsites**

**Trend:**

Population monitoring has not been initiated for *Penstemon kingii*. No information is available for this species, which is currently under review.

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**Key Unknowns and Monitoring or Research Needs:**

Both monitoring and inventory are needed for this poorly known species; basic understanding of population biology would **also** be useful, including information on competitive abilities, pollination, seed biology, and habitat specifics.

**Degree of Confidence in Knowledge of Species:** Low

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species: *Penstemon "nikei"*

Province and/or Section: Owyhee

Life Form: 4

**Key Environmental Correlates:**

1. Barren substrate

**Suitable Categories (Categorical):**

1. Weathered ash/clays
2. Diatomaceous outcrops

**Applies Seasonally? No**

2. Dependable moisture source to promote growth and reproduction

**Suitable Categories (Categorical):**

1. Heavy winter precipitation
2. Snow melt
3. Spring/summer thundershowers

**Applies Seasonally? Yes**

**Which Seasons?** Winter, spring, and summer

3. Pollinators

**Suitable Categories (Categorical):**

1. Native bees
2. Possibly sphinx moths

**Applies Seasonally? No**

4. Interactions with exotic organisms

**Suitable Categories (Continuous):**

1. Introduced annual grasses and other weeds (off of the ash substrate)
2. Cattle trampling

**Applies Seasonally? No**

**Key Ecological Functions (*Penstemon "nikei"*):**

1. Primary producer on barren ash or diatomaceous substrate
2. Decomposition of plants releases nutrients in a nutrient-poor environment
3. Presumably **provides** pollen for foraging colonies of native bees

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

**Change in Fire Regimes** - Low

**Grazing** - Medium (trampling)

**Mining** - Low (potentially High)

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**Exotics - Low**

**Development - Low**

**Timber Harvest - Low**

**Roads (explain) - Low**

**Others - ATV traffic (potentially High; currently Low)**

**Key Assumptions:**

Some of the information provided here on species biology is inferred from observations of *Penstemon miser*, a similar species and apparent close relative.

**Dispersal (see Key Assumptions):**

**Pollinators - Presumably native bees**

**Dispersal Mode - Wind and gravity for seeds**

**Requirements for Dispersal - Open microsites**

**Trend:**

**There** are no demographic studies of this species per se; the insular nature of the habitat suggests populations are stable (assuming disturbance remains minimal). Significant increases are unlikely due to the fact that the sites are isolated and scattered.

**Key Unknowns and Monitoring or Research Needs:**

The taxonomy of this group of populations needs to **be** worked out -- if they merit recognition as distinct then the name should be published. Other key unknowns include response to disturbance (important if the sites ever are mined), geological uniqueness of habitat, germination biology and seed bank dynamics, pollination ecology, and further inventory (which should be relatively easy judging **by** the distinctive substrate).

**Degree of Confidence in Knowledge of Species: Medium**

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**Species:** *Penstemon peckii*

**Province and/or Section:** East Cascades/HLP

**Life Form: 4**

**Key Environmental Correlates:**

1. Ample winter/spring moisture for germination

**Suitable Categories (Categorical):**

1. Snow melt and runoff
2. Spring/summer thunderstorms
3. Edges of vernal moist depressions

**Applies Seasonally? Yes**

**Which Seasons? Winter and spring**

2. Interactions with exotic organisms

**Suitable Categories (Categorical):**

1. Weedy annual grasses and other species
2. Livestock (cattle and sheep)

**Applies Seasonally? Yes**

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**Which Seasons?** Spring, summer, and fall

### 3. Elevation

**Suitable Categories (Continuous):**

1. In a relatively narrow belt, from ca. **900-1200** meters

**Applies Seasonally?** No

### 4. Effective pollinators

**Suitable Categories (Categorical):**

1. Bumblebees
2. Various solitary and semi-social native **bee** species
3. Syrphid flies
4. **Beeflies**

**Applies Seasonally?** Yes

**Which Seasons?** Spring and summer

### **Key Ecological Functions (*Penstemon peckii*):**

1. Primary producer within understory of ponderosa pine **dominated** forests
2. Provides seeds and foliage for phytophagous insects and food for native **bees**
3. Mid to late **seral** colonizer of moderate forest and meadow disturbances

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

**Change in Fire Regimes** - Medium

**Grazing** - Medium

**Mining** - Low

**Exotics** - Low

**Development** - Medium (in Camp Sherman area)

**Timber Harvest** - Medium (Low if only thinning)

**Roads (explain)** - Low

**Others** - Recreational activities (Low)

### **Key Assumptions:**

The above threats are defined on the assumption the Deschutes National Forest will continue to take this species into account during forestry operations.

### **Dispersal:**

**Pollinators** - Bumblebees; solitary **bees**; occasional syrphid and **beeflies**

**Dispersal Mode** - Wind or occasionally via water

**Requirements for Dispersal** - Wind and/or local flowing water

### **Trend:**

Populations relatively stable; respond well to disturbance (see Section 2.).

### **Key Unknowns and Monitoring or Research Needs:**

This species would lend itself well to an experimental transition matrix modeling study (focussing on demographic trends); more definitive (quantitative) information on responses to disturbance and seed bank dynamics would **also** be valuable to managers. Evaluation of the genetic diversity in this rather polymorphic species would be interesting.

**Degree of Confidence in Knowledge of Species: High**

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species: *Penstemon perpulcher*

**Province and/or Section:** Owyhee

**Life Form:** 4

**Key Environmental Correlates:**

1. Substrate/topography  
**Suitable Categories (Categorical):**
  1. Thin-soiled scab
  2. Sandy-loam
  3. Gravelly ridges and slopes**Applies Seasonally? No**
2. Suitable moisture to promote germination, growth, and reproduction  
**Suitable Categories (Categorical):**
  1. Winter snowmelt
  2. Spring/summer thunderstorms**Applies Seasonally? Yes**  
**Which Seasons? Winter, spring, and summer**
3. Effective pollinators  
**Suitable Categories (Categorical):**
  1. Presumably native bees/wasps
  2. Possibly lepidopterans**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 (*Penstemon perpulcher*):**

1. Provides foliage and seeds for phytophagous insects
2. Primary producer in forb layer of sagebrush dominated communities
3. Probably typically a late seral species in sagebrush communities

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

- Change in Fire Regimes** - Medium  
**Grazing** - Medium  
**Mining** - Low  
**Exotics** - High  
**Development** - Low

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**Timber Harvest - Low**

**Roads (explain) - Low**

**Key Assumptions:**

Much of this information is extrapolated **from** knowledge of the taxonomically and ecologically similar species, *Penstemon payettensis*, which occurs just north in the CRB along the Snake River in Oregon and Idaho.

**Dispersal (see Key Assumptions):**

**Pollinators -** Presumably various native bees

**Dispersal Mode -** Wind

**Requirements for Dispersal -** Open sites

**Trend:**

There are no population monitoring plans underway for this species; it is a very recent addition to the review list and no conclusive data on demography or population biology are currently available.

**Key Unknowns and Monitoring or Research Needs:**

Additional field inventory to ascertain the extent of populations in the CRB would be useful. Also, evaluation of the need to implement a monitoring study should be completed, as well as the gathering of appropriate data on reproduction, competitive abilities, disturbance response, and seed bank dynamics.

**Degree of Confidence in Knowledge of Species:** Medium

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**Species:** *Penstemon pratensis*

**Province and/or Section:** Owyhee

**Life Form:** 4

**Key Environmental Correlates:**

1. Dependable soil moisture for growth and reproduction

**Suitable Categories (Categorical):**

1. Vicinity of streambanks in meadows
2. Melting snowpack
3. Spring/summer thundershowers
4. Seeps/springs

**Applies. Seasonally? Yes**

**Which Seasons?** Winter, spring, and summer

2. Associate vegetation

**Suitable Categories (Categorical):**

1. Sagebrush/forb-dominated mesic meadows
2. Aspen understories (under broken canopies)

**Applies Seasonally? No**

3. Elevation

**Suitable Categories (Continuous):**

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1. Ca. 1500-2700 meters

**Applies Seasonally? No**

4. Effective pollinators

**Suitable Categories (Categorical):**

1. Small native bees (solitary and semi-social species)

2. Bumblebees

3. Sphinx moths and other meadow lepidopterans (rare)

**Applies Seasonally? Yes**

**Which Seasons? Spring and summer**

**Key Ecological Functions (*Penstemon pratensis*):**

1. Provides nectar and pollen for native bee fauna and other insects

2. Primary producer in **mesic** aspen forest and montane meadow **communities**

3. Late seral to potentially climax species in above habitats

**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**

**Key Assumptions:**

This is based on the species distribution within the CRB — populations occurring in Nevada may have different habitat requirements. Some of the pollinator information is inferred from observation of the morphologically similar, related species *Penstemon rydbergii*.

**Dispersal (see Key Assumptions):**

**Pollinators - Small native bees; bumblebees; sphinx moths**

**Dispersal Mode - Wind-dispersed; water**

**Requirements for Dispersal - Running water after seeds are dispersed**

**Trend:**

There are no studies in progress to examine the demography of this species. Brief observations of selected populations in Oregon over the last decade show *P. pratensis* to exhibit an apparently stable trend (although no data are available to confirm this).

**Key Unknowns and Monitoring or Research Needs:**

The taxonomy of this entity is weak; further work may be necessary to determine if it merits species designation (or designation at all). If so, demographic monitoring may be necessary, to evaluate growth trends and the potential for populations to serve as montane range condition indicators. Basic biological data (pollination, germination ecology, seed bank information, etc.) are also lacking.

**Degree of Confidence in Knowledge of Species: Medium**

**Species:** *Penstemon seorsus*

**Province and/or Section:** East Cascades/HLP; Wallowa

**Life Form:** 4

**Key Environmental Correlates:**

1. Associate shrub cover

**Suitable Categories (Categorical):**

1. Big sagebrush-dominated
2. Low sagebrush-dominated

**Applies Seasonally? No**

2. Dependable source of precipitation for growth and reproduction

**Suitable Categories (Categorical):**

1. Above average snowfall
2. Heavy late winter/early spring rains
3. Spring/summer thundershowers

**Applies Seasonally? Yes**

**Which Seasons?** Winter, spring, and summer

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. Effective pollinators

**Suitable Categories (Categorical):**

1. Native bees (solitary and semi-social)
2. Syrphid flies

**Applies Seasonally? Yes**

**Which Seasons?** Spring and summer

**Key Ecological Functions (*Penstemon seorsus*):**

1. Provides seeds and foliage to insect foragers and predators
2. Primary producer in sagebrush **scabland** or flats
3. Local soil binder (mat-forming ecotypes)

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

**Change in Fire Regimes** - Medium

**Grazing** - Medium

**Mining** - Low

**Exotics** - High

**Development** - Low

**Timber Harvest** - Low

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**Roads (explain) - Low**

**Dispersal:**

**Pollinators** - Native bees and syrphid flies

**Dispersal Mode** - Wind; possibly foraging insects and rodents

**Requirements for Dispersal** - Open spaces

**Trend:**

No demographic studies are available for this species; population numbers are believed to be probably stable based on observations of the species in the eastern part of its range, but quantitative data are lacking.

**Key Unknowns and Monitoring or Research Needs:**

Additional field inventory should be conducted; considering the relatively broad range of this species it may turn out to be more common than currently believed. The taxonomic relationship with *P. gairdneri* may need further investigation. Reliable data on pollination ecology, seed germination biology, and disturbance and fire tolerance are **all** lacking. Demographic monitoring should be implemented for selected populations across the range of the species.

**Degree of Confidence in Knowledge of Species:** High

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*species:* ***Penstemon spathulatus***

**Province and/or Section:** Wallowa

**Life Form:** 4

**Key Environmental Correlates:**

1. Effective pollinators

**Suitable Categories (Categorical):**

1. Bumblebees
2. Tachinid flies
3. Solitary, ground-nesting bees

**Applies Seasonally? Yes**

**Which Seasons?** Spring and summer

2. Well-drained, exposed substrates

**Suitable Categories (Categorical):**

1. Granite-based pinnacles and outcrops
2. Decomposed granodiorite **scree**
3. **Coarse**, sandy meadows

**Applies Seasonally? No**

3. Summer moisture source to promote rapid growth and reproduction

**Suitable Categories (Categorical):**

1. Seepage from snowpack
2. Thunderstorms

**Applies Seasonally? Yes**

**Which Seasons?** Winter, spring, and summer

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4. Elevation

Suitable Categories (Continuous):

1. Ca. 2600-3200 meters

Applies Seasonally? No

**Key Ecological Functions (*Penstemon spathulatus*):**

1. Provides seed and foliage for phytophagous alpine insects
2. Soil binder on alpine slopes and in rocky meadows
3. Provides resources for species of alpine pollinators (especially solitary 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) - Low**

**Others - Recreational foot traffic (Low)**

**Dispersal:**

**Pollinators -** Solitary bees; tachinid flies; small bumblebees

**Dispersal Mode -** Wind; possibly seed foraging insects or rodents (**pikas**)

**Requirements for Dispersal -** Open space; proximity to rodent activity

**Trend:**

Presumably stable since the species, although a local endemic, is found in isolated locations and is rarely sympatric with humans. There have apparently never been any demographic studies completed for *P. spathulatus*; however, observations of patches known to the author showed them to remain essentially static or actually increase in size during **the 1980's**. The stability of the species recently resulted in it's being downlisted **to the** level of federal candidate 3C.

**Key Unknowns and Monitoring or Research Needs:**

Continued qualitative monitoring would be prudent, to ensure that the species **does not need to** be re-considered for listing in the future.

**Degree of Confidence in Knowledge of Species:** High

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species: *Penstemon wilcoxii*

**Province and/or Section:** Wallowa; eastern Washington

**Life Form:** 4

**Key Environmental Correlates:**

1. **Sufficient** winter/vernal/summer precipitation for germination and establishment

**Suitable Categories (Categorical):**

1. Above average snowpack
2. Spring thundershowers/rain

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3. High rivers/streams from winter runoff
4. Seepage/springs  
**Applies Seasonally? Yes**  
**Which Seasons?** Winter and spring
2. Interactions with exotic species  
**Suitable Categories (Categorical):**
  1. Livestock
  2. **Annual weedy grasses** and other introduced species**Applies Seasonally? Yes**  
**Which Seasons?** Spring and summer
3. Associate vegetation  
**Suitable Categories (Categorical):**
  1. Broken canopies (mixed coniferous/deciduous woods)
  2. Tall shrub thickets
  3. **Mesic**, forb-rich meadows**Applies Seasonally? No**
4. Effective pollinators  
**Suitable Categories (Categorical):**
  1. Small to medium-sized solitary or semi-solitary native bees
  2. Bumblebees
  3. **Syrphid** flies**Applies Seasonally? Yes**  
**Which Seasons?** Spring and summer

**Key Ecological Functions (*Penstemon wilcoxii*):**

1. Contributes to soil litter layer in meadows and understory via decomposition
2. Provides food resources for insect pollinators
3. Provides food resources for phytophagous insects, rodents; browse for ungulates

**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

**Key Assumptions:**

*Penstemon wilcoxii* is considered sensitive only in Washington; however, most information available on this species is from adjacent northeastern Oregon. Although listed as “in need of field work” in Washington (WNHP, 1994), the state Heritage Program apparently does not track the species.

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**Dispersal:**

**Pollinators** - Small to medium native bees; bumblebees; syrphid flies

**Dispersal Mode** - Wind; potentially water; possibly animal fur

**Requirements for Dispersal** - Open sites and running streams

**Trend:**

There are no demographic studies initiated in Washington or other parts of the CRB.

**Key Unknowns and Monitoring or Research Needs:**

Additional inventory and **tracking of** populations are needed for the species in Washington, to be followed by demographic monitoring unless numerous sites are located; the taxonomic relationship of the Washington populations to *Penstemon albertinus*, an extremely similar species common in adjacent Idaho, may also be worth pursuing. Basic data on the biology of the species is lacking, including germination biology, pollination ecology, shade tolerance, and responses to grazing.

**Degree of Confidence in Knowledge of Species:** High

7. **Special Habitats**

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

<i>Taxon</i>	<i>Habitat Description</i>
<i>Penstemon barrettiae</i>	Fractured basalt cliffs and walls with limited annual seepage, above riparian vegetation of major rivers; not all population sites for the species fit this general description, but the majority of known localities do -- unspoiled examples of habitat for this species should actually be relatively easy to preserve, although local destruction via ill-planned roadbuilding and quarrying is an occasional problem that might be encountered; the colonizing ability of <i>P. barrettiae</i> suggests that projects aimed at road 'widening along the Columbia River Gorge might actually create suitable habitat if artfully designed

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<p><i>Penstemon davidsonii</i> var. <i>praeteritus</i></p>	<p>Rocky outcrops and <b>scree</b> (high montane to subalpine) in the mountains of southeast Oregon (<b>Steens</b>, Pueblos, and Trout Creeks); habitat for this variety seems surprisingly scarce (at least in the Trout Creek and adjoining Oregon Canyon Mountains),, although this may not be the case in adjacent Nevada; however, sites where Oregon populations occur are largely out of the reach of grazing livestock (the only conceivable disturbance) – still, populations might be impacted by some indirect effect of <b>grazing</b> -- a means to exclude cattle from selected populations would be worth considering (followed by monitoring) if further evaluation of populations across ‘the <b>CRB</b> indicate any threat</p>
<p><i>Penstemon duestus</i> var. <i>variabilis</i></p>	<p>This is a species of mostly low elevation basalt cliffs, tams, open <b>gravelly flats</b>, roadcuts, or washes, <b>typically</b> in the sagebrush steppe or within a matrix of <b>xeric</b> bunchgrass and shrub steppe or dry pine forest; examples of suitable habitat for this seemingly <b>indestructable</b>, undemanding, and early colonizer of primary substrates should be relatively easy to preserve (or create); population destruction via roadbuilding or quarrying is the only threat to really consider, and even then populations would probably ‘e-appear naturally (based on observations of var. <i>duestus</i>); field work might determine if special habitat requirements for this variety actually exist, or if it is merely the weedy colonizer it appears</p>

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<p><i>Penstemon janishiae</i> and <i>P. "nikei"</i></p>	<p>These edaphically restricted species have perhaps the most specialized habitat of all the rare penstemons in the CRB, occurring only on unique eroded ash/clay or diatomaceous substrates, their slopes usually naturally barren and devoid of vegetation due to the harshness of the physical environment; additional inventory for both species should be relatively easy (it possibly could be completed aerially), by using soil maps as guides -- the focus for this work should be in Malheur County, Oregon and appropriate areas in southern Idaho and nearby Nevada; management recommendations concerning the conservation of populations and habitat should be uncontroversial as far as grazing <b>permittees</b> go, since the bleak slopes where these penstemons occur offer little palatable forage to livestock -- the only likely question needing to be answered is how much of a buffer zone is necessary between the livestock and <b>Penstemon</b> populations; any mining activities that <b>occurred</b> on the sites, however, 'would need careful coordination, and could be potentially devastating -- it remains to be established just how important these unusual ash outcrops may ultimately become to the mining and minerals industries, and what profitable resources (if any) they may harbor; it is unknown if any of the slopes are significant enough to warrant diatomite or zeolite extraction at this time</p>
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<p><i>Penstemon kingii</i>, <i>P. perpulcher</i>, and <i>P. seorsus</i></p>	<p>These three species share a habitat preference of rocky, sagebrush-steppe flats and slopes, typically at lower to middle 'elevations -- such communities are components of the most common and widespread ecosystem in the CRB, but pristine, intact examples of such sites are essentially non-existent now, except in isolated 'pockets' on steep bluffs; or along rocky ridges where cattle and sheep have historically been denied access due to terrain or water limitations -- inventories in the CRB for significant examples of <b>truly unaltered</b> sagebrush-steppe have largely come up empty to date (but should continue); sites that contain significant populations of these species may be among the <b>best</b> sagebrush habitats remaining; exclusion of livestock from major populations of these <b>taxa</b>, followed by community- and population-level research will enhance the chances for their conservation</p>
<p><i>Penstemon peckii</i></p>	<p>The Sisters Ranger District has been ably managing for this species, assisted by several outside studies (see Section 2.), for several years; maintenance of open, early to mid-seral ponderosa pine forest, and adjacent dry meadow, should ensure continued perpetuation of a significant majority of populations; conservation efforts should focus on incorporating as much existing diversity as possible (populations show a remarkable array of floral color morphs and other signs of genetic contrast)</p>

<p><i>Penstemon pratensis</i></p>	<p>In pre-grazing times, this species would have probably occurred along pristine streambanks or <b>mesic</b> meadows within the sagebrush-steppe of the lower CRB and adjacent northern Great Basin; such habitats were obviously common decades ago, but today virtually all have been moderately to severely impacted by livestock -- <b>ungrazed</b> sites are extremely infrequent within this geographic area; the restoration of habitat for <i>P. pratensis</i> may be possible if cattle impacts are reduced by the use of <b>exclosures</b>; any populations located, pristine or otherwise, would benefit from active research aimed at determining the relationships between the species and the current vegetation dynamics of its habitat</p>
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**8. Range Maps for *Penstemon* 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.

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A major problem faced by the **EEMP** is that these objectives are largely unattainable for the vast majority of **taxa in the CRB**, even **those** such as *Penstemon*, 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, or 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 flora. 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 arrive at 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**. Other important traits not specifically requested (although they could, of course, be

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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 *Penstemon* (and many other genera), there is a clear need to establish monitoring protocols for particularly rare or vulnerable species -- there are virtually no effectively designed, long-range monitoring plans in the **CRB** for any members of the genus (at least in Oregon and Washington). Methods are available for establishing excellent demographic assessments, and most penstemon species possess ideal life history characteristics for such studies (i.e., being long-lived herbaceous perennials that produce many seeds per plant).

In lieu of a genus-wide demographic study in the **CRB** (clearly impractical), representative **penstemon** species could be selected from a range of life histories (e.g., dormant seeds, non-dormant seeds, cliff or outcrop species, mat-forming species with suspected vegetative reproduction, herbaceous versus subshrubby, etc.) and monitored over time. Setting up monitoring programs now is not going to assist in **filling** the data void associated with the **EEMP**, but would hopefully result in useful information to be utilized the next time a region-wide ecosystem evaluation is proposed. In addition, a subset of the most important species (these could be the most sensitive, most typical, or whatever) could be studied in detail, with the goal of characterizing **all** or some of the important life history traits previously mentioned 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 solely 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, inventories for several penstemon species are still largely incomplete, and a number of areas within the **CRB** are yet to be well explored botanically (particularly in

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southeast Oregon). The table below summarizes these and other important gaps in our knowledge for specific *Penstemon* taxa in the CRB.

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

<i>Taxon</i>	<i>Data or Research Needs</i>
<i>Penstemon barrettiae</i>	Additional inventory (concentrating in <b>Klickitat</b> County, Washington), a design of a qualitative monitoring plan, data on potential dependancy on particular pollinators, breeding system information (including genetic compatibility and the possibility of inbreeding depression as a result of population isolation), seed biology and germination requirements (dormant versus non-dormant), and the potential for seed bank development in rocky environments are all important considerations for this horticulturally desirable, regional endemic. The species is well-established in the nursery trade, and is easily propagated.
<i>Penstemon davidsonii</i> var. <i>praeteritus</i>	Information on the <b>taxon's</b> distribution in Oregon and northern Nevada is needed, as is data on seed germination, seed bank size, frequency of recruitment, pollinator types and vulnerability, and potential interactions with livestock; it is unknown if this large-flowered variety of the species has been introduced into cultivation. Seeds or cuttings should be collected for the Berry Botanic Garden from each mountain range where it occurs.

<p><i>Penstemon duestus</i> var. <i>variabilis</i></p>	<p>This apparently uncommon and vaguely defined variety of a very common species should be reviewed <b>taxonomically</b> to determine if it merits continued recognition as a distinct <b>taxon</b> -- the species as a whole is very polymorphic over the entire CRB, and named varieties tend to intergrade; comparison between this variety and other forms of <i>P. duestus</i> might be made, to determine if populations of <i>var. variabilis</i> have any unique habitat requirements or biological traits. This might be best accomplished by comparative monitoring studies, and possibly some experimental manipulation of populations.</p>
<p><i>Penstemon glaucinus</i></p>	<p>An enhanced understanding of the relationship between this species and disturbance might be most <b>useful</b> to land managers. Considerable anecdotal information exists regarding the propensity of populations to increase with certain disturbances, including fire and limited logging. Some quantitative monitoring work; using populations within planned land management actions as treatments and controls, would generate valuable data to supplement existing qualitative reports and observations. Additional areas that need investigation include germination and seed bank ecology, pollination requirements, and competitive interactions with other vegetation.</p>

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<p><i>Penstemon janishiae</i></p>	<p>Additional inventory is needed for this species, currently under review by the ONHP (1993). Special attention should be paid to ecological requirements and long-term population trends in relation to the ashy substrate. Ability to compete with exotics, deal with disturbance and drought, substrate removal (including ability to recolonize), seed bank characteristics and germination biology, and pollination traits are all potentially important areas of research.</p>
<p><i>Penstemon kingii</i></p>	<p>This imperfectly known species (currently in review status -- ONHP, 1993) is in need of additional basic inventory. Any significant populations should be studied in terms of competitive interactions with exotics, pollination biology, and seed biology (germination and seed bank dynamics).</p>
<p><i>Penstemon "nikei "</i></p>	<p>The taxonomic significance of this "species" needs clarification -- if formal recognition is warranted then a published description is needed to help validate conservation efforts. In the meantime, additional inventory is needed, a task made easier by the apparently distinctive habitat of this edaphic specialist. Special regard should also be paid to ecological requirements (i.e., reproductive requirements and disturbance ecology in particular), and long-term population trends in relation to the soil type.</p>

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<p><i>Penstemon peckii</i></p>	<p>This is perhaps the most studied of all penstemon species in the CRB (at least in Oregon and Washington), ironic in that it is probably the most locally common of the sensitive <b>taxa</b>. A group of reports and studies (including a doctoral dissertation -- Field, 1985) have provided a solid background of information from which USFS managers have followed a reasonable conservation plan. The species might yet benefit from some additional work on long-term population dynamics (using more quantitative methods), as well as an evaluation of genetic diversity within and between populations, which seem to exhibit a tendency for clonal growth via stolon production.</p>
<p><i>Penstemon perpulcher</i></p>	<p>This imperfectly known species. (currently in review. status -- ONHP, 1993) is in need of additional basic inventory in <b>Malheur</b> County, Oregon, and adjacent Idaho. Any significant populations that are located should be studied in terms of competitive interactions with exotics, pollination biology, and seed ecology (germination and seed bank dynamics). The habitats of rare sagebrush ecosystem penstemon species (such as this one) might also be evaluated as <b>possible</b> plant community preserves or <b>ACEC's</b>, if associated native biodiversity is high and the exotic weedy component low.</p>

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<p><i>Penstemon pratensis</i></p>	<p>This is another southeastern Oregon and adjacent Nevada species needing further review before a status can be assigned (ONHP, 1993); additional inventory is needed across the mountain ranges of the lower <b>CRB</b> in eastern Oregon to assist in this determination. The <b>taxonomic</b> relationship between <i>P. pratensis</i> and <i>P. rydbergii</i> should also be revisited at some point. Significant populations may require conservation in conjunction with fenced <b>exclosures</b>, considering the habitat (commonly meadows and aspen understory) is often visited by herds of livestock. <b>Basic</b> information on the palatability to grazers, competitive abilities, pollination requirements, and seed biology of the species would be useful in designing conservation and management plans.</p>
<p><i>Penstemon seorsus</i></p>	<p>This imperfectly known, yet widely ranging <b>scabland</b> species (currently in review status -- ONHP, 1993) is in need of additional basic inventory. Any significant populations should be studied in terms of competitive interactions with exotics, pollination biology, and seed biology (germination and seed bank dynamics). Where native plant diversity is especially high, the habitats of rare sagebrush ecosystem penstemon species should also be evaluated for inclusion in preserves, possibly in an ACEC or something comparable.</p>

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<p><i>Penstemon spathulatus</i></p>	<p>Inventory in recent years (resulting in the discovery of additional populations), coupled with the generally inaccessible habitat, has reduced the urgency for conservation management of this alpine endemic. Biological data are still largely lacking, however, including information on pollination ecology, seed biology, and potential predation. Biennial monitoring of selected populations (simple observations only) should be adequate safeguard for this species.</p>
<p><i>Penstemon wiicoxii</i></p>	<p>Considered a sensitive species only in Washington. Workers there should be sure that putative populations of this species are correctly identified, and not actually <i>P. albertinus</i> (a similar species that is particularly common in nearby Idaho). In the meantime, information on pollinators and seed production, palatability to big game and livestock, competitive abilities, and germination requirements may be valuable information that could be gathered concurrent with a monitoring study.</p>

**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

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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.

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