

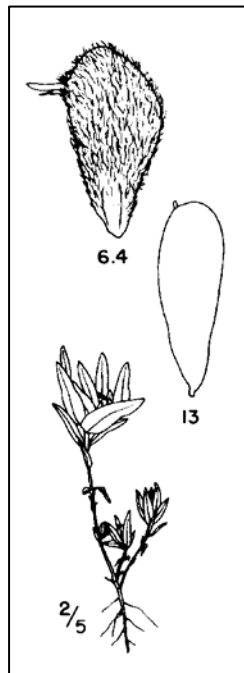
COSEWIC Assessment and Update Status Report

on the

Dwarf Woolly-heads *Psilocarphus brevissimus*

Southern Mountain population
Prairie population

in Canada



**SOUTHERN MOUNTAIN POPULATION – ENDANGERED
PRAIRIE POPULATION – SPECIAL CONCERN
2006**

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA



COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Previous reports:

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Douglas, G.W., J.L. Penny and K. Barton. 2003. COSEWIC status report on the dwarf woolly-heads *Psilocarphus brevissimus* in Canada in COSEWIC assessment and status report on the dwarf woolly-heads *Psilocarphus brevissimus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-19 pp

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COSEWIC would like to acknowledge Matt Fairbarns for writing the update status report on the dwarf woolly-heads *Psilocarphus brevissimus* in Canada, prepared under contract with Environment Canada, overseen and edited by Erich Haber, Co-chair (Vascular Plants), COSEWIC Plants and Lichens Species Specialist Subcommittee.

Dwarf woolly-heads *Psilocarphus brevissimus* was first assessed by COSEWIC as Endangered in Canada in 2003. However, because the original status report failed to note the presence of the Prairie population, which is present at numerous sites in southeastern Alberta and southwestern Saskatchewan, COSEWIC requested that a new update report be prepared for re-evaluation of the species' conservation status.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le psilocarpe nain (*Psilocarphus brevissimus*) Population des montagnes du Sud et la population des Prairies au Canada – Mise à jour.

Cover illustration:

Dwarf woolly-heads — Illustration by J.H. Janish in Hitchcock *et al.* 1995, with permission.

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COSEWIC Assessment Summary

Assessment Summary – April 2006

Common name

Dwarf woolly-heads – Southern Mountain population

Scientific name

Psilocarphus brevissimus

Status

Endangered

Reason for designation

An annual herb restricted to a very small range and present at only three small sites on private lands within the COSEWIC Southern Mountain Ecological Area of British Columbia. Population size is subject to extreme fluctuations in the number of mature individuals due to variation in precipitation levels and the population is at risk from such factors as increased land development in the region and land use practices.

Occurrence

British Columbia

Status history

Designated Endangered in November 2003. Renamed dwarf woolly-heads (Southern Mountain population) in April 2006 and designated Endangered. Last assessment based on an update status report.

Assessment Summary – April 2006

Common name

Dwarf woolly-heads – Prairie population

Scientific name

Psilocarphus brevissimus

Status

Special Concern

Reason for designation

This population is widely distributed in Saskatchewan and Alberta at more than 40 sites with large among-year fluctuations in numbers of mature individuals and with concerns over potentially significant future impacts. These pertain to potential future development of coal-bed methane gas extraction in a significant part of the range of the population and disruptions from pipeline construction.

Occurrence

Alberta, Saskatchewan

Status history

Designated Special Concern in April 2006. Last assessment based on an update status report.



COSEWIC
Executive Summary

Dwarf Woolly-heads
Psilocarphus brevissimus
Southern Mountain population
Prairie population

Species information

Dwarf woolly-heads (*Psilocarphus brevissimus*) is a low, woolly annual herb with short, opposite leaves. The heads lack whorls of bracts that form an involucre that surrounds the heads of most members of the aster family; they also lack rays or any showy structures and are copiously woolly and inconspicuous like the rest of the plant. Each head is lobed and each lobe contains a few central male flowers surrounded by anywhere between 8 and 80 female flowers. The female flowers are each partially enclosed by a minute, woolly, sack-like receptacular bract that has a lateral, translucent appendage. The style, near the tip of the achene, is offset.

Distribution

In Canada, *Psilocarphus brevissimus* occurs in south central British Columbia and in southeast Alberta/southwest Saskatchewan. The two groups of populations, referred to as the Southern Mountain Population and Prairie Population respectively, appear to function as separate evolutionary units because they are not united by a continuous distribution of populations to the south. The species' global range extends through central and eastern Oregon south along both sides of the Sierra Nevada Mountains to Baja California as well as in Argentina and Chile.

Habitat

Psilocarphus brevissimus occurs in vernal pools, temporarily flooded depressions and drawdown areas along lakes and ponds. Some of the potential habitat has been lost over the past century due to agricultural development and invasion by exotic grasses and shrubs. The amount of suitable habitat fluctuates greatly depending on the degree of spring flooding.

Biology

Psilocarphus brevissimus is an annual that flowers and fruits in mid- to late summer. Its floral structure is strongly adapted to favour self-pollination. The seeds are dispersed in the late fall. The seeds are enveloped by a woolly receptacular bract and

lack structures to aid long-distance dispersal. The seeds germinate during the early summer but the plant continues to develop even as the surrounding uplands become droughty. The ability to tolerate high moisture levels in the winter and very low moisture levels in the summer allows it to grow where many other plants would succumb to environmental stress.

Population sizes and trends

Populations fluctuate greatly among years, depending on rainfall and flooding. The Southern Mountain Population may have as few as 700 mature individuals in 'trough' years and perhaps as many as 2,000,000 in 'peak' years. The Prairie Population may have as many as 27,000 individuals in 'peak' years but many sub-populations disappear completely during trough years, when the aggregate population may be as low as 2,000 individuals.

Limiting factors and threats

The Southern Mountain Population is highly susceptible to extirpation because there are very few localities and they are restricted to small areas of suitable habitat. The primary threats to this population in Canada come from habitat alteration due to changes in hydrology and grazing practices. Other threats include the use of herbicides to control invasive species on the surrounding rangelands and all-terrain vehicle use.

The Prairie Population is threatened by agricultural development, oil and gas exploration, range management practices and weed control measures.

Special significance of the species

The Canadian populations may be remnants of a broader distribution during the warm, dry Hypsithermal Interval.

Existing protection or other status designations

Dwarf Woolly-heads (*Psilocarphus brevissimus*) was first assessed by COSEWIC as Endangered in Canada in 2003. However, because the original status report failed to note the presence of the Prairie Population, which is present at numerous sites in southeastern Alberta and southwestern Saskatchewan, COSEWIC requested that a new update report be prepared for re-evaluation of the species' conservation status. *Psilocarphus brevissimus* has no species-specific protection in Canada or elsewhere. Only 2 of the 41 Prairie Population sites are known to occur in protected areas and all three of the Southern Mountain Population sites occur on private land.



COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5th 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2006)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and it is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.



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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

**Update
COSEWIC Status Report**

on the

Dwarf Woolly-heads
Psilocarphus brevissimus

Southern Mountain population
Prairie population

in Canada

2006

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SPECIES INFORMATION

Name and classification

Scientific name: *Psilocarphus brevissimus* Nutt.
Synonyms: *Psilocarphus oreganus* Nutt. var. *brevissimus* (Nutt.) Jeps.
P. globiferus Nutt.
P. chilensis Gray
Bezanilla chilensis Remy
Common name: Dwarf woolly-heads
Family: Asteraceae (Compositae), aster family

Two varieties of *Psilocarphus brevissimus* have been described but var. *multiflorus* is restricted to central California. All other material belongs to var. *brevissimus* (Morefield 1993).

Morphological description

Psilocarphus brevissimus is a small, woolly, low annual herb arising from a short taproot (Figure 1). It has narrow, short, opposite stem leaves that are usually 5-20 mm long and 1.5-5 mm wide. The upper leaves usually surpass the flower heads.

The heads appear to be terminal on shoots but careful examination reveals they are born in the forks of inconspicuous branches. The heads lack involucre (rings of small bracts around the flowers which are present in most members of the aster family), rays or any showy structures and are copiously woolly and inconspicuous like the rest of the plant. Each head is lobed and the lobes appear to have derived from the incomplete combination of 4-5 heads into one. Each lobe contains a few central male flowers surrounded by anywhere between 8 and 80 female flowers. The female flowers are each partially enclosed by a minute, woolly, sack-like receptacular bract that has a lateral, translucent appendage. The bracts are about 3 mm long at maturity (2.5-4.0 mm). The style near the tip of the achene is offset (Cronquist 1950, Douglas 1998).

Although species in the genus *Psilocarphus* are relatively well defined (Morefield pers. comm.) “the character-combinations of the species interlock” (Cronquist 1950) and specimens are not always easily identified using a dichotomous key. *Psilocarphus brevissimus* can generally be distinguished from the other two members of the genus found in Canada - *P. tenellus* and *P. elatior*. *Psilocarphus tenellus* has shorter receptacular bracts (1.2 – 2.7 mm vs. 2.5 – 4.0 mm in *brevissimus*), its leaves tend to be widest at the tip (rather than at the base), and its achenes tend to be broadly oblanceolate to narrowly obovate (rather than oblanceolate) (Cronquist 1950). Nevertheless, *P. tenellus* and *P. brevissimus* may occasionally be hard to distinguish (Björk pers. comm. 2005). *Psilocarphus elatior* is more closely related to *P. brevissimus*. The receptacular bracts of both species are about 3 mm long. *Psilocarphus elatior* differs in being less densely woolly, has a simple rather than lobed receptacle, has a subapical rather than offset style, and tends to be more erect rather

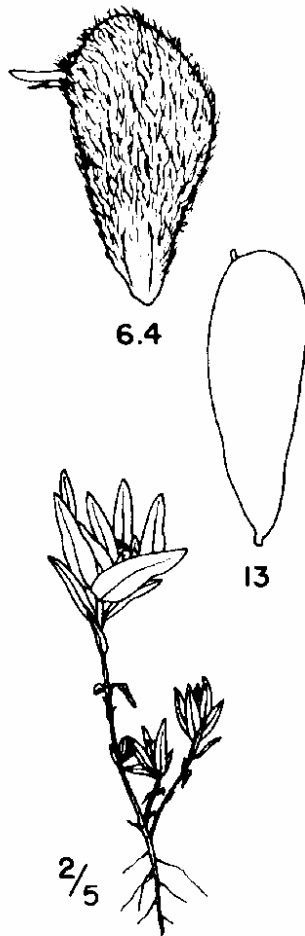


Figure 1. Illustration of *Psilocarphus brevissimus* Top: woolly receptacular bract with its lateral appendage. Middle: achene with offset style. Lower: Typical plant, with flower head hidden among leaves at top of stem. By J.H. Janish in Hitchcock *et al.* 1955, with permission. Numbers show degree of magnification.

than prostrate. The achene of *P. elatior* tends to be turgid and narrowly oblong to elliptic-oblong, rather than flattened and oblanceolate as in *P. brevissimus* (Cronquist 1950). Specimens of *P. elatior* may occur found within the range of *P. brevissimus* var. *brevissimus* and look like the latter (Morefield 1993; pers. comm.).

Despite difficulties in identifying the species, *Psilocarphus elatior*, *P. tenellus* and *P. brevissimus* have been recognized as separate species for over a century, and were accepted as such in the most recent generic treatment (Cronquist 1950) as well as the soon-to-be-released treatment in the Flora of North America (Morefield pers. comm.).

Genetic description

Morefield (1993) reports that $2n=28$ in *Psilocarphus brevissimus* and has indicated that this number is consistent among most members of its subtribe which have been examined (Morefield pers. comm. 2005). No other genetic information is available on the genetics of the species.

Designatable units

The Southern Mountain Population (Princeton area of British Columbia) and Prairie Population (Alberta and Saskatchewan) should be considered separate Designatable Units. There is a pronounced disjunction between the two units, which are separated by a distance of over 500 km and several north-south oriented mountain ranges including the Rocky Mountains, the Purcell Mountains, the Selkirk Mountains and the Okanagan Mountains. The Southern Mountain Population is probably derived from a source population farther south, but west of the Rockies. The Prairie Population is more likely to be derived from source populations east of the Rockies, in Montana or Wyoming. From a continental perspective, populations east of the Rockies appear to be only weakly linked with those from west of the Rockies. As a result, there has probably never been dispersal between the Southern Mountain Population and the Prairie Population in Canada, even indirectly through a Washington-Idaho-Montana corridor. Such dispersal is not likely to occur in the foreseeable future.

Furthermore, the two units occupy different eco-geographic regions as defined by COSEWIC: the Southern Mountain Ecological Area and the Prairie Ecological Area.

Morefield (pers. comm. 2005) characterized material collected from Alberta and Saskatchewan as taller and more elongate than is normal for the species.

Plants recognized in this report as belonging to the Prairie Population were previously identified and erroneously treated as the Prairie Population of tall woolly-heads (*P. elatior*) and designated as special concern by COSEWIC in May 2001. Specimens from Alberta and Saskatchewan were subsequently re-examined in 2005 by provincial vascular plant specialists from Alberta and Saskatchewan. These included: Dr. John G. Packer (Professor Emeritus, Botany, University of Alberta, Edmonton) and Ms. Joyce Gould (Alberta Natural Heritage Information Centre) and Dr. Vernon L. Harms (The Fraser Herbarium Dept. of Crop Science and Plant Ecology and Dept. of Biology University of Saskatchewan, Saskatoon). Their examination of specimens resulted in the re-identification of prairie specimens formerly considered to represent *P. elatior* as *P. brevissimus*. Dr. James D. Morefield, (Botanist, Nevada Natural Heritage Program) the world specialist on the genus *Psilocarphus*, has also examined Canadian prairie specimens and confirmed their identities as belonging to *P. brevissimus*. Specimens of *P. elatior* appear not to be found east of the Rockies, even in the United States (Hitchcock *et al.* 1955).

DISTRIBUTION

Global range

The main range of *Psilocarphus brevissimus* extends from central and eastern Oregon south along both sides of the Sierra Nevada Mountains to Baja California (Figure 2). The species also occurs in Chile and Argentina (Hitchcock *et al.* 1955, Morefield 1993).

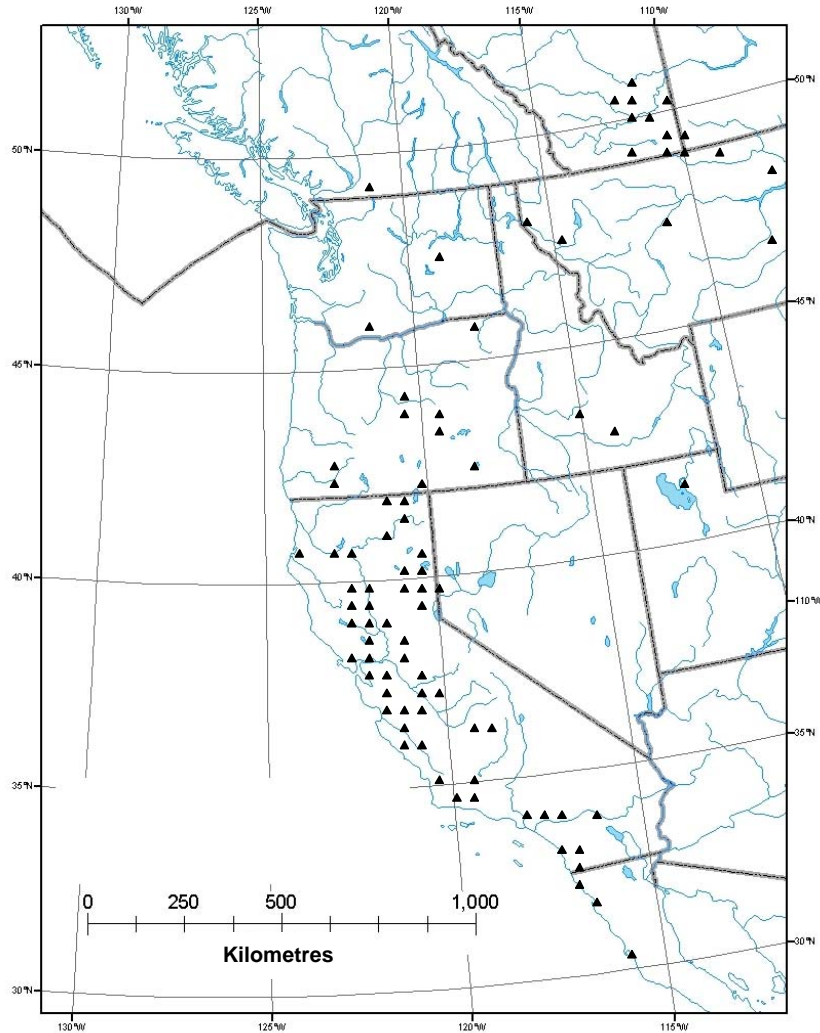


Figure 2. North American distribution of *Psilocarphus brevissimus* (Based on maps from Cronquist 1950; Douglas *et al.* 2000, 2003; Kartesz 2003).

There are numerous outliers north and east of the main range - in northern Utah, Wyoming, Montana, southern Idaho, east-central Washington and north to western Canada just north of the 49th parallel (Kartesz 2003). The outlier populations appear to be discontinuous and there is no evidence of regular gene transfer among them. It appears

likely that populations of many vernal pool plants are established as the result of seeds transferred by migrating waterfowl and shorebirds (Silveira 1998). Curiously, *Psilocarphus brevissimus* has been reported from southern Idaho where it is relatively common, but not from northern Idaho. A similar but smaller species, *P. tenellus*, has been reported from northern Idaho where it is very rare (Mancuso pers. comm. 2005). In contrast, *P. tenellus* has not been reported from Montana and all material in that state (including populations in the northern tier of counties) has been identified as *P. brevissimus*.

Canadian range

The Prairie Population (Figure 3) consists of numerous sites that have a 23,760 km² extent of occurrence. The area of occupancy of several sites of the Prairie Population has not been recorded but their aggregate area of occupancy is estimated, from habitat descriptions and preferences, as under 40 ha.

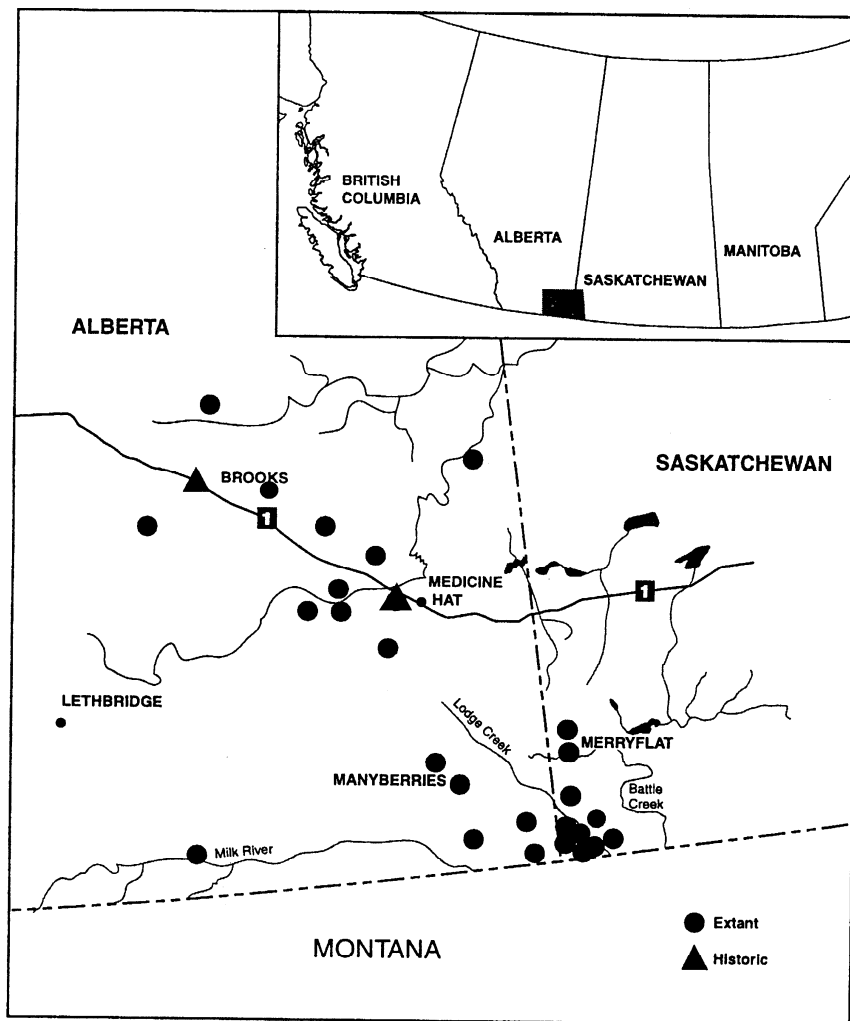


Figure 3. Distribution of the Prairie Population of *Psilocarphus brevissimus*.

The Southern Mountain Population (Figure 4) consists of three sites with a 1.5-2.0 km² extent of occurrence. It occupies an area of about 0.1 ha.

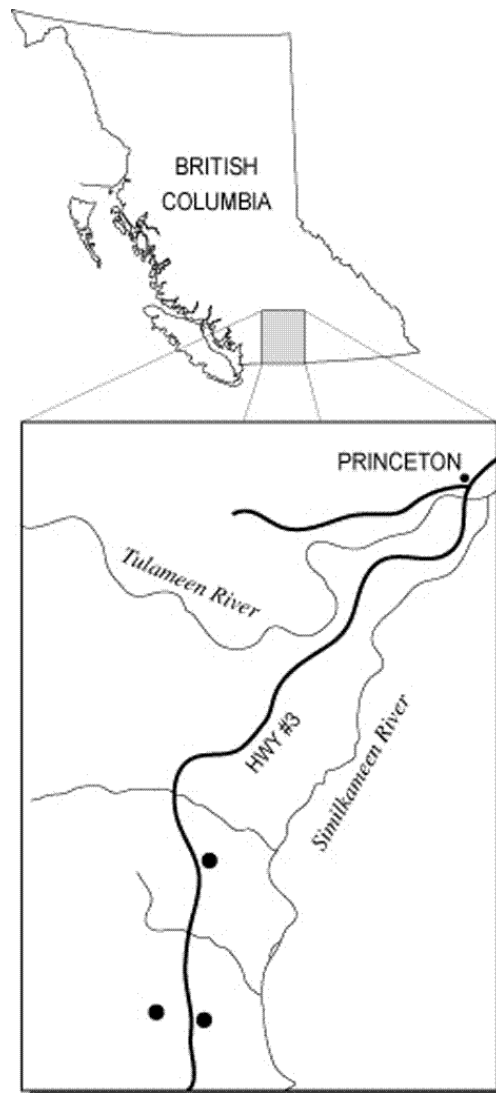


Figure 4. Distribution of the Southern Mountain Population of *Psilocarphus brevissimus*. (The two southern locations are only about 700 m apart and about 2.5 km from the northern location.).

HABITAT

Habitat requirements

Southern Mountain Population

The Princeton unit occurs in a rainshadow cast by the Coast-Cascade Mountains. The resulting continental climate has cool winters with low to moderate snowfall. The

growing season is relatively long (about 95 frost-free days), warm (about 1,028-1,266 growing degree days > 5°C) and dry (185-313 mm growing season precipitation). There are substantial growing season moisture deficits (Lloyd *et al.* 1990).

The species occurs on calcareous clay soils along pond margins and in shallow depressions which are dominated by annual plants which can take advantage of the brief period of favourable growing conditions. The leading species include *Plagiobothrys scouleri* (Scouler's popcornflower) and *Polygonum polygaloides* ssp. *confertiflorum* (Close-flowered knotweed). Common associates include *Myosurus minimus* (tiny mouse-tail), *Alopecurus carolinianus* (Carolina meadow-foxtail), *Gnaphalium palustre* (lowland cudweed), and *Deschampsia danthonioides* (annual hairgrass). The most commonly associated perennial plant is *Danthonia unispicata* (One-spike oatgrass) (Douglas *et al.* 2003). The surrounding area is composed of shrub/grassland dominated by *Artemisia tridentata*, *Pseudoroegneria spicata* and *Hesperostipa comata* as well as open to closed woodlands dominated by *Pinus ponderosa* (Ponderosa pine) and *Pseudotsuga menziesii* (Douglas-fir).

Prairie Population

The prairie population occurs in a semi-arid region with very cold winters and short, warm summers. Most of the precipitation falls in summer, with 75-130 mm in June but an average of less than 50 mm per month in July and August (Hare and Thomas 1979).

In the Prairie Population, sites tend to occur on shallowly depressional, seasonally flooded sites such as Solonchetsic pans, slough margins and ephemeral wetlands with sandy bottoms (Hudson pers. comm. 2005; Porter 2005 pers. comm., Romuld pers. comm. 2005; Wallis pers. comm. 2005; Bush pers. comm. 2005). There does not appear to be any consistent suite of associated species but vegetation data is lacking for most sites (Douglas *et al.* 2000). The surrounding uplands tend to support grassland vegetation dominated by *Hesperostipa comata*, *H. curtisetata*, *Pascopyrum smithii*, *Elymus lanceolatus*, *Koeleria macrantha* and *Bouteloua gracilis*.

Trends

There is no reliable information regarding the rates of change in extent of occurrence, area of occupancy or habitat suitability in either unit.

Habitat protection/ownership

The three localities of the Southern Mountain Population occur on a private ranch within the Agricultural Land Reserve (Table 1). Two of the Prairie Population localities occur in protected areas. Most of the other localities occur on provincial crown land or land ownership is unknown.

Table 1. *Psilocarphus brevissimus* population data.

Population Localities	Last Observation	Presumed Status	Land Status	Extent	Number Individuals¹
Prairie 1	C. Wallis 1989	extant	protected	< 1 acre	? - several hundred
Prairie 2	M. Romuld 1990	extant	protected	< 1 acre	? - >50
Prairie 3	K. Tannas 1989	extant	unknown	< 2 ha	? - (50-100)
Prairie 4	C. Wallis 1985	extant	crown	< 1 acre	? - (100-1000)
Prairie 5	D. Bush 1997	extant	unknown	< 2 ha	? - >2,700
Prairie 6	D. Bush 1996	extant	unknown	< 1 ha	0 - (100-1000)
Prairie 7	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 8	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 9	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 10	D. Bush 1996	extant	private	< 1 ha	0 - (100-1000)
Prairie 11	D. Bush 1996	extant	unknown	< 1 ha	0 - (100-1000)
Prairie 12	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 13	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 14	E. Moss 1927	historic	unknown	unknown	unknown
Prairie 15	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 16	C. Wallis 1979	extant	crown	< 1 acre	0 - (100-1000)
Prairie 17	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 18	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 19	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 20	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 21	D. Bush 1996	extant	unknown	< 1 ha	0 - (100-1000)
Prairie 22	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 23	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 24	D. Bush 1996	extant	crown	< 1 ha	0 - (100-1000)
Prairie 25	D. Bush 1996	extant	private	< 1 ha	0 - (100-1000)
Prairie 26	E. Moss 1953	historic	unknown	unknown	unknown
Prairie 27	C. Wallis 2003	extant	private	< 1 acre	~1,000
Prairie 28	J. Hudson 1979	extant	leased crown?	~ 1 acre	locally abundant
Prairie 29	J. Hudson 1979	extant	leased crown?	~ 1 acre	scarce
Prairie 30	J. Hudson 1980	extant	leased crown?	~ 1 acre	small amount
Prairie 31	Harris and Harris 1999	extant	unknown	unknown	? - ~ 200
Prairie 32	Harris and Harris 1999	extant	unknown	unknown	? - 1,000
Prairie 33	Harris and Harris 1999	extant	unknown	unknown	? - 50
Prairie 34	Harris and Lamont 1999	extant	unknown	unknown	? - 1,000
Prairie 35	Harris and Lamont 1999	extant	unknown	unknown	? - 200
Prairie 36	Harris and Lamont 1999	extant	unknown	unknown	? - 200
Prairie 37	Harris and Harris 1999	extant	unknown	unknown	? - 500
Prairie 38	Harris and Harris 1999	extant	unknown	unknown	? - 10
Prairie 39	Harris and Harris 1999	extant	unknown	unknown	? - 50
Prairie 40	Harris and Harris 1999	extant	unknown	unknown	? - 75
Prairie 41	Harris and Harris 1999	extant	unknown	unknown	? - 10
S. Mtn. 1	Lomer 1996	extant	private	<0.1 ha	30-300
S. Mtn. 2	Douglas 2002	extant	private	0.1 ha	225 - (1-2 million)
S. Mtn. 3	Lomer 2002	extant	private	<0.1 ha	450 - 7,700

¹Most (perhaps all) populations disappear during drought years or their numbers decrease by more than an order of magnitude (almost 4 orders of magnitude in the case of Princeton 3)

BIOLOGY

General

Very little has been written about the life history, demography or physiology of *Psilocarphus brevissimus* or other species within the genus. Cronquist's 1950 monograph on the genus remains one of the best sources of information, although some aspects of life history can be inferred from studies of other annual vernal pool species with similar phenological characteristics.

Reproduction and dispersal

Species of *Psilocarphus* are annual plants that most often occur in vernal moist environments. Pollination likely occurs within the flower head, since there are no structures to aid in wind or animal dispersal. Furthermore, only a small amount of pollen is produced in staminate flowers and it is unlikely to be carried by the wind because the flowers are sheltered by the upper stem leaves and 'wool' which encircle each head. Appendages on each receptacular bract guide the long, slender styles of the outer (pistillate) flowers toward pollen-producing flowers in the centre of the lobe (Cronquist 1950).

Movements/dispersal

Many vernal pool plants lack apparent dispersal-enhancing traits, perhaps because the island-like distribution of suitable habitat penalizes a species that tends to disperse widely (Zedler 1990).

The receptacular bracts, which persist around the mature achene, may buoy it up when the site is flooded, thereby dispersing achenes short distances throughout a pond or pool (Cronquist 1950).

Some of the light, fluffy receptacular bracts may catch in the wind, dispersing the attached achenes over slightly longer distances. Generalist mammalian herbivores may also play a role in medium-distance dispersal. In a California study, seeds of *Psilocarphus brevissimus* germinated from cottontail rabbit droppings collected from the vicinity of vernal pools, including 'new' pools which were artificially created. The data suggest that cottontails, though weak dispersers of seeds, may play an important role in the colonization and re-establishment of *P. brevissimus* in habitat patches (Zedler and Black 1992). Cottontail rabbits occur in the grasslands of southern Alberta and Saskatchewan and may play a role in medium-distance dispersal of *P. brevissimus* among vernal pools and other suitable habitats. Cottontails have not been observed in the Princeton area of British Columbia but other small mammals may play a similar role.

Some seeds may be carried long distances, in mud on the feet of shorebirds and waterfowl (Cronquist 1950). A number of waterfowl, shorebird and passerine species that frequent vernal pools and moist prairie depressions (Silveira 1998) may serve as

vectors. Long-distance dispersal is probably a rare event, given the absence of the species from many suitable habitats within its extent of occurrence in Canada.

There is no evidence regarding the species' ability to bank seeds in the soil but this is a common adaptation among vernal pool species that allows them to persist over drought years.

Germination and seedling ecology

Many annuals of moist depressions are adapted to limited growth under water during cool periods, followed by rapid growth and maturation as the pools warm up and then dry out (Zedler 1990). It is not certain, however, that *Psilocarphus brevissimus* actually germinates under water. *Psilocarphus elatior*, a closely related species of vernal pools in coastal British Columbia, either germinates after standing water disappears or is too small to detect at that time (pers. obs.).

Survival

Psilocarphus brevissimus is not capable of clonal growth. Vegetative development, flowering and fruit production are probably regulated by the rate at which the soil desiccates. Late spring and early summer rains may prolong the growing period, increasing fecundity. Consistent levels of high moisture in the spring and early summer likely favour an increase in the cover of perennial herbs, which can outcompete *P. brevissimus*. There is no evidence of herbivory on the plants.

Physiology

There is no information on the physiology of *Psilocarphus brevissimus* that is relevant to assigning at-risk status or developing recovery plans.

POPULATION SIZES AND TRENDS

Search effort

The Princeton populations appear to be restricted to non-saline vernal pools, a rare habitat type at low elevations in south-central British Columbia. Experienced searchers can find the plant with relative ease despite its small size, because it has a distinctive form, is visible and exposed on open ground, and can be detected for several months of the year (it was first found in October). All three sites were found by Frank Lomer, who has explored the botany of south-central British Columbia for about 15 years and has searched suitable habitat for new occurrences of *Psilocarphus brevissimus* several times since originally discovering it in 1996. The site where *P. brevissimus* occurs also has two plant species not found elsewhere in Canada – *Collomia tenella* and *Antennaria flagellaris* – which supports the hypothesis that this site is unique from an ecological and biogeographic perspective (Lomer pers. comm. 2005).

There is no measure of search effort for the Prairie Unit. Most of the records were found in two surveys carried out in exceptionally wet years. It seems likely that other populations exist within the Prairie Unit although they are probably only present in the soil seed bank in most years.

Fluctuations and trends

Population fluctuations are common among annual plants of vernal pools and temporary ponds (Bauder 2000, Griggs and Jain 1983).

The sub-populations of *Psilocarphus brevissimus* in the Southern Mountain Population fluctuate greatly. The largest of the sub-populations numbered “a few thousand” in 1997 but rose to “1-2 million” in 2002. Repeat counts are only available for one of the other two (much smaller) populations and it fluctuated between 300 and 11,500 plants in an 8-year period.

In the Prairie Population, the majority of the Alberta occurrences were reported in 1996. That year was very wet and the records came from a series of sites that had probably not been flooded for several years, or even decades (D. Bush pers. comm. 2005). Most of the Saskatchewan records came from 1999. During that spring, high runoff and rainfall caused severe flooding in southwest Saskatchewan which took several thousand hectares out of production and probably created ideal growing conditions for *Psilocarphus brevissimus*. It appears quite likely that many of these sites are too dry to support the species during dry years.

Abundance

Population estimates for the most recent observations are provided in Table 1. At their lowest recorded levels, the aggregate population size of the Southern Mountain Population is as low as 700 individuals. In exceptionally dry years, it may drop even lower. Population counts for most of the Prairie Population sites are imprecise and in most cases may represent peak numbers since negative search results are not recorded. The aggregate total population in peak years may be as low as 9,000 or as high as 27,000 for the Prairie Population, given the uncertainty of individual site counts. The aggregate population in trough years is probably well below 5,000 and perhaps as low as 2,000.

Rescue effect

The two Canadian designatable units are separated by great distances and high mountain barriers so genetic interchange is unlikely. The United States population nearest to the Southern Mountain Population appears to be in Grant County, Washington State, a distance of over 200 km. The population nearest to the Prairie Population appears to be near Dodson, Montana – a distance of over 50 km. Given the species' limited power of dispersal over great distances, there is little likelihood of regular genetic interchange between Canadian and American populations. Similarities

in habitat suggest that seeds from U.S. populations may be relatively well adapted to site conditions that prevail where Canadian populations occur, so there is some potential for deliberate re-introduction if Canadian populations are extirpated by events that do not reduce habitat suitability.

LIMITING FACTORS AND THREATS

Climate change may present a significant threat to the species by reducing the frequency of flooding in suitable sites. This could increase mortality within soil seed banks while at the same time decreasing the size and frequency of seed bank inputs. The impacts of climate change may be exacerbated by the species' weak powers of dispersal, which will likely restrict colonization of sites that may become more suitable for the species.

Southern Mountain Population

The Southern Mountain Population is particularly vulnerable because the small area of occupancy and scarcity of suitable habitat leave it prone to extirpation. The most obvious threats are posed by altered hydrological regimes or changes in patterns of livestock grazing. Changes in vegetation cover around the area would alter snow accumulation, the capture and release of water and transpiration losses. Such changes may occur as a result of various influences including timber harvesting and fire. Changes in the timing and intensity of grazing may directly or indirectly impact the hydrological regime, favour the accumulation of thatch which would stifle germination, shift the competitive balance towards perennial species, or directly damage plants through trampling during the early growing season. Invasive species are unlikely to have a significant impact on *Psilocarphus brevissimus* unless there are changes in hydrology or grazing. The use of herbicides to control invasive weeds on rangelands, transmission rights-of-way and highway verges (all of which occur near or adjacent to one or more of the sub-populations) may also eliminate the population. All-terrain-vehicle use, an increasingly popular form of recreation in the region, may threaten the population by churning up soil, altering hydrology or directly impacting plants. The habitat occupied by *P. brevissimus* presently lies within the Agricultural Land Reserve (ALR), designed to protect agricultural land from other forms of development. Key areas within the ALR have been deleted over the past decade in order to allow development in the vicinity of towns and cities. Given the proximity of the sub-populations to Princeton (less than 10 km away) and the scenic nature of the grasslands where they occur (near the dramatic breaks of the Similkameen Valley), it may become a candidate for deletion from the ALR for purposes of development. Housing sales have trended upwards in the last 12-18 months in the Princeton area in tandem with markets in the Okanagan Valley (Fabri, pers. com., 2003). A wide range of agricultural practices (even topsoil stripping) are permitted within the ALR (Provincial Agricultural Land Commission 2003) and even without deletion from the ALR, changes in use may eliminate the critical habitat.

Prairie Population

Douglas *et al.* (2000) cite habitat destruction associated with agricultural development and oil and gas exploration as the primary threats to populations of this species in the prairies. Some of the sites lie within an area intensively developed for agriculture while others may be at less risk because soil and climatic factors discourage intensification of agricultural activities.

Significant amounts of habitat of sixteen of the sites have been directly damaged by pipeline development (Rintoul pers. comm. 2005). Several other populations, while lying just outside a pipeline rights-of-way, may be impacted by changes in hydrology associated with pipeline development and maintenance.

As with the Southern Mountain Population, range management practices and weed control measures present a threat to many of the sub-populations.

SPECIAL SIGNIFICANCE OF THE SPECIES

The distribution of *Psilocarphus brevissimus* suggests that both populations may be relicts of the Hypsithermal Interval of warm, dry climate 4,000-6,000 years b.p.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Psilocarphus brevissimus var. *brevissimus* is not covered under the Convention on International Trade in Endangered Species (CITES), the Endangered Species Act (USA) or the IUCN Red Data Book. It is ranked G4T4? (apparently secure) (NatureServe 2005). The species is not ranked in Washington State (SNR) but is ranked as S2 (imperiled) in Idaho and Montana, states that are also adjacent to Canada.

Southern Mountain Population

Psilocarphus brevissimus is ranked S1 (critically imperiled) in British Columbia, a province that lacks legislation protecting plants at risk. The population does not occur in a protected area, and there is no specific management or implementation plan to protect it or the habitat at its sole occurrence.

Prairie Population

Psilocarphus brevissimus is ranked S2 (imperiled) in Alberta (NatureServe 2005). It should presumably be ranked S1S2 (imperiled to critically imperiled) in Saskatchewan since that is the rank the Saskatchewan Conservation Data Centre assigned to the misidentified *P. elatior* (Saskatchewan Conservation Data Centre 2005).

TECHNICAL SUMMARY

Note: The Vascular Plant Specialists of the Subcommittee for Plants and Lichens (COSEWIC) recognizes two separate designatable units within this species. These are geographically disjunct, present in two different COSEWIC ecological areas, and are subject to very different levels of risk based, in particular, on marked differences in the number of populations present in each unit.

***Psilocarphus brevissimus*: Southern Mountain population**

dwarf woolly-heads (Southern Mountain population) *psilocarphe nain* (Population des montagnes du Sud)
 Occurrence: British Columbia

Extent and Area information	
<ul style="list-style-type: none"> Extent of occurrence (EO) [estimated using OziExplorer mapware area calculation] 	< 2 km ²
<ul style="list-style-type: none"> Specify trend 	unknown
<ul style="list-style-type: none"> Are there extreme fluctuations in EO 	no
<ul style="list-style-type: none"> Area of occupancy (AO) [estimated from summing up area occupied by individual occurrences and estimating missing values] 	0.1 ha
<ul style="list-style-type: none"> Specify trend in AO 	unknown
<ul style="list-style-type: none"> Are there extreme fluctuations in AO 	probably
<ul style="list-style-type: none"> Number of known or inferred current locations 	3
<ul style="list-style-type: none"> Specify trend in # 	unknown
<ul style="list-style-type: none"> Are there extreme fluctuations in number of locations? 	perhaps
<ul style="list-style-type: none"> Specify trend in area, extent or quality of habitat 	unknown
Population information	
<ul style="list-style-type: none"> Generation time (average age of parents in the population) 	4 months
<ul style="list-style-type: none"> Number of mature individuals 	700 – 2,000,000 depending on the year
<ul style="list-style-type: none"> Total population trend 	S. Mtn. Pop
<ul style="list-style-type: none"> % decline over the last/next 10 years or 3 generations 	n/a
<ul style="list-style-type: none"> Are there extreme fluctuations in number of mature individuals? 	yes
<ul style="list-style-type: none"> Is the total population severely fragmented? 	yes
<ul style="list-style-type: none"> Specify trend in number of populations 	unknown
<ul style="list-style-type: none"> Are there extreme fluctuations in number of populations? 	unknown
<ul style="list-style-type: none"> List populations with number of mature individuals in each: 	1: 30-300 2: 225 – 2 million 3: 450 – 7,700
Threats (actual or imminent threats to populations or habitats)	
Potential threats - ATV use, herbicide weed control measures, changes in hydrology due to land use practices, and increased land development in the region.	
Rescue Effect (immigration from an outside source)	
<ul style="list-style-type: none"> Status of outside population(s)?. 	The species is not ranked in Washington but S2 in Idaho and Montana
<ul style="list-style-type: none"> Is immigration known or possible? 	Immigration is possible but probably occurs so rarely that it has no significance to rescue over periods of less than at least a few decades

• <i>Would immigrants be adapted to survive in Canada?</i>	unknown
• <i>Is there sufficient habitat for immigrants in Canada?</i>	yes
• <i>Is rescue from outside populations likely?</i>	no
Quantitative Analysis	Not available
Current Status	
COSEWIC: Endangered (2006)	

Status and Reasons for Designation

Status: Endangered	Alpha-numeric code: B1ac(iv) + 2ac(iv)
<p>Reasons for Designation:</p> <p>An annual herb restricted to a very small range and present at only three small sites on private lands within the COSEWIC Southern Mountain Ecological Area of British Columbia. Population size is subject to extreme fluctuations in the number of mature individuals due to variation in precipitation levels and the population is at risk from such factors as increased land development in the region and land use practices.</p>	
<p>Applicability of Criteria</p>	
<p>Criterion A: (Declining Total Population): No decline data</p> <p>Criterion B: (Small Distribution, and Decline or Fluctuation): Met Endangered B1ac(iv) + 2ac(iv) since both extent of occurrence and area of occupancy are well below critical values, only three sites are known and populations of this annual species undergo extreme fluctuations in area of occupancy and number of mature individuals.</p> <p>Criterion C: (Small Total Population Size and Decline): Not applicable. Population size is too large.</p> <p>Criterion D: (Very Small Population or Restricted Distribution): Met threatened D2 based on the presence of only three sites and a very small area of occupancy well below 20 km² with several threats documented in an area undergoing rapid urban expansion..</p> <p>Criterion E: (Quantitative Analysis): Not available.</p>	

TECHNICAL SUMMARY

***Psilocarphus brevissimus*: Prairie population**

dwarf woolly-heads (Prairie population)

Occurrence: Alberta, Saskatchewan

psilocarphe nain (Population des Prairies)

Extent and Area information	
<ul style="list-style-type: none"> • <i>Extent of occurrence (EO)</i> [estimated using OziExplorer mapware area calculation] 	23,760 km ²
<ul style="list-style-type: none"> • <i>Specify trend</i> 	unknown
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in EO</i> 	probably, unless seed banks are considered
<ul style="list-style-type: none"> • <i>Area of occupancy (AO)</i> [estimated from summing up area occupied by individual occurrences and estimating missing values] 	<40 ha
<ul style="list-style-type: none"> • <i>Specify trend in AO</i> 	unknown
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in AO</i> 	yes
<ul style="list-style-type: none"> • <i>Number of known or inferred current locations</i> 	41
<ul style="list-style-type: none"> • <i>Specify trend in #</i> 	unknown
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in number of locations?</i> 	yes
<ul style="list-style-type: none"> • <i>Specify trend in area, extent or quality of habitat</i> 	unknown
Population information	
<ul style="list-style-type: none"> • <i>Generation time (average age of parents in the population)</i> 	4 months
<ul style="list-style-type: none"> • <i>Number of mature individuals</i> 	2,000 – 27,000 depending on the year
<ul style="list-style-type: none"> • <i>Total population trend</i> 	unknown
<ul style="list-style-type: none"> • <i>% decline over the last/next 10 years or 3 generations</i> 	n/a
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in number of mature individuals?</i> 	yes
<ul style="list-style-type: none"> • <i>Is the total population severely fragmented?</i> 	perhaps not severely
<ul style="list-style-type: none"> • <i>Specify trend in number of populations</i> 	unknown
<ul style="list-style-type: none"> • <i>Are there extreme fluctuations in number of populations?</i> 	Probably

<ul style="list-style-type: none"> List populations with number of mature individuals in each: 	Prairie 1: 0? – several hundred Prairie 2: 0? – 50 Prairie 3: 0? – 100 Prairie 4: 0? – 1,000 Prairie 5: 0? - >2,700 Prairie 6: 0? – 1,000 Prairie 7: 0? – 1,000 Prairie 8: 0? – 1,000 Prairie 9: 0? – 1,000 Prairie 10: 0? – 1,000 Prairie 11: 0? – 1,000 Prairie 12: 0? – 1,000 Prairie 13: 0? – 1,000 Prairie 14: unknown Prairie 15: 0? – 1,000 Prairie 16: 0? – 1,000 Prairie 17: 0? – 1,000 Prairie 18: 0? – 1,000 Prairie 19: 0? – 1,000 Prairie 20: 0? – 1,000 Prairie 21: 0? – 1,000 Prairie 22: 0? – 1,000 Prairie 23: 0? – 1,000 Prairie 24: 0? – 1,000 Prairie 25: 0? – 1,000 Prairie 26: unknown Prairie 27: 1,000 Prairie 28: locally abundant Prairie 29: scarce Prairie 30: small amount Prairie 31: 0? - 200 Prairie 32: 0? - 1,000 Prairie 33: 0? - 50 Prairie 34: 0? – 1,000 Prairie 35: 0? - 200 Prairie 36: 0? - 200 Prairie 37: 0? - 500 Prairie 38: 0? - 10 Prairie 39: 0? - 50 Prairie 40: 0? - 75 Prairie 41: 0? - 10
Threats (actual or imminent threats to populations or habitats)	
Actual threats - agricultural expansion, oil and gas exploration Potential - changes in hydrology, changes in grazing practices, weed control measures	
Rescue Effect (immigration from an outside source)	
<ul style="list-style-type: none"> <i>Status of outside population(s)?</i> 	The species is not ranked in Washington but S2 in Idaho and Montana.
<ul style="list-style-type: none"> <i>Is immigration known or possible?</i> 	Immigration is possible but probably occurs so rarely that it has no significance to rescue over periods of less than at least a few decades
<ul style="list-style-type: none"> <i>Would immigrants be adapted to survive in Canada?</i> 	unknown
<ul style="list-style-type: none"> <i>Is their sufficient habitat for immigrants in Canada?</i> 	yes

• <i>Is rescue from outside populations likely?</i>	no
Quantitative Analysis	Not available
Current Status COSEWIC: Special Concern (2006)	

Status and Reasons for Designation

Status: Special Concern	Alpha-numeric code: not applicable
<p>Reasons for Designation: This population is widely distributed in Saskatchewan and Alberta at more than 40 sites with large among-year fluctuations in numbers of mature individuals and with concerns over potentially significant future impacts. These pertain to potential future development of coal-bed methane gas extraction in a significant part of the range of the population and disruptions from pipeline construction.</p>	
<p>Applicability of Criteria</p>	
<p>Criterion A: (Declining Total Population): Not available. No data for significant decline.</p> <p>Criterion B: (Small Distribution, and Decline or Fluctuation): Although having a small total area of occupancy, this criterion is not applicable because the population comprises many sites that likely are not extremely fragmented and have not shown significant declines in numbers of plants.</p> <p>Criterion C: (Small Total Population Size and Decline): Not applicable. Total numbers of plants may be sufficiently low to consider the species at risk during years of drought, but continued or inferred declines cannot be adequately rationalized to assess status under this criterion.</p> <p>Criterion D: (Very Small Population or Restricted Distribution): Not applicable. Although having an area of occupancy < 20 km², threatened D2 likely does not apply since it is uncertain as to the actual extent of impact of the various threats such as oil and gas exploitation and development and agricultural expansion on the naturally fragmented habitats and populations.</p> <p>Criterion E: (Quantitative Analysis): Not available.</p>	

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The following authorities were contacted:

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Gould, Joyce. Botanist, Alberta Natural Heritage Information Centre.
Goulet, Gloria. Coordinator, Aboriginal Traditional Knowledge. COSEWIC Secretariat Canadian Wildlife Service
Penny, Jenifer. Botanist, British Columbia Conservation Data Centre. BC Ministry of Environment.
Porter, Steve. Data Manager, Saskatchewan Conservation Data Centre.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Matt Fairbarns has worked on rare species and ecosystem mapping, inventory and conservation in western Canada for approximately 20 years and is the author or co-author of a number of COSEWIC plant status reports.

COLLECTIONS EXAMINED

Collections at the Royal BC Museum herbarium (V) and the University of Alberta (ALTA) were examined. Databases of the BC Conservation Data Centre, the Alberta Natural Heritage Information Centre and the Saskatchewan Conservation Data Centre were queried.