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In Canada, Dwarf Woolly-heads, *Psilocarphus brevissimus var. brevissimus*, is restricted to the Similkameen River valley, south of Princeton in southwestern British Columbia and the extreme southeast and southwest corners of Alberta and Saskatchewan, respectively. This paper deals with the three British Columbia populations which represent the northwestern limit of the species which ranges from south-central British Columbia, southward in the western United States to Montana, Idaho, Washington, Oregon, Nevada, Utah, Wyoming, California and Baja California, Mexico. In British Columbia, *P. brevissimus* is associated with calcareous vernal pools and ephemeral pond edges in large forest openings. This habitat is rare in the area the few existing populations could easily be extirpated or degraded through slight changes in groundwater levels, coalbed methane gas drilling, housing development or recreational vehicles.

Key Words: Dwarf Woolly-heads, *Psilocarphus brevissimus var. brevissimus*, British Columbia, endangered, distribution, population size.

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Dwarf Woolly-heads, *Psilocarphus brevissimus var. brevissimus* Nutt., is a member of a genus of five species which occur in the Americas (Cronquist 1950). It is one of three species occurring in British Columbia and Canada (Douglas 1998). Two varieties of *P. brevissimus*, var. *brevissimus* and var. *multiflorus*, are recognized. The var. *multiflorus* occurs only in California (Morefield 1993). *Psilocarphus brevissimus var. brevissimus* was first recorded in Canada in 1997 (Douglas et al. 1998a).

*Psilocarphus brevissimus var. brevissimus* is a prostrate, matted annual herb with a short taproot (Figure 1; Douglas 1998). The plants are from 8 to 20 cm long. The few leaves are restricted to the stems and are opposite, lance-linear to lance-oblong or lance-triangular, 4-15 mm long and white woolly-hairy. The flower heads are disciform, lack a pappus, and are usually solitary in the leaf axils or at the tips of the branches and lack involucres. The receptacular bracts are 2.4-4 mm long, hooded and balloonlike. The achenes are more or less cylindric, glabrous, nerveless and tipped with a small, 1-2 mm long, offset style.

In British Columbia herbaria, specimens of *P. brevissimus var. brevissimus* may be distinguished from *P. elatior* by their prostrate and matted habit and much narrower leaves. It is separated from *P. tenellus var. tenellus* by its longer (2.5-4 mm versus 1.3-2.5 mm

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¹ Taxonomy and nomenclature follows Douglas et al. (1998b; 1998c; 1999; 2001).
long) receptacular bracts and its much narrower leaves. For many years in Alberta and Saskatchewan, this species was called *P. elatior* (Packer 1983; Kershaw 2001; Saskatchewan Conservation Data Centre 2004*). In 2004, Alberta taxonomists examined material from both provinces and reidentified them as *Psilocarphus brevissimus* var. *brevissimus* (J. Gould, personal communication). It is quite likely that the “species of concern” ranking given by COSEWIC (2004) for the Alberta/Saskatchewan populations of *P. elatior* will now be applied to the *P. brevissimus* populations.

**North American and Provincial Ranges**

*Psilocarphus brevissimus* var. *brevissimus* ranges from south-central British Columbia, southward in the western United States to Montana, Idaho, Washington, Oregon, Nevada, Utah, Wyoming, California and Baja California, Mexico (Morefield 1993; Cronquist 1994; Douglas 1998). There are also disjunct populations in Chile and Argentina (Cronquist 1950, 1955). In Canada, the species is known only from along 2.6 km of Highway #3 in the Similkameen River valley south of Princeton in south-central British Columbia (Figure 2; Douglas 1998; Douglas et al. 2002) and in the south-eastern and south-western corners of Alberta and Saskatchewan, respectively.

**Habitat**

*Psilocarphus brevissimus* var. *brevissimus* occurs in the southern interior of British Columbia in the lower montane zone in the Interior Douglas-fir biogeoclimatic zone (Hope et al. 1991). Climatic conditions are continental, characterized by hot, dry summers, a fairly long growing season and cool winters. A rainfall-shadow effect prevails in this area due to the presence of the Coast-Cascade Mountains to the west.

Within this zone, the sites occur in a matrix of level to gently sloping Big Sagebrush (*Artemisia tridentata*) shrub/grassland with scattered Ponderosa Pine (*Pinus ponderosa* and Douglas-fir (*Pseudotsuga menziesii*) [Nomenclature follows Douglas et al. 1998, 1998c, 1999 and 2001]). The area is at the western edge of the distribution of open shrub/grassland at that elevation. Specifically, *P. brevissimus* var. *brevissimus* occurs in calcareous clay soils in vernal pools in large forest openings dominated by Scouler’s Popcornflower (*Plagiobothrys scouleri*) and Close-flowered Knotweed (*Polygonum polygaloides* ssp. *confertiflorum*) (Figure 3). Associates in these sites include One-spike Oatgrass (*Danthonia unispicata*), Tiny Mouse-tail (*Myosurus minimus*), Carolina Meadow-foxtail (*Alopecurus carolinianus*), Common knotweed (*Polygonum aviculare*), Lowland Cudweed (*Gnaphalium palustre*), and Annual Hairgrass (*Deschampsia danthonioides*). *Psilocarphus brevissimus* var. *brevissimus* also occurs at the edge of ephemeral ponds in the same type of sub-stratum (Figure 4). The vernal pools and ephemeral pond edges are wet in spring and dry and compacted in the summer.

*Psilocarphus brevissimus* var. *brevissimus* is considered to be a vernal pool specialist (Schlising and Sanders 1982; Keeley and Zedler 1998; Bauder 2000). Keeley and Zedler (1998) define vernal pools as “precipitation-filled seasonal wetlands inundated during periods when temperature is sufficient for plant growth, followed by a brief waterlogged-terrestrial stage and culminating in extreme desiccating soil conditions of extended duration”. The species is able to outcompete grassland species due to its tolerance of inundation, and aquatic/wetland species due to its tolerance of soil dessication and heat during summer drought (Bauder 2000).

**Biology**

Little information is available on the biology of *Psilocarphus brevissimus* var. *brevissimus* in British Columbia. Only basic facts about its life cycle and reproduction are known.

Keeley and Zedler (1998) recognize four stages in the annual vernal pool cycle: (1) a wetting phase; (2) an aquatic or inundation phase; (3) a waterlogged-terrestrial phase; and (4) the drought phase. In vernal pool species, germination is typically initiated during the wetting or inundation phases. Flowering is usually initiated during the transition to the waterlogged-terrestrial phase. In the Princeton area of south-central British Columbia, this phase occurs during June and fruiting follows in July during the drought period.

*Psilocarphus brevissimus* var. *brevissimus* is an annual herb that likely reproduces primarily by self-pol- lination. The assumption of a selling breeding system is based on the taxon’s lack of pollinator attracting structures and the proximity of the stigmas to the central pollen-producing flowers. In addition, the abundance of woolly hairs and lack of achene pappus appear to limit pollen dispersal by wind. Another possibility is that plants set seed without pollination, through asexual reproduction (Cronquist 1950).
Animals may be the primary vectors of seed dispersal for *Psilocarphus brevissimus* var. *brevissimus*. Birds may disperse seeds over small and large geographic areas. The use of vernal pools by various migrating avian species, particularly waterfowl and shorebirds, is well documented in other regions (Silveira 1998). Finally, cottontail rabbits (*Sylvilagus spp.*) are potential agents of dispersal of *P. brevissimus* var. *brevissimus* seeds. A study in California found that *P. brevissimus* var. *brevissimus* seeds were commonly found in cottontail rabbit pellets. The excreted seeds germinated easily, suggesting that the lagomorphs may be important agents of seed dispersal between vernal pools on a small scale (Zedler and Black 1992). British Columbia sites for *P. brevissimus* var. *brevissimus* may provide habitat for Nuttall’s Cottontail (*Sylvilagus nuttallii*), a species that frequents grasslands.

**Population Attributes**

The three populations of *Psilocarphus brevissimus* var. *brevissimus* were discovered in 1997 in the Similkameen River valley, west of Princeton, British Columbia (Table 1; Douglas et al. 1998a). These populations are between approximately 0.8 and 2.6 km apart (Figure 2). During the period from 2002 to 2004, two of the populations decreased in size by about 25%. Plant numbers increased at one site from 450 to about 7200 plants and decreased at the other from about 900 000 to about 12000 plants.

Trends for these populations are not well known but it is obvious that they can be expected to vary markedly due to differences in yearly seed germination and seedling success. Population sizes of this annual herb are strongly tied to annual precipitation patterns (Bauder 2000) and are typical of vernal pool plants (Griggs and Jain 1983).

**Provincial, National and Global Ranks**

Globally, *Psilocarphus brevissimus* var. *brevissimus* has a rank of G4T4 indicating that in most of its range the plant is secure and frequent to common. Since the species is restricted to British Columbia it has a national rank in Canada of N1. Provincially, *P. brevissimus* var. *brevissimus* has been ranked S1 by the Conservation Data Centre and appears on the British Columbia Ministry of Sustainable Resource Management red list (Douglas et al. 2002). This is the most critical rank that can be applied to species at the provincial level and indicates that the species is “critically imperiled because of extreme rarity (typically five or fewer occurrences or very few remaining individuals) or because of some factor(s) making it especially vulnerable to extirpation or extinction”.

**Threats and Protection**

The major threats to *P. brevissimus* var. *brevissimus* are through drilling for coalbed methane gas, housing development and off-road recreational vehicles. In 2002 three test holes, targeting coalbed methane gas deposits, were drilled in the Similkameen valley. If brought into production the drilling, access roads and pumping stations could cause major degradation in the area.

Other potential threats result from activities that are permitted in the Agricultural Land Reserve. The private property where *P. brevissimus* var. *brevissimus* occurs is on the Agricultural Land Reserve, where primary land use is agriculture. For instance, some types of fill/soil removal are allowable without application to the Agricultural Land Commission (Provincial Agri-
Calcareous vernal pool habitat of *Psilocarphus brevissimus* var. *brevissimus* south of Princeton, British Columbia. Colorado Rush (*Juncus confusus*), another rare species in British Columbia, is conspicuous on both sides of the dried-up vernal pool. The several large plants in the habitat are the introduced grass, American Sloughgrass (*Beckmannia syzigachne*).

*Psilocarphus brevissimus* var. *brevissimus* is not formally protected in British Columbia, however, it could be in the future since this species is a potential candidate for listing under the provincial *Wildlife Amendment Act* (2004). As part of its commitment to the National Accord (National Accord for the Protection of Species at Risk), the province is required to take measures to protect this species. It is on Schedule 1 of the federal *Species At Risk Act* and a recovery strategy is expected to be completed by the summer of 2006.

**Evaluation**

The British Columbia Conservation Data Centre considers *P. brevissimus* var. *brevissimus* to be threatened/endangered in British Columbia (Douglas et al. 2002) and the Committee on the Status of Endangered Wildlife in Canada has assessed the species as endangered (COSEWIC 2003*). The three populations are small and vulnerable to a number of threats. With limited knowledge of the plant’s biological and ecological requirements, this species is vulnerable to extirpation in British Columbia. Without research on growth requirements and further demographic information, the stability of the present populations will remain unknown. The limited number of plants also reduces the potential for genetic variation, which may be necessary to respond to environmental changes in the future.
Acknowledgments

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Documents Cited (marked * in text)


Literature Cited


Figure 4. The ephemeral pond habitat of *Psilocarphus brevissimus* var. *brevissimus* south of Princeton, British Columbia. Myosurus minimus, Plagiobothrys scouleri and Polygonum aviculare are also prominent species on the calcareous clay soils. The adjacent bands of vegetation consist mainly of Meadow Barley (*Hordeum brachyantherum*) in the foreground and Common Cattail (*Typha latifolia*) in the background.


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