

# Conservation Evaluation of the Pacific Population of Dwarf Woolly-heads, *Psilocarphus brevissimus* var. *brevissimus*, in Canada\*

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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.

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 involucre. 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



FIGURE 1. Illustration of *Psilocarphus brevissimus* var. *brevissimus* (Line drawing by Elizabeth J. Steven in Douglas et al. 1998; 2002a).

\* The field work for *Psilocarphus brevissimus* was funded by the British Columbia Conservation Data Centre. The results appear in the British Columbia Conservation Data Centre database and a rare plant manual (Douglas et al. 2002). This information formed the basis for a Committee on the Status of Endangered Wildlife in Canada status report (Douglas et al. 2003\*) and the subsequent assessment of *Endangered* (COSEWIC 2003\*). This paper includes more recent information that did not appear in the original status report.

† Taxonomy and nomenclature follows Douglas et al. (1998b; 1998c; 1999; 2001).

TABLE 1. Locations and population sizes for *Psilocarphus brevissimus* var. *brevissimus* south of Princeton, British Columbia.

Collection site	Observation	Collector/Observer	Number of plants/area
Princeton, Tracey Lake, ca. 0.75 km SE of Lake	1996	Lomer	30/unknown
Princeton, Tracey Lake, ca. 1.3 km ESE of Lake	2002	Douglas and Penny	450/392 m <sup>2</sup>
	2004	Douglas and Smith	7200±500/100 m <sup>2</sup>
Princeton, Stevenson Lake, ca. 0.75 km SE of	2002	Douglas and Penny	900 000±100 000/570 m <sup>2</sup>
	2004	Douglas and Smith	11 775/155 m <sup>2</sup>

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 rain-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 Oat-

grass (*Danthonia unispicata*), Tiny Mousetail (*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 substratum (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 desiccation 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-pollination. The assumption of a selfing 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 brevisissimus* var. *brevisissimus*. 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. brevisissimus* var. *brevisissimus* seeds. A study in California found that *P. brevisissimus* var. *brevisissimus* 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. brevisissimus* var. *brevisissimus* may provide habitat for Nuttall's Cottontail (*Sylvilagus nuttallii*), a species that frequents grasslands.

### Population Attributes

The three populations of *Psilocarphus brevisissimus* var. *brevisissimus* 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 brevisissimus* var. *brevisissimus* 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. brevisissimus* var. *brevisissimus* 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. brevisissimus* var. *brevisissimus* are through drilling for coalbed methane gas, housing development and off-road recreational vehicles. In 2002

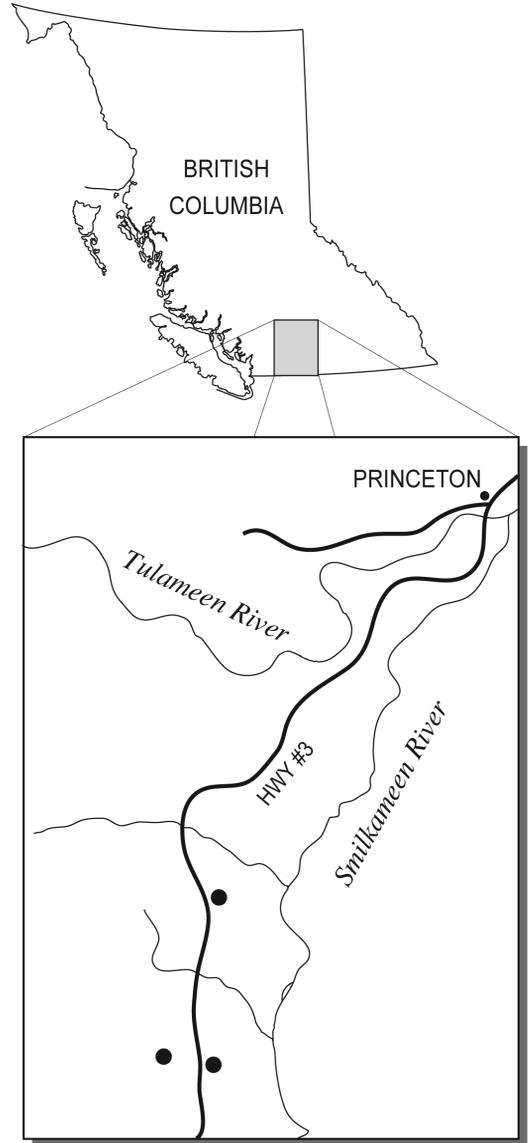


FIGURE 2. Distribution of *Psilocarphus brevisissimus* var. *brevisissimus* in British Columbia.

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. brevisissimus* var. *brevisissimus* 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-



FIGURE 3. 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*).

cultural Land Commission 2003\*). On these lands, development pressures do not appear to be an immediate issue at this time. The Agricultural Land Reserve status may prevent subdivision development, but does allow other activities that could also potentially threaten the populations. In recent years many tracts of Agricultural Land Reserve land in southern British Columbia has been converted to housing developments, shopping malls and golf courses, either by decisions of the Agricultural Land Commission or very rarely by an "order in council" by the sitting provincial legislature.

Another threat likely to have a negative impact is recreational off-road vehicle use. The authors observed evidence of all-terrain vehicles and dirt bike use in the area of the sites in 2004. The vernal pools and ephemeral pond edges are wet in spring and are susceptible to permanent changes if disturbed at this.

An additional threat to the population of *P. brevissimus* var. *brevissimus* is its vulnerability to extirpation due to the extremely small occupied area and population size. Such small populations are at risk of inbreeding depression (Primack 1998). Due to lack of genetic variation, these small populations are vulnerable to demographic and environmental variation. Furthermore, suitable habitats for *P. brevissimus* var. *brevissimus* in the southern interior of British Columbia are extremely limited and thus opportunities for colonisation are also limited.

*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.

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## Documents Cited (marked \* in text)

**COSEWIC.** 2003. COSEWIC assessment and status report on Dwarf Woolly-heads, *Psilocarphus brevissimus* var. *brevissimus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario. 19 pages. [www.cosewic.gc.ca](http://www.cosewic.gc.ca).

**COSEWIC.** 2004. Canadian Species at Risk. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario. 13 pages. [www.cosewic.gc.ca](http://www.cosewic.gc.ca).

**Douglas, G. W., J. L. Penny and K. Barton.** 2003. COSEWIC Status report on Dwarf Woolly-heads, *Psilocarphus brevissimus* var. *brevissimus* in Canada. In COSEWIC assessment and status report on Dwarf Woolly-heads, *Psilocarphus brevissimus* var. *brevissimus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario. 1-19 pages. [www.cosewic.gc.ca](http://www.cosewic.gc.ca).

**Provincial Agricultural Land Commission.** 2003. Agricultural Land Reserve – Frequently Asked Questions. Provincial Agricultural Land Commission. 133-4940 Canada Way, Burnaby, British Columbia V5G 4K6 Canada. [http://www.alc.gov.bc.ca/faq/faq\\_alr.htm](http://www.alc.gov.bc.ca/faq/faq_alr.htm).

**Saskatchewan Conservation Data Centre.** 2004. Tracked species list for vascular plants. Saskatchewan Conservation Data Centre, Fish and Wildlife Branch, Saskatchewan Environment and Resource Management. Regina, Saskatchewan.

## Literature Cited

**Bauder, E. T.** 2000. Inundation effects on small-scale plant distributions in San Diego, California vernal pools. *Aquatic Ecology* 34: 43-61.

**Cronquist, A.** 1950. A review of the genus *Psilocarphus*. *Research Studies of the State College of Washington* 18: 71-89.

**Cronquist, A.** 1955. Vascular plants of the Pacific Northwest. Part 5: Compositae. University of Washington Press, Seattle, Washington. 343 pages.

**Cronquist, A.** 1994. Intermountain flora-vascular plants of the Intermountain West, U.S.A. Volume 5: Asterales. New York Botanical Garden, New York, New York. 496 pages.

**Douglas, G. W.** 1998. Asteraceae. Pages 96-392 in *Illustrated flora of British Columbia*. Volume 1. Gymnosperms and Dicotyledons (Aceraceae through Asteraceae). Edited by G. W. Douglas, G. B. Straley, and D. Meidinger. British Columbia Ministry of Environment, Lands and Parks and British Columbia Ministry of Forests, Victoria, British Columbia. 436 pages.

**Douglas, G. W., F. Lomer, and Hans L. Roemer.** 1998a. New or rediscovered native vascular plant species in British Columbia. *Canadian Field-Naturalist* 112: 276-279.

**Douglas, G. W., D. Meidinger, and J. L. Penny.** 2002. Rare native vascular plants of British Columbia. Second edition. Province of British Columbia, Victoria, British Columbia. 359 pages.

**Douglas, G. W., D. Meidinger, and J. Pojar.** 1999. *Illustrated flora of British Columbia*. Volume 4. Dicotyledons (Orban-



**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.

chaceae through Rubiaceae). British Columbia Ministry of Environment, Lands and Parks and British Columbia Ministry of Forests, Victoria, British Columbia. 427 pages.

**Douglas, G. W., D. Meidinger, and J. Pojar.** 2001. *Illustrated flora of British Columbia*. Volume 7. Monocotyledons (Orchidaceae to Zosteraceae). British Columbia Ministry of Sustainable Resource Management and British Columbia Ministry of Forests, Victoria, British Columbia. 379 pages.

**Douglas, G. W., G. B. Straley, and D. Meidinger.** 1998b. *Illustrated flora of British Columbia*. Volume 1. Gymnosperms and Dicotyledons (Aceraceae through Asteraceae). British Columbia Ministry of Environment, Lands and Parks and British Columbia Ministry of Forests, Victoria, British Columbia. 436 pages.

**Douglas, G. W., G. B. Straley, D. Meidinger, and J. Pojar.** 1998c. *Illustrated flora of British Columbia*. Volume 2. Dicotyledons. (Balsaminaceae through Cuscutaceae). British Columbia Ministry of Environment, Lands and Parks and British Columbia Ministry of Forests, Victoria, British Columbia. 401 pages.

- Griggs, F. T., and S. K. Jain.** 1983. Conservation of vernal pool plants in California, II. Population biology of a rare and unique grass genus *Orcuttia*. *Biological Conservation* 27: 171-193.
- Hope, G. D., W. R. Mitchell, D. A. Lloyd, W. R. Erickson, W. L. Harper, and B. M. Wikeem.** 1991. Interior Douglas-fir zone. Pages 153-166 in *Ecosystems of British Columbia*. Edited by D. Meidinger and J. Pojar. British Columbia Ministry of Forests Special Report Series Number 6, Victoria, British Columbia. 330 pages.
- Keeley, J. E., and P. H. Zedler.** 1998. Characterization and global distribution of vernal pools. In *Ecology, conservation, and management of vernal pool ecosystems: Proceedings from a 1996 Conference*. Edited by C. W. Witham, E. T. Bauder, D. Belk, W. R. Ferren Jr., and R. Ornduff. California Native Plant Society, Sacramento, California.
- Kershaw, L.** 2001. Rare vascular plants of Alberta. The University of Alberta Press, Edmonton, Alberta. 484 pages.
- Morefield, J. D.** 1993. *Psilocarphus*. Page 329 in *The Jepson manual: Higher plants of California*. Edited by J. C. Hickman. University of California Press. Berkeley, California. 1400 pages.
- Packer, J. G.** 1983. *Flora of Alberta*. Second edition. University of Toronto Press, Toronto, Ontario. 687 pages.
- Primack, R. B.** 1998. *Essentials of conservation biology*. Sinauer Associates Inc., Sunderland, Massachusetts.
- Schlising, R. A., and E. L. Sanders.** 1982. Quantitative analysis of vegetation at the Richvale vernal pools, California. *American Journal of Botany* 69: 734-742.
- Silveira, J. G.** 1998. Avian uses of vernal pools and implications for conservation practice. In *Ecology, conservation, and management of vernal pool ecosystems. Proceedings from a 1996 Conference*. Edited by C. W. Witham, E. T. Bauder, D. Belk, W. R. Ferren Jr., and R. Ornduff. California Native Plant Society, Sacramento, California.
- Zedler, P. H., and C. Black.** 1992. Seed dispersal by a generalized herbivore: rabbits as dispersal vectors in a semi-arid California vernal pool landscape. *American Midland Naturalist* 128: 1-10.

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