

**COSEWIC**  
**Assessment and Update Status Report**

on the

**Prairie Lupine**  
*Lupinus lepidus*

in Canada



**ENDANGERED**  
**2009**

**COSEWIC**  
Committee on the Status  
of Endangered Wildlife  
in Canada



**COSEPAC**  
Comité sur la situation  
des espèces en péril  
au Canada

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Ryan, M., and G.W. Douglas. 1996. COSEWIC status report on the Prairie Lupine *Lupinus lepidus* var. *lepidus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-18 pp.

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## COSEWIC Assessment Summary

### Assessment Summary – April 2009

**Common name**

Prairie Lupine

**Scientific name**

*Lupinus lepidus*

**Status**

Endangered

**Reason for designation**

A perennial species found at only 2 or possibly 3 remaining locations within southeastern Vancouver Island. Its small total population has been reduced in recent decades with < 250 mature individuals present in 2009. The spread of invasive plants continues to degrade habitat within and adjacent to extant sites that could serve to support the establishment and survival of the species.

**Occurrence**

British Columbia

**Status history**

Designated Endangered in April 1996. Status re-examined and confirmed in May 2000 and in April 2009. Last assessment based on an update status report.



## COSEWIC Executive Summary

### Prairie Lupine *Lupinus lepidus*

#### Species information

Prairie Lupine (*Lupinus lepidus*) is a perennial herb that grows 20-45 cm tall. It has leaves divided into lobes from a central point. These compound leaves grow from the base of the plant with a few alternate leaves also found along the stem. The leaves and stems are covered with silky hairs, giving the plants a distinctive appearance. The pea-like flowers range in colour from blue, white to purple and are arranged in a compact terminal inflorescence. The seedpods are also hairy and contain 2-4 brown seeds. Most taxonomists recognize only a single variety of Prairie Lupine in Canada.

#### Distribution

In Canada, Prairie Lupine is restricted to southeastern Vancouver Island in British Columbia. Historically, it was found from just north of Duncan, south to Oak Bay and west to Langford, BC. There are currently likely only two extant populations remaining in Langford and Metchosin, BC. Globally, the range is difficult to determine because of taxonomic confusion, in particular with Kettle Falls Lupine (*Lupinus minimus*). The concept followed in this status report considers the range to be from southwestern BC south to Washington and Oregon, west of the Cascade Mountains.

The Extent of Occurrence (EO) of extant sites is 4 km<sup>2</sup> or 5.5 km<sup>2</sup> if the Mount Wells site is included. The Index of Area of Occupancy (IAO) is 12 km<sup>2</sup> based on a 2 km x 2 km grid overlay and 4 km<sup>2</sup> based on a 1 km x 1 km grid overlay for the two extant sites. The actual area of the habitat occupied by Prairie Lupine is about 900 m<sup>2</sup>.

#### Habitat

Prairie Lupine inhabits dry rocky outcrops in the Coastal Douglas-fir biogeoclimatic zone. The habitat is dry, fully exposed, with well-drained, nutrient-poor soils. The two remaining populations occur either near or on top of wind-swept hilltops on gentle grades or on ledges within the steep slopes with very few invasive species present.

## **Biology**

The species is a perennial that flowers as early as its second year of growth. Flowers are formed by mid-June and the seed, which can persist in the seedbank, is set in July. Scarification (mechanically breaking the seed coat to allow water and gas penetration) stimulates seed germination.

Prairie Lupine appears to be short-lived with a maximum age of about five years. The interaction between competition and periodic disturbance in maintaining populations is not fully understood. Its generation time is likely 2-3 years.

## **Population sizes and trends**

The species has been known historically from nine populations but only two populations are confirmed as extant. A seedbank may persist at a third site where the population has not been observed since 2003. During surveys in 2007, no mature plants were found at the extant sites but over 2200 seedlings were recorded. In 2008 and early 2009, a number of mature individuals were reported from the Mount MacDonald/Mount Braden area.

## **Limiting factors and threats**

Habitat destruction by development for residential and commercial uses has destroyed historic populations of Prairie Lupine. Habitat degradation by the invasion of exotic shrubs and grasses is a persistent threat to this species. Prairie Lupine appears to be highly sensitive to competition, requiring either highly intact habitat with few invasive species or constant disturbance to remove competing vegetation. Although fire suppression may have increased competition from woody shrubs in historic populations, fires pose a serious threat to the extant population because burns may increase the invasion by opportunistic invasive species. Trampling threatens Prairie Lupine by causing soil disturbance, which in turn causes increased invasion by exotic species.

## **Special significance of the species**

The species is disjunct from other populations in the United States and may be genetically distinct. It is possible that Prairie Lupine acts as a host plant for butterfly species, including species that are endangered or extirpated, such as the Island Blue Butterfly (*Plebejus saepiolus insulanus*). There is no record of aboriginal use of this species.

## **Existing protection**

In Canada, Prairie Lupine is listed as Endangered (COSEWIC, May 2000) on Schedule 1 of the Species at Risk Act (SARA). It is not protected under provincial legislation or by site management plans where it occurs.



## 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 5, 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 (2008)

|                        |  |
|------------------------|--|
| 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 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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**Update  
COSEWIC Status Report**

on the

**Prairie Lupine**  
*Lupinus lepidus*

in Canada

2009

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## SPECIES INFORMATION

### Name and classification

Scientific name: *Lupinus lepidus* Dougl. ex Lindl.  
Synonymy: various names, see below  
Common name: Prairie Lupine, Pacific Lupine or Elegant Lupine  
Family: Fabaceae (Pea Family)  
Major plant group: Eudicot flowering plant

In their treatment of lupines (*Lupinus*) in the Pacific Northwest, Hitchcock and Cronquist (1961) state “taxonomically, the genus is probably in a more chaotic state than any other to be found in our area”. Classification is difficult because species of lupines have morphological plasticity, many species interbreed, and the flowers and seedpods of different species may be morphologically similar (Hitchcock and Cronquist 1961; Barneby 1989). It is not known whether Prairie Lupine (*Lupinus lepidus*) interbreeds with other species in the Pacific Northwest.

The confusion observed in the genus *Lupinus* is also mirrored in the taxonomy of *Lupinus lepidus*. Hitchcock and Cronquist (1961) state that although the *L. lepidus* complex is distinct, the variation within this group has resulted in a large number of proposed subspecies and varieties of which some are considered to be distinct species by other workers. According to Phillips (1955), the nomenclature is even more confusing, and the number of synonyms is greater for *L. lepidus* than for any other *Lupinus* species. The work of Detling (1951), Phillips (1955) and Dunn and Gillett (1966) has improved the nomenclature and delineation of lupine species but many problems remain.

The type specimen of Prairie Lupine was collected by David Douglas in 1826 from "... Fort Vancouver to the Great Falls of the Columbia". Hitchcock and Cronquist (1961) recognized five geographic or ecological varieties of *Lupinus lepidus* of which two, var. *lepidus* and var. *lobbii* (Gray) C.L. Hitchc., are reported to occur in British Columbia. The latter variety, Dwarf Mountain Lupine, is considered to be a separate species (*L. lyallii* A. Gray) in more recent floras of Canada and British Columbia (e.g., Dunn and Gillett 1966; Taylor 1974; Scoggan 1978-79; Douglas 1990). Dwarf Mountain Lupine occurs on well-drained soils in subalpine and alpine areas (Douglas 1990, Douglas and Bliss 1977) whereas Prairie Lupine occurs on dry gravelly openings and rock outcrops in coastal lowlands (Douglas 1990). Kartesz refers to *Lupinus lepidus* var. *lepidus* as being synonymous with *Lupinus lepidus* (NatureServe 2007). No infraspecific entities are, therefore, recognized for this species in Canada.

Some authors consider Kettle Falls Lupine (*Lupinus minimus* Dougl.) to be a synonym of *L. lepidus* (Hitchcock and Cronquist 1961; Kuijt 1982; Packer 1983; Douglas 1990). Other researchers consider it to be a separate species (Cox 1973a, b; Dunn and Gillett 1966; Scoggan 1978-79; Taylor 1974; Ryan and Douglas 1996; Kartesz 1999; Gould pers. comm. 2004; Sholars pers. comm. 2007). Kettle Falls Lupine

has been reported to occur in the Columbia River drainage of southern British Columbia (Argus and White 1978, Dunn and Gillett 1966, Taylor 1974), in the Crowsnest area of Alberta (Dunn and Gillett 1966), in and adjacent to Waterton Lakes National Park (Argus and White 1978, Kuijt 1982). According to the BC Conservation Data Centre database (BCCDC 2007, Kettle Falls Lupine does not occur in BC. It is known from six locations near the southern Alberta border (Packer 1983). Further review of Alberta specimens will be done after the Flora of North America treatment of perennial lupines is complete (Gould pers. comm. 2007). This status report treats Kettle Falls Lupine as a separate entity.

### **Morphological description**

Prairie Lupine is a tufted, perennial caespitose herb (Figures 1, 2) that grows 20-45 cm tall from a caudex (woody stem-base). The slender stems are sericeous (silky-hairy) and are 2-5 mm in diameter. Most of the silky-hairy leaves grow at the base of the plant with a few (1-4) alternate leaves found along the stem. The leaves are palmately compound (divided into lobes from a central point), with 5-9 oblanceolate leaflets and petioles 2-5 times as long as the leaf blades. The flower is a compact terminal raceme (elongated inflorescence with flowers arranged on a single axis) of pea-like flowers, ranging in colour from blue to white and purple. The peduncles are 9-10 cm long, the pedicels are 2 cm long and the petals are 8-13 mm long. The banners (largest upper petals) are circular to egg-shaped, hairless, and bent backward below the mid-point. The upper calyx is silky-hairy with both lips 6-7 mm long and is bifid for at least half the length. The keels (two lower petals) are fringed with long hairs and the wings are glabrous. The hairy seedpods are 1-3 cm long and contain 2-4 brown seeds (Hitchcock and Cronquist 1961; Douglas 1990).



Figure 1. Photo of Prairie Lupine on Mount Braden (1996) (used with permission from H. Roemer).



Figure 2. Illustration of Prairie Lupine by J. R. Janish (used with permission from the University of Washington Press) - approximately  $\frac{1}{2}$  scale as shown.

Distinguishing features for the species include the densely hairy stems and leaves and the woody stem-base (Douglas 1990; Ryan and Douglas 1996). In British Columbia, there are five small perennial lupine species (less than 50 cm tall) with blue flowers and densely whitish-hairy leaves. However, the range of Prairie Lupine is restricted to coastal lowlands on southeastern Vancouver Island and does not overlap with other small perennial lupine species in British Columbia: Dwarf Mountain Lupine is a subalpine/alpine plant of the southern Coastal and Cascade Mountains, Yukon Lupine (*Lupinus kuschei* Eastw.) is a montane species of northern British Columbia, Wyeth's Lupine (*L. wyethii* S. Wats.) occurs in the steppe/montane zones of southern British Columbia, east of the Coast-Cascade Mountains (Ryan and Douglas 1996). Prairie Lupine can be distinguished from Kettle Falls Lupine by the floral bracts, which are deciduous at anthesis (flowering time) in Kettle Falls Lupine but persistent in Prairie Lupine (Scholars pers. comm. 2007).

Two hairy annual species, Dense-flowered Lupine (*L. densiflorus* var. *densiflorus*) and Two-coloured Lupine (*L. bicolor* ssp. *bicolor*), which are found in the same range as Prairie Lupine, lack the woody stem-base that characterizes the species.

### **Genetic description**

There have been no published genetic studies on Prairie Lupine. There are geographical barriers to gene flow because Canadian populations are disjunct from populations found in the United States.

### **Designatable units**

A single designatable unit is recognized based on the restricted geographical occurrence of the species within a single COSEWIC national ecological area (Pacific).

## **DISTRIBUTION**

### **Global range**

The range of Prairie Lupine, as based on the type specimen, was considered by Dunn and Gillett (1966) and Hitchcock and Cronquist (1961) to extend from southwestern British Columbia to northwestern Oregon, west of the Cascade Mountains. This concept has been followed in the present status report (Figure 3).

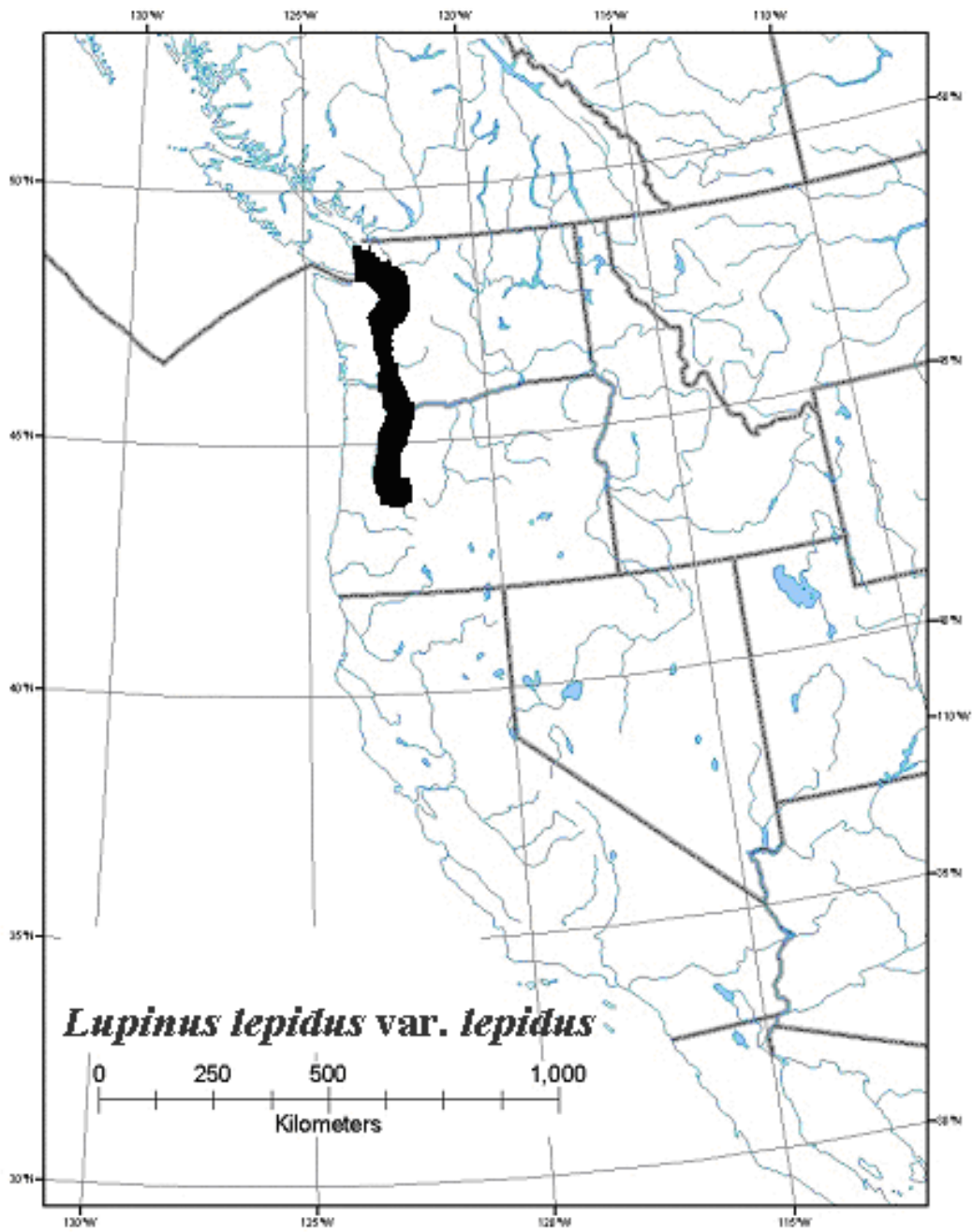


Figure 3. Global range of Prairie Lupine.

The distribution in Washington and Oregon is difficult to determine because of the taxonomic confusion. In Oregon, Kettle Falls Lupine has been used synonymously with Prairie Lupine (Douglas 1990; Liston pers. comm. 2004) and the distribution in Washington is not tracked. However, Prairie Lupine is relatively common in southern Puget Sound prairies (Thurston and Pierce Counties). Although the prairies themselves are highly fragmented and threatened, within the prairies, Prairie Lupine is common and is a characteristic species of Roemer's Fescue/White-topped Aster (*Festuca idahoensis* var. *roemerii*/*Sericocarpus rigidus*) plant association (Chappell pers. comm. 2004).

References to *Lupinus lepidus* from other U.S. States in western North America (e.g., Davis 1952; Booth and Wright 1966; Welsh *et al.* 1987 and Sholars 1993) are based on the numerous variations created by several taxonomists (see Smith 1944; Hitchcock and Cronquist 1961; and Sholars 1993). Hulten (1968) reported Prairie Lupine from southeast Alaska (on the panhandle near Hyder, AK) based on a single herbarium specimen, although some authors have questioned the identification of this specimen (Ryan and Douglas 1996; Sholars pers. comm. 2007). Although Prairie Lupine has been noted as occurring in Idaho (NatureServe 2007; Mancuso pers. comm. 2004), it is not clear if this is because Kettle Falls Lupine has been included with Prairie Lupine.

### **Canadian range**

In Canada, Prairie Lupine has been found in nine locations (Figure 4) in a rough triangle ranging from Somenos Lake just north of Duncan, BC, south to Cattle Point in Victoria, BC and west to Mount Braden in Langford, BC (Brayshaw 1991; Ryan and Douglas 1996; BC CDC 2007; Roemer 2007). The three herbarium records at the Canadian Museum of Nature from high elevations (1675-1825 metres) in the Chilliwack Valley are likely misidentifications. Reports of Prairie Lupine from Alberta (Kuijt 1982; Packer 1983) are probably based on specimens of Kettle Falls Lupine. Less than 1% of the global population is found in Canada.

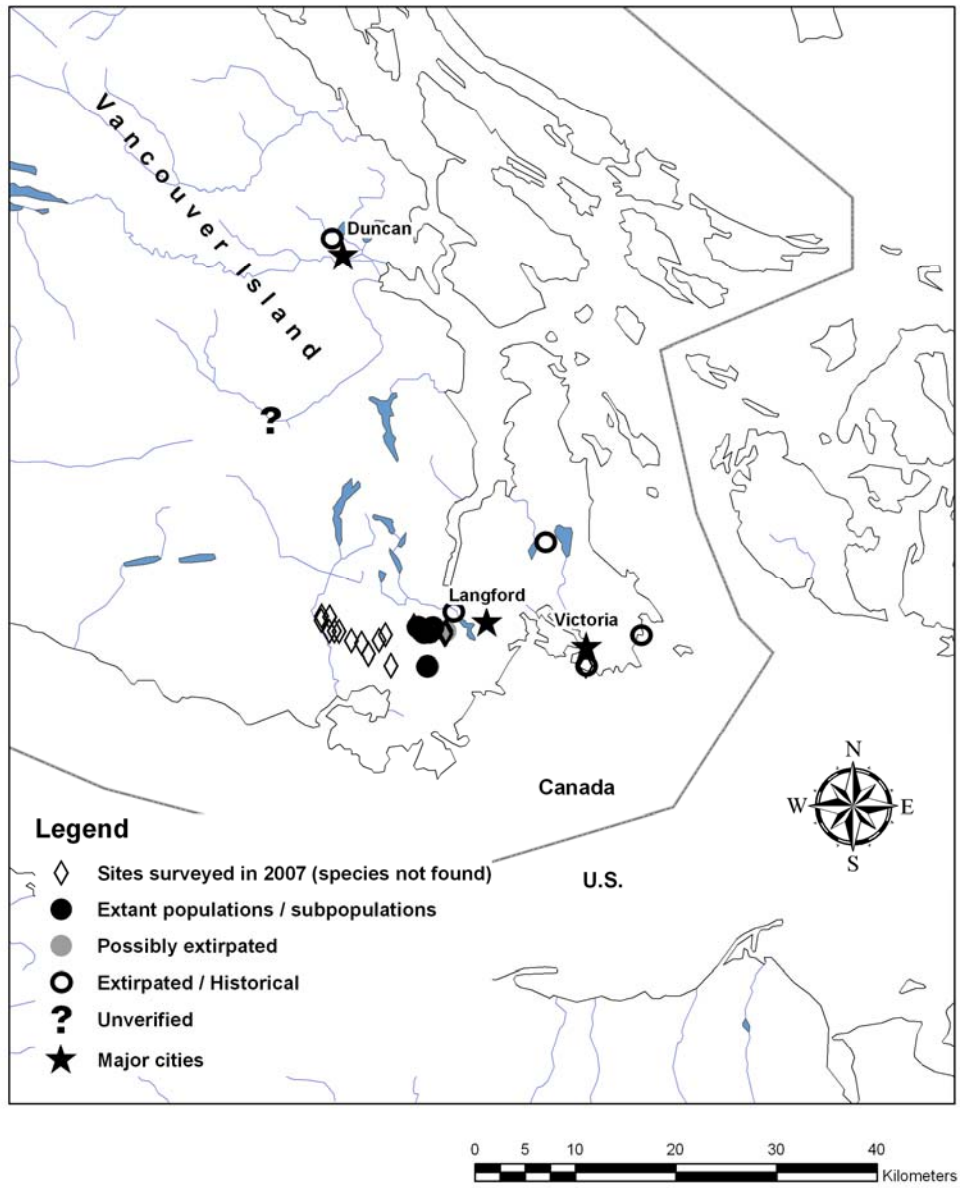


Figure 4. Canadian occurrences of Prairie Lupine.



Prairie Lupine appears to have been extirpated from 7 populations. Three of the historic populations are known only from herbarium records and location information is too vague to identify the exact location where the specimens were collected (Langford Plains, Oak Bay District/Cattle Point<sup>1</sup>, Koksilah River Valley). The population at Observatory Hill was recorded in 1960 but has not been observed since. Two populations (Beacon Hill and Somenos Lake) were destroyed in 1994 by construction activities. The population at Mount Wells was first observed in 2001. It occupies perhaps 75 m<sup>2</sup> of habitat. It was last seen in 2003, and may persist in the seedbank. One of the two remaining extant populations is on Mount Braden and Mount MacDonald<sup>2</sup>, in Langford, BC. This was first recorded by Newcombe in 1915 and was not observed again until 1996. It currently consists of 15 clusters in 5 scattered subpopulations of seedlings comprising an area of about 720 m<sup>2</sup> of habitat (Roemer 2007). The second extant population was found in 2007 at a single site on Mount Helmcken where it covers an area of about 120 m<sup>2</sup> (Roemer pers. comm. 2007).

The Mount Wells location is just over 1 km from the Mount Braden and Mount MacDonald location and 3.5 km from Mount Helmcken. The Mount Helmcken location is about 3.5-4 km from the Mount Braden and Mount MacDonald location.

The Index of Area of Occupancy (IAO) is 12 km<sup>2</sup> based on a 2 km x 2 km grid overlay and 4 km<sup>2</sup> based on a 1 km x 1 km grid overlay for the two extant sites only. The IAO of the two extant sites plus Mount Wells where plants may persist in the seedbank is 16 km<sup>2</sup> based on a 2 km x 2 km grid overlay and 5 km<sup>2</sup> based on a 1 km x 1 km grid overlay. However, the actual area of the habitat occupied by Prairie Lupine based on field observations is about 900 m<sup>2</sup>. The Extent of Occurrence (EO) of a minimum convex polygon of extant sites only is 4 km<sup>2</sup> or 5.5 km<sup>2</sup> if Mount Wells is included. The loss of two populations (Beacon Hill and Somenos Lake) around 1993-94 represents a loss of area of occupancy.

## HABITAT

### Habitat requirements

In Canada, Prairie Lupine occurs only in the Coastal Douglas-fir (*Pseudotsuga menziesii*) biogeoclimatic zone. Prairie Lupine has been documented from few sites in Canada, so precise habitat descriptions are difficult to determine (Ryan and Douglas 1996). The habitat for Prairie Lupine is naturally highly fragmented. Many apparently suitable patches are not occupied by the species.

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<sup>1</sup> It is uncertain whether the Newcombe collection of Oak Bay District is the same population referred to as Cattle Point by Brayshaw (1991). Fairbarns (2004) conducted a plant species at risk inventory at Cattle Point but did not find prairie lupine.

<sup>2</sup> It is not known whether the population found in the last 10 years was in the same location as that found by Newcombe in 1915.

Historic sites that no longer support Prairie Lupine have incomplete habitat information. In general, all sites were xeric with well-drained, nutrient poor soils (Ryan and Douglas 1996; BC CDC 2007). Elevations ranged from 30-415 metres. Prairie Lupine is not shade tolerant and all sites have full sun exposure.

Extant sites of Prairie Lupine at Mount Braden/Mount MacDonald and Mount Helmcken are quite similar and consist of a diverse assemblage of native Garry Oak ecosystem species. The aspect of most sites ranges from southeast to south although a few sites face west, southwest, northwest or north. The elevation ranges from 370-415 metres. Macrotopography slope varies from 0-80%, although the plants themselves are found on gentle grades or on ledges within the steep slopes. All sites are on dry, rocky terrain either near or on top of wind-swept hilltops. The soil depth above the bedrock is minimal (5-35 cm). The associated vegetation consists of a sparse cover of grasses and grass-like plants including Roemer's Fescue, Dune Bentgrass (*Agrostis pallens*), California Oatgrass (*Danthonia californica*), and Long-stoloned Sedge (*Carex inops*) above a dense carpet of mosses and lichens (species include Grey Rock-moss (*Racomitrium canescens*), Broom-moss (*Dicranum scoparium*), Juniper Haircap Moss (*Polytrichum juniperinum*), Wallace's Selaginella (*Selaginella wallacei*), and *Cladonia* spp.). The non-native Sweet Vernalgrass (*Anthoxanthum odoratum*) is also present at two locations (Roemer 2007).

The role of disturbance for maintaining Prairie Lupine habitat is unclear. Ryan and Douglas (1996) suggested that Prairie Lupine requires some form of periodic disturbance. Two of the extirpated Prairie Lupine populations were growing on dry, gravelly, disturbed sites; one site (Beacon Hill) occurred along a roadbank that was regularly mowed and another (Somenos Lake) was in a disturbed area between the highway and a railroad that was periodically mowed and sprayed (Ryan and Douglas 1996; BC CDC 2007). Although both populations dwindled to a single plant prior to their extirpation, the regular disturbance may have helped limit the effect of competition (Ryan and Douglas 1996). However, the persistence of plants in the undisturbed habitat of Mount Braden/Mount MacDonald and Mount Helmcken suggest competition may be a more important limiting factor than regular disturbances.

### **Habitat trends**

The Coastal Douglas-fir biogeoclimatic zone has been severely impacted and less than 1% remains undisturbed (Pacific Marine Heritage Legacy 1996). Habitat for Prairie Lupine has probably declined to a similar extent. The specialized open, meadow habitat has been extensively developed for residential and commercial uses in almost all sites occurring outside parks or ecological reserves and has likely destroyed former populations.

Habitat degradation by the invasion of exotic shrubs and grasses is a serious threat to this species (Ryan and Douglas 1996). The two extant populations occur in an area remarkable for its intact species assemblages and the small numbers of exotic plants present. However, Scotch Broom (*Cytisus scoparius*) is currently present and in time may impact the sites. All the historic sites for Prairie Lupine have high concentrations of Scotch Broom and invasive grasses. The Mount Wells site, whose population may be extirpated, also has abundant Scotch Broom and invasive grasses. Much of the remaining unoccupied habitat surrounding the extant sites has been degraded by the invasion of non-native shrubs and grasses to the point where it is no longer suitable for Prairie Lupine. It appears that Prairie Lupine is highly sensitive to competition. Scotch Broom may have facilitated the decline of the Beacon Hill and Somenos populations prior to their destruction through construction activities. The dense turf formed by invasive grasses likely prevents the establishment of Prairie Lupine from seed. Adult plants and seedlings are likely impacted by direct competition for water, light and nutrients. Similar unoccupied habitat in the Sooke Hills has been degraded by the invasion of exotic species. The remoteness of Mount Braden/Mount MacDonald and Mount Helmcken has slowed the movement of invasive species into these areas but increased access over the next 10 years will promote the spread of invasive species.

The role of fires and fire suppression is not fully understood for this taxon. Historically, First Nations burned large areas to increase production of Camas (*Camassia* spp.) and to increase forage for ungulates. There has been almost complete fire suppression in these habitats for several decades resulting, in habitat deterioration due to an increased density of exotic shrubs such as Scotch Broom as well as native woody shrubs including Common Snowberry (*Symphoricarpos albus*) and Nootka Rose (*Rosa nutkana*). The population at Mount Wells appeared on a flat site with shallow soil after a burn removed much of the existing vegetation. The burn may have also scarified existing Prairie Lupine seed, stimulating germination. The plants persisted for only 3 years before they were outcompeted by re-sprouting Hairy Manzanita (*Arctostaphylos columbiana*), seedlings of Red-flowering Currant (*Ribes sanguineum*), Gummy Gooseberry (*Ribes lobbii*), and Cream-bush Oceanspray (*Holodiscus discolor*), annual grasses and weeds.

### **Habitat protection/ownership**

One of the remaining extant populations is unprotected on private land. The second extant population of Prairie Lupine is protected from development within the Sooke Hills Wilderness Regional Park Reserve, managed by Capital Regional District Parks. The population at Mount Wells (where the species may persist in the seedbank) is also managed by Capital Regional District Parks. There is no current management plan in place to protect this species in CRD Parks. The species is not currently protected by British Columbian legislation.

## BIOLOGY

There is no published information about the biology and ecology of this species in British Columbia. Many species of lupines share common traits of which some likely characterize Prairie Lupine. The only available information on Canadian populations of the taxon comes from the following sources: personal observation by Maslovat during the preparation of this status report, an inventory and monitoring survey conducted in Capital Regional District Parks (Roemer 2007), and observations of the species under garden conditions by a local botanist (Roemer pers. comm. 2007).

### Life cycle and reproduction

Flowers contain both male and female parts. Further information about reproductive strategies is not available. There is no published information on the pollination mechanism or pollinators of this taxon. Although many species of lupine interbreed, it is not known whether Prairie Lupine hybridizes.

Prairie Lupine seeds appear to persist in the seedbank, a trait common to other lupine species (Lambert 2003). Prior to extirpation of the Somenos site, the number of plants fluctuated and one plant was observed in 1994 a year after no plants were observed at the site (Ryan and Douglas 1996). Plants also appeared following a burn on Mount Wells where no plants had been previously recorded (BC CDC 2007) and re-appeared 9 years after first being observed at Mount Braden (Roemer 2005; Roemer 2007). The seed of many lupine species require scarification (mechanically breaking the seed coat via abrasion, digestion or fire to allow water and gas penetration) in order to stimulate germination (Rose *et al.* 1998; Lambert 2003). Prairie Lupine does not appear to reproduce asexually (Maslovat pers. obs. 2007) although species such as *L. perennis* do spread by short rhizomes.

Like other horticultural lupine species, Prairie Lupine appears to be short-lived and populations can experience die-off in some years (Ryan and Douglas 1996; USDA 2007). Three plants found at Mount Braden in the spring of 1996 had disappeared by late summer and were not found during searches for the following two years (Roemer 2005). Although seedling recruitment was high, no plants of flowering size persisted at Mount MacDonald between the summer of 2006 and the spring of 2007. A single plant grown under garden conditions died after flowering (Roemer pers. comm. 2007). Prairie Lupine is, however, normally polycarpic, flowering in successive years, as indicated in the work by del Moral and Wood (1993). It is not known whether certain conditions are required for flowering and fruit development.

More research is needed to accurately determine the phenology of this species. The following observations are not based on detailed phenological studies but rather on random observations of plants in the field and under garden conditions. Under garden conditions, Prairie Lupine seed germinated 1-2 months after being planted following the first heavy rains in September (Roemer pers. comm. 2007). Plants are in the rosette stage by April/May. Plants do not appear to flower in their first year of growth (Maslovat

pers. obs. 2007; Roemer pers. comm. 2007). Plants flower by mid-June and set seed in July (Roemer pers. comm. 2007). A single plant grown under garden conditions produced 45 flowering stems and abundant seed and subsequently died. Seed is very difficult to collect because the seedpods twist and actively scatter the seed (Roemer pers. comm. 2007). Generation time is likely in the order of 2-3 years because first flowering may occur in the second year and the species' lifespan is only about five years as based on studies of succession on Mount St. Helens (del Moral and Wood 1993).

## **Herbivory**

Lepidopteran herbivory on other lupine species can be high: lepidopterans impacted both flowers and fruits of newly colonized populations of Dwarf Mountain Lupine on Mount Saint Helens causing adult mortality rates of up to 88%. The edges of populations were damaged the most by lepidopterans (Fagan and Bishop 2000; Fagan *et al.* 2001). Prairie Lupine seed in Washington is impacted by herbivory at rates up to 90%, depending on the year (Grossboll pers. comm. 2004). The impact of herbivores on Prairie Lupine in Canada is not known.

After one and a half years of planting trials in Seattle, Washington, an unknown disease killed all of the out-planted seedlings during the span of a week (Ewing 2002; Ewing pers. comm. 2004). The impact of diseases on Canadian populations of Prairie Lupine is not known.

## **Physiology**

Some lupine species are poisonous to cattle and sheep although the toxicity appears to vary with season, habitat conditions, and the phenological state of the plant; the seeds contain a much higher concentration of alkaloids of which some forms are believed to be toxic (Hitchcock and Cronquist 1961; Dunn and Gillett 1966; FDA 2006; USDA 2007).

## **Dispersal**

Like other lupine species, the seed is probably dispersed short distances as the seedpods twist open. It has been speculated that Blue Grouse (*Dendragapus obscurus*) may disperse the seeds of Prairie Lupine in Canada (Roemer 2005; BC CDC 2007) but further research is required to confirm this hypothesis. The infrequent dispersal to appropriate germination sites in highly fragmented ecosystems likely limits the success of this taxon.

## **Interspecific interactions**

The roots of *Lupinus* species have nodules containing *Rhizobium* bacteria that have the ability to fix atmospheric nitrogen (Ryan and Douglas 1996). Nitrogen fixing allows such species to colonize soils low in nitrogen, including recently disturbed sites. Soils enriched with nitrogen by such means also facilitate the colonization of these sites by other species (Halvorson *et al.* 1991; Halvorson *et al.* 1992; del Moral and Wood 1993). Prairie Lupine is historically known from populations in disturbed sites but the full role of disturbance and colonization for this taxon is not completely understood.

In Washington, Prairie Lupine was found to decrease in size with the addition of mulch and fertilizer (Ewing 2002). The invasion of nitrogen fixing shrubs, such as Scotch Broom or herbaceous plants that increase mulch layers, will probably negatively affect Prairie Lupine.

Prairie Lupine has mycorrhizal associations (O'Dell and Trappe 1992).

## **Adaptability**

In Washington, Prairie Lupine appears to prefer more stressful sites that have low soil moisture in the summer (Ewing pers. comm. 2004). Although stochastic environmental events such as fire may scarify seeds and provide open sites for germination, Prairie Lupine may be particularly vulnerable to events that create large amounts of bare soil enabling establishment of invasive alien plants.

Douglas (pers. comm. 2004) achieved 60-70% germination of Prairie Lupine by nicking the seed coat with fine pliers. Roemer (pers. comm. 2007) had the highest germination of Prairie Lupine seeds that had boiling water poured over them, moderate germination of seeds resulted when they were mechanically scratched with sandpaper in contrast to the germination of a single seed when left untreated. Prairie Lupine seed was sown successfully without treatment in restoration trials at a capped landfill next to Washington State University (Ewing 2002; Ewing pers. comm. 2004). Plants grown in containers and transplanted have a very poor survival rate; it is possible that the deep taproots of such plants are damaged during transplanting (Roemer pers. comm. 2007).

## POPULATION SIZES AND TRENDS

### Search effort

Fieldwork is described in Appendix 1. Surveys for Prairie Lupine were conducted by C. Maslovat and by Roemer (2007) at extant and historic locations assembled from herbarium specimens and BC Conservation Data Centre (Table 1). Documented locations from other sources are summarized in Table 2 and sites surveyed in 2007 are documented in Table 3. Location data for historic populations that have not been observed recently (Langford Plains, Oak Bay District/Cattle Point, Koksilah River Valley) were too vague to identify a search area. Species at risk inventories have been formerly conducted at two historic locations (Cattle Point and Observatory Hill) but did not find Prairie Lupine (Fairbarns 2004; Roemer pers. comm. 2007). From 2005 to 2007, Matt Fairbarns spent 30 hours searching Observatory Hill and 10 hours searching Cattle Point. The C. Maslovat spent 5 hours and Roemer (2007) spent 5 hours searching for extirpated populations (Mount Wells, Beacon Hill). The report writer spent 23 hours and Roemer (2007) spent 31 hours visiting extant sites (Mount MacDonald/Mount Braden) and searching adjacent habitat.

**Table 1. Historic and extant populations of Prairie Lupine.**

| <b>Population</b>         | <b>1<sup>st</sup> Observer and date</b> | <b>Last field visit and date</b>       | <b>Status of population</b> |
|---------------------------|---|--|-----------------------------|
| Beacon Hill               | Macoun (1893)                           | Maslovat (2007)                        | Extirpated                  |
| Langford Plains           | Macoun (1908)                           |  | Likely extirpated           |
| Oak Bay/Cattle Point      | Newcombe (1920)                         | Fairbarns (2007)                       | Likely extirpated           |
| Observatory Hill          | Hardy (1960)                            | Fairbarns (2007)                       | Likely extirpated           |
| Koksilah River Valley     | Brayshaw (1973)                         |  | Unknown                     |
| Somenos Lake              | Clark (1969)                            | Douglas (1994)                         | Extirpated                  |
| Mount Wells               | Roemer and Ceska (2001)                 | Roemer and Maslovat (2007)             | Extirpated?                 |
| Mt. MacDonald/ Mt. Braden | Newcombe (1915)                         | Roemer, Maslovat, Holm and Holm (2007) | Extant                      |
| Mount Helmcken            | Roemer and Holm (2007)                  | Roemer and Holm (2007)                 | Extant                      |

**Table 2. Prairie Lupine documented locations from other sources.**

| Pop.   | Land Tenure  | Date       | Observer (Source)                   | Number of Plants | Current Status  |
|--|--|------------|-------------------------------------|------------------|---|
| "sandy places" near Victoria, BC Beacon Hill | Unknown  | 1885       | Fletcher (NMC- 75215)               | Unknown          | Location too vague to identify  |
|  | Municipality of Victoria (municipal park)                    | 1893       | Macoun (NMC- 75213)                 | Unknown          | Extirpated by post removal from along the roadbank, which destroyed Prairie Lupine site (Ryan and Douglas 1996)                             |
|  |  | 1896       | Anderson (RBCM-2979)                | Unknown          |   |
|  |  | 1908       | Macoun (NMC- 75216)                 | Unknown          |   |
|  |  | 1913       | Macoun (RBCM-2980)                  | Unknown          |   |
|  |  | 1915       | Newcombe (RBCM-40449)               | Unknown          |   |
|  |  | 1920       | Copley (UBC-V45359)                 | Unknown          |   |
|  |  | 1920       | Newcombe (UBC-V23869/ RBCM-6002)    | Unknown          |   |
|  |  | 1924       | Hardy (RBCM-26179)                  | Unknown          |   |
|  |  | 1924       | Preece (RBCM-7369)                  | Unknown          |   |
|  |  | 1927       | Sampson (UBC-V23870)                | Unknown          |   |
|  |  | 1937       | Newcombe (RBCM-52917)               | Unknown          |   |
|  |  | 1939       | Goddard (RBCM-23804)                | Unknown          |   |
|  |  | 1977       | Armstrong (RBCM-105265/RBCM-105266) | 10 plants        |   |
|  |  | 1993       | Ryan (RBCM-162113)                  | 1 plant          |   |
| 1994   | (Ryan and Douglas 1996)                                      | Extirpated |                                     |                  |   |
| 2007   | Maslovat   | Not found  |                                     |                  |   |
| Langford Plains                              | Unknown  | 1908       | Macoun (NMC - 75217)                | Unknown          | Location too vague to identify  |
| Oak Bay District <sup>3</sup>                | Unknown  | 1920       | Newcombe (RBCM-40447)               | Unknown          | Location too vague to identify  |
| Observatory Hill                             | National Research Council Herzberg Institute of Astrophysics | 1960       | Hardy (RBCM-30908)                  | 2 plants         | Likely extirpated   |
|  |  | 1993       | Douglas (Ryan and Douglas 1996)     | Not found        |   |
|  |  | 2001       | Fairbarns                           | Not found        |   |
|  |  | 2003       | Fairbarns                           | Not found        |   |
|  |  | 2007       | Fairbarns                           | Not found        |   |
| Koksilah River Valley <sup>4</sup>           | Unknown  | 1973       | Brayshaw (RBCM-)                    | Unknown          | No further information  |
| Somenos Lake <sup>5</sup>                    | Unknown  | 1969       | Clark (RBCM-100759)                 | Unknown          | Extirpated by heavy equipment used in sewer line construction, which excavated the soil 30-60cm destroying habitat (Ryan and Douglas 1996). |
|  |  | 1978       | Long det. Brayshaw (RBCM-104462)    | Unknown          |   |
|  |  | 1989       | Straley (UBC- V197499)              | Unknown          |   |
|  |  | 1991       | Straley (UBC- V197499)              | 250 plants       |   |
|  |  | 1992       | Douglas (Ryan and Douglas 1996)     | 1 plant          |   |
| 1994   | Douglas (Ryan and Douglas 1996)                              | Extirpated | Douglas (CDC Field Report)          |                  |   |

3 May be the same location as Cattle Point but location is too vague to determine

4 Herbarium specimen collection made in 1973 from a plant growing in BC Provincial Museum Garden which was originally collected in 1968 by Butterworth, Lenfesty and Brayshaw in the Koksilah River Valley

5 Site lies between the Trans Canada Highway (jurisdiction of BC Ministry of Transportation) and rail line owned by the Esquimalt and Northern Railway



| Pop.                               | Land Tenure  | Date                         | Observer (Source)  | Number of Plants                              | Current Status   |
|------------------------------------|--|------------------------------|--|---|--|
| Cattle Point                       | Municipality of Oak Bay (municipal park)                   | 1991<br>2004<br>2007         | Brayshaw<br>Fairbarns<br>Fairbarns   | Unknown<br>Not found<br>Not found             | May have been based on misidentification (Fairbarns and Penny 2003)<br>Likely extirpated |
| Mount Wells                        | Capital Regional District (CRD), Mount Wells Regional Park | 2001<br>2003<br>2007         | Roemer (RBCM-186994) and Ceska<br>Roemer (Roemer 2005; 2007)<br>Roemer (Roemer 2007)   | 12<br>2<br>Not found                          |  |
| Mount MacDonald <sup>6</sup>       | CRD Park Reserve, Sooke Hills Wilderness Area              | 1915<br>2005<br>2007         | Newcombe (RBCM-40448)<br>Roemer (Roemer 2007)<br>Roemer, Maslovat, Holm, Holm (Roemer 2007)  | Unknown<br>144<br>2000+ seedlings (no adults) | Extant   |
| Mount Braden                       | CRD Park Reserve, Sooke Hills Wilderness Area              | 1996<br>1999<br>2005<br>2007 | Roemer, Djan-chekar (RBCM-168059; Roemer 2007)<br>Roemer (Roemer 2007)<br>Roemer (Roemer 2007)<br>Roemer, Maslovat, Holm (Roemer 2007) | 3<br>None found<br>2<br>4 seedlings           | Extant   |
| Taine Hy?, Chilliwack River        | Unknown  | 1901                         | Macoun (NMC- 75084)  | Unknown                                       | Unlikely habitat-Questionable specimen ID  |
| Glacier Lake, Chilliwack Valley    | Unknown  | 1906                         | Spreadborough (NMC-75083)  | Unknown                                       | Unlikely habitat-Questionable specimen ID  |
| Selese Mountain, Chilliwack Valley | Unknown  | 1906                         | Spreadborough (NMC-75085)  | Unknown                                       | Unlikely habitat-Questionable specimen ID  |
| Goldstream "sandy thickets"        | Unknown  | 1887                         | Macoun (NMC- 75218)  | Unknown                                       | Unlikely habitat-Questionable specimen ID or mislabeled                                  |

<sup>6</sup> It is not known whether the population found in 1915 is in the same location as plants found during later surveys

**Table 3. Sites surveyed for Prairie Lupine in 2007.**

| Location                     | Surveyor            | Survey Date  | Status                             |
|------------------------------|---------------------|--|------------------------------------|
| Mount Helmcken               | Roemer and Holm     | Nov 30   | Extant                             |
| Mount Braden/Mount MacDonald | Maslovat and Roemer | April 30, May 2<br>May 22<br>May 24<br>August 27<br>October 24 | Extant- 2 new subpopulations found |
| Mount Wells                  | Maslovat and Roemer | May 31<br>October 25   | None found                         |
| Beacon Hill                  | Maslovat            | August 15  | None found                         |
| Buck Hill area               | Roemer              | May 28   | None found                         |
| Ragged Mountain area         | Roemer              | June 2   | None found                         |
| Mt. Manuel Quimper           | Roemer              | June 2   | None found                         |
| Charters River area          | Roemer              | May 29   | None found                         |
| Todd Creek area              | Roemer              | May 26   | None found                         |
| Mary Vine Creek Area         | Roemer              | June 7   | None found                         |

In 2007, Roemer also conducted surveys at potential sites within the Sea to Sea planning area and in CRD Parks land. Nine areas, some with several hill-top habitats, were surveyed. Roemer spent approximately 47 hours searching potential habitat. Two new subpopulations were found in the Mount MacDonald/Mount Braden population, which was first documented in 1915. No other new populations were found during these searches although a new population at Mount Helmcken was found in 2007 during a recreational hike (Roemer pers. comm. 2007). The lack of mature plants made searches for new Prairie Lupine populations in 2007 very difficult because seedlings are much harder to locate because of their small size and vegetative condition. Although searches were intensive in areas with suitable habitat, it is possible that there may be other populations that were missed.

Roemer also conducted field checks at the Mount MacDonald/Mount Braden site in 2008 and reported the presence of mature plants in the fall of 2008 and subsequently also in early 2009 following a snowstorm (Roemer pers. comm. 2009). The exact number of mature individuals reported by Roemer was not determined but was apparently quite small.

### **Abundance**

Numbers of plants are recorded and population trends summarized in Table 4. The total population size of mature individuals was 0 in 2007 but has likely consisted of only a few hundred flowering plants, at the most, in recent decades. The mature plants observed by Roemer (pers. comm. 2009) in 2008 and 2009 at the Mount MacDonald/Mount Braden site was apparently small and likely consisted of <250. A census of Mount MacDonald/Mount Braden in 2005 found 144 plants, with approximately 40% flowering. Surveys in 2007 found new subpopulations at this site but no mature plants. Over 2000 seedlings were found in 5 subpopulations grouped in 15 clusters. At Mount Helmcken, 214 juvenile plants were counted in the new

population found in 2007. The Mount Wells population in 2001 contained only 12 plants; a single plant was seen in 2004 with none in 2007.

**Table 4. Prairie Lupine population trend data.**

| Population            | Observer and date         | Number of individuals      | Number flowering        |
|-----------------------|---------------------------|----------------------------|-------------------------|
| Beacon Hill           | Armstrong (1977)          | 10                         | 1?                      |
|                       | Ryan (1993)               | 1                          | 0                       |
|                       | Ryan and Douglas (1994)   | Extirpated by construction |                         |
|                       | Maslovat (2007)           | Not found                  |                         |
| Langford Plains       | Macoun (1908)             | Unknown                    |                         |
| Oak Bay District      | Newcombe (1920)           | Unknown                    |                         |
| Observatory Hill      | Hardy (1960)              | 2                          | 2?                      |
|                       | Fairbarns (2007)          | Not found                  |                         |
| Koksilah River Valley | Brayshaw (1973)           | Unknown                    |                         |
| Somenos Lake          | Douglas (1991)            | 250                        |                         |
|                       | Douglas (1992)            | 1                          |                         |
|                       | Douglas (1994)            | Extirpated by construction |                         |
| Mount Wells           | Roemer and Ceska (2001)   | 12                         |                         |
|                       | Roemer (2003)             | 2                          | 1                       |
|                       | Roemer (2004)             | 1                          |                         |
|                       | Roemer/Maslovat (2007)    | Not found                  |                         |
| Mount MacDonald       | Roemer (2005)             | 144                        | 40%                     |
|                       | Roemer (2007)             | 2000+ seedlings            | 0                       |
|                       | Roemer (2008)             | likely <250                | no data                 |
|                       | Roemer (winter 2008-2009) | likely <250                | none (winter condition) |
| Mount Braden          | Roemer/Djan-chekar (1996) | 3<br>None found            |                         |
|                       | Roemer (1999)             | 2                          | 2                       |
|                       | Roemer (2005)             | 4                          | 0                       |
|                       | Roemer (2007)             |                            |                         |
| Mount Helmcken        | Roemer and Holm (2007)    | 214 juvenile plants        | 0                       |

The three populations of Prairie Lupine documented in recent years are considered to be severely fragmented based on several considerations: the two populations known to be extant occupy very small areas of habitat (Mount Braden/Mount MacDonald, 720 m<sup>2</sup>; Mount Helmcken, 120 m<sup>2</sup>); they are separated by about 3.5-4 km of fragmented habitat with no adaptations for dispersal other than around the immediate areas of the parent plants; and the population sizes recorded to date are very small with, at most, 250 individuals at a location, with generally a smaller number of mature flowering plants. Such small numbers doubtfully represent viable populations. The third population (Mount Wells), possibly persisting only in the seed bank, had declined in number from a maximum of 12, in 2001, to a single individual in 2004 with no mature individuals seen in 2007. This likely does not represent a viable population even if some seeds remain in the soil seedbank. Scotch Broom and invasive grasses are abundant at the site. The possible disappearance of the population at Mount Wells could represent a decline in the Extent of Occurrence or at best a fluctuation. Identification of the new

subpopulations at the Mount Braden/Mount MacDonald population and the new population at Mount Helmcken do not represent an increase in the area of occupancy, because the populations were likely always present, but are simply new records.

### **Fluctuations and trends**

Prairie Lupine has not been sampled consistently over 10 years or three generations, so year to year changes in total population size and density are difficult to determine. There is no evidence of total population decline over the last 10 years or three generations based on any of the following: direct observation; an index of abundance; decline in area of occupancy, extent of occurrence and/or quality of habitat; levels of exploitation; or the effects of introduced taxa. The new subpopulations found in the last 10 years at Mount Braden/Mount MacDonald and Mount Helmcken were likely always present but are new records. The population found at Mount Wells, which may now persist only in the seedbank, was not known 10 years ago. There is, however, likely to be a continuing decline in the quality of habitat from the invasion of exotic plants.

No mature plants survived from the summer of 2006 to the spring of 2007, indicating populations are subject to complete die off. Because of the large number of seedlings found in 2007, the species clearly fluctuates greatly in number of immature individuals. However, this does not represent a case of extreme fluctuation as defined by the IUCN/COSEWIC definition because the species maintains a soil seedbank and seedlings are produced, although the level of their survival is unknown.

Estimates of abundance for historic populations are limited, but where counts were made (Observatory Hill, Beacon Hill, Mount Wells, Somenos Lake) the number of plants ranged from a maximum of 1-250 plants per population. Three of the extirpated populations (Somenos Lake, Mount Wells, Beacon Hill) gradually declined over time until a single plant remained.

Records of occurrences in British Columbia are recorded in Table 2 (based on data at the BC Conservation Data Centre).

### **Rescue effect**

Prairie Lupine is not ranked in Washington or Oregon (NatureServe 2007). Due to the taxonomic confusion explained in the section on name and classification, further studies are required to determine the global distribution of Prairie Lupine. Dispersal capabilities of the Prairie Lupine are very limited and the potential for rescue effect from other locations is highly unlikely. The nearest population may be as far away as 150 km in the glacial outwash prairies in Thurston Co, WA.

## **LIMITING FACTORS AND THREATS**

Habitat destruction has posed a direct and immediate threat to Prairie Lupine. Two populations were destroyed around 1993-94. The Somenos Lake population was destroyed during the construction of a sewer line adjacent to the site. Although nominally protected within a municipal park, the Beacon Hill population was destroyed during removal of posts next to the roadbank where the plants occurred. The historic populations in Langford Plains and Oak Bay District have almost certainly been destroyed by development (Ryan and Douglas 1996). The Mount Helmcken population is on private land and the future plans for the property are unknown.

Fires threaten Prairie Lupine in several ways. Although it is not known whether the species is adapted to cool frequent fires, fire suppression over the past several decades has led to increased fuel loading which creates hot fires that will likely destroy the root crowns. Although a burn stimulated the germination of a new population, the plants were quickly outcompeted as native and exotic woody species re-vegetated the site. Given the large number of opportunistic exotic grasses that readily occupy freshly disturbed habitat, fire is likely to cause increased invasion that will likely harm populations in the long-term.

Recreational activities threaten Prairie Lupine. Trampling can damage sensitive root crowns and can also cause soil disturbance that could create suitable conditions for the establishment of exotic species. Increased recreational use of an area formerly relatively inaccessible can also serve to promote the spread of invasive species. The population at Mount Braden/Mount MacDonald is in the Sooke Hills Wilderness Reserve, a very remote area that currently receives little public use. The area will likely receive greater public use in the future, increasing the soil disturbance associated with trampling and increasing the invasion of exotic plants in the area. The population on Mount Helmcken is not easily accessible because it is on private land.

Demographic collapse may also threaten Prairie Lupine. The extant populations are very small and highly fragmented. The genetic variability of the remaining populations is not known.

## **SPECIAL SIGNIFICANCE OF THE SPECIES**

Although numerous Aboriginal groups have used other lupine species for food, medicine and ceremonial purposes, there is no specific mention of Prairie Lupine in the literature (Moerman2007; Turner pers. comm. 2004; USDA 2007). Given its limited abundance in Canada, it is unlikely First Nations groups would have used this lupine species.

Prairie Lupine is disjunct from other populations in the United States and may be genetically distinct. It is possible that Prairie Lupine acts as a host plant for butterfly species, including species that are endangered or extirpated, such as the Island Blue Butterfly, *Plebejus saepiolus insulanus* (Fraser pers. comm. 2007).

## EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Prairie Lupine is not protected under the Convention on International Trade on Endangered Species (CITES), the Endangered Species Act (USA) nor is it listed in the World Conservation Union (IUCN) Red List of Threatened Species. NatureServe (2007) treats *Lupinus lepidus* as synonymous with *L. lepidus* var. *lepidus* and ranks the global status as G5 (secure). In the United States, *Lupinus lepidus* is not ranked nationally (NNR) and is described as common in dry habitats with thousands of occurrences (NatureServe 2007).

The British Columbia Conservation Data Centre (2007) currently ranks Prairie Lupine as S1 (critically imperiled) because of extreme rarity or some factor(s) making it especially susceptible to extirpation or extinction. Prairie Lupine is on the provincial RED LIST, which includes indigenous species and subspecies that are considered to be extirpated, endangered or threatened in British Columbia. Such listings, however, do not confer protection. The taxon is not formally listed under the British Columbia Wildlife Amendment Act (2004).

Prairie Lupine is listed on Schedule 1 of the Species at Risk Act (SARA) under the name *Lupinus lepidus* var. *lepidus* and given the status of Endangered (facing imminent extirpation or extinction)(COSEWIC, May 2000). Because the two extant occurrences do not occur on federal lands, the sites are not protected under SARA. None of the specific actions to protect the species listed in the recovery strategy have been implemented (Parks Canada Agency 2006).

The population on Mount Braden/Mount MacDonald is protected from development within a Capital Regional District Park Reserve. No management plans have yet been developed for this area. The population on Mount Helmcken is on private land and is not formally protected. The population at Mount Wells, which may persist in the seedbank, is protected from development within a Capital Regional District Park.

Land status and protection of sites where Prairie Lupine no longer occurs is varied. Cattle Point is protected from development within a municipal park, but it is not clear whether the historical record occurred within the park. Observatory Hill is federal land managed by the National Research Council Herzberg Institute of Astrophysics. Exact location and therefore ownership of the Langford Plains and Koksilah River Valley populations is not known. The two populations extirpated by construction occurred on public lands: Beacon Hill (municipal park) and Somenos Lake (Ministry of Transportation and Highways or Esquimalt and Northern Railroad). Public ownership of these lands did not guarantee the protection for these populations.

## TECHNICAL SUMMARY

*Lupinus lepidus*

Prairie Lupine

Range of Occurrence in Canada: BC

Lupin élégant

### Demographic Information

|  |         |
|--|---------|
| Generation time (average age of parents in the population)   | 2-3 yrs |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 or 5 years, or 3 or 2 generations].<br>Due to fluctuation in numbers of plants, percentage loss or decline is unknown.   | Unknown |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 or 5 years, or 3 or 2 generations].   | Unknown |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 or 5 years, or 3 or 2 generations] period, over a time period including both the past and the future.   | Unknown |
| Are the causes of the decline clearly reversible?  | Unknown |
| Are the causes of the decline understood?  | Unknown |
| Have the causes of the decline ceased?   | Unknown |
| [Observed, inferred, or projected] trend in number of populations<br>Two populations extirpated by construction in 1994 and the Mount Wells population may also be extirpated as of 2007 or perhaps in near future since its continued decline from 12 plants in 2001 to 2 in 2003 to 1 in 2004 and 0 in 2007. | Decline |
| Are there extreme fluctuations in number of mature individuals?<br>The presence of seed banks precludes this based on definition.  | No      |
| Are there extreme fluctuations in number of populations?   | No      |

### Extent and Area Information

|  |                        |
|--|------------------------|
| Estimated extent of occurrence<br>Determined by COSEWIC secretariat (5.5 km <sup>2</sup> if Mount Wells is included)   | 12 km <sup>2</sup>     |
| [Observed, inferred, or projected] trend in extent of occurrence<br>Decline if Mount Wells site is considered extirpated or fluctuating depending on the presence of a seed bank.  | Decline or fluctuating |
| Are there extreme fluctuations in extent of occurrence?  | No                     |
| Index of area of occupancy (IOA)<br>12 km <sup>2</sup> using 2x2 km grid (4 km <sup>2</sup> if calculated using 1x1 grid)<br>16 km <sup>2</sup> if Mount Wells is included using 2x2 km grid (5 km <sup>2</sup> if using a 1x1 grid)   | 12 km <sup>2</sup>     |
| [Observed, inferred, or projected] trend in area of occupancy<br>Two populations destroyed through construction activities in the last 13 years and the Mount Wells population may also be extirpated or is likely to be within at least three generations since the seed bank seems to have become depleted based on the observed decline in plant numbers. | Decline observed       |
| Are there extreme fluctuations in area of occupancy?   | No                     |

|   |         |
|---|---------|
| Is the total population severely fragmented?<br>The two or three populations produce few mature individuals and could be considered to be questionably viable; the quality of the very small areas of habitat is in decline due to invasive species within the populations and in adjacent areas and the populations are separated by distances over which seeds or pollen are not likely to be dispersed in the course of one or more generations. | Yes     |
| Number of current locations<br>The extant sites are several km apart in an area where the only significant threat that could impact several populations and their habitat is a major and extensive fire event. Because fire control measures are in place there would appear to be no major threat that would impact all or some of the sites at the same time. Each population is therefore considered present at a distinct location.             | 2-3     |
| Trend in number of locations<br>Two distinct populations were extirpated around 1994 due to construction and the Mount Wells population may also be extirpated as of 2007.  | Decline |
| Are there extreme fluctuations in number of locations?  | No      |
| Trend in [area and/or quality] of habitat<br>Decline in area due to population losses since 1994 and the recent extirpation or near extirpation of the Mount Wells population and the decline in habitat quality due to the impact of invasive plants.  | Decline |

#### Number of mature individuals in each population

| Population  | N Mature Individuals |
|---|----------------------|
| Mature plants observed at the Mount MacDonald/Mount Braden site in 2008 and 2009 but exact total unavailable but likely <250. | <250                 |
| Total   | <250                 |
| Number of populations (locations)   | 2-3                  |

#### Quantitative Analysis

|  |                |
|--|----------------|
|  | None available |
|--|----------------|

#### Threats (actual or imminent, to populations or habitats)

|   |
|---|
| Potential threats:<br>Habitat loss; invasion by exotic plants; lack of fire to regenerate habitats; demographic collapse. |
|---|

#### Rescue Effect (immigration from an outside source)

|   |         |
|---|---------|
| Status of outside population(s)?<br>USA: Not assessed in adjacent WA, likely because the species is not at risk in the state and perhaps also because of nomenclatural confusion. |         |
| Is immigration known?   | Unknown |
| Would immigrants be adapted to survive in Canada?   | Likely  |
| Is there sufficient habitat for immigrants in Canada?   | Likely  |
| Is rescue from outside populations likely?  | No      |

#### Current Status

|                                  |
|----------------------------------|
| COSEWIC: Endangered (April 2009) |
|----------------------------------|

Additional Sources of Information: None



### Status and Reasons for Designation

|  |  |
|--|--|
| <b>Status:</b><br>Endangered   | <b>Alpha-numeric code:</b><br>B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v); C2a(i); D1 |
| <b>Reasons for designation:</b><br>A perennial species found at only 2 or possibly 3 remaining locations within southeastern Vancouver Island. Its small total population has been reduced in recent decades with <250 mature individuals present in 2009. The spread of invasive plants continues to degrade habitat within and adjacent to extant sites that could serve to support the establishment and survival of the species. |  |

### Applicability of Criteria

|  |
|--|
| <b>Criterion A</b> (Decline in Total Number of Mature Individuals):<br>Not applicable since percent population decline cannot be quantified due to population fluctuations.  |
| <b>Criterion B</b> (Small Distribution Range and Decline or Fluctuation):<br>Meets Endangered B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v). EO and IAO are below critical limits and only 2-3 extant populations are known. Habitat and mature individuals have been lost since 1994 at 2 extirpated sites and the Mount Wells population is possibly extirpated. Quality of habitat has declined within and adjacent to areas of extant populations due to the presence and spread of invasive plants that have likely degraded the habitat. Invasive plants such as Scotch Broom also occur at the extant sites and may have been instrumental in reducing population sizes at 2 sites before they were destroyed by construction. |
| <b>Criterion C</b> (Small and Declining Number of Mature Individuals):<br>Meets Endangered C2a(i) since the total population of mature individuals was likely <250 mature individuals in 2009 and no population in recent decades has ever been recorded as having >250 mature individuals.  |
| <b>Criterion D</b> (Very Small Population or Restricted Distribution):<br>Meets Endangered D1 with < 250 mature individuals.   |
| <b>Criterion E</b> (Quantitative Analysis):<br>None available.   |

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## **BIOGRAPHICAL SUMMARY OF REPORT WRITER**

Carrina Maslovat has an M.Sc. in Botany from the University of Victoria (2001). She currently works as a consultant with a focus on plant species at risk and ecological restoration, primarily in Garry Oak ecosystems. She has conducted inventories and monitoring for species at risk. Carrina has developed protocols to minimize impacts to plant species at risk during habitat restoration and from recreational impacts and has worked extensively to restore habitat and control invasive species. Between 1997 and 2003, she was co-owner of Woodland Native Plant Nursery where she developed propagation expertise for a range of native species including several at-risk plants.

## **COLLECTIONS EXAMINED**

The following collections were consulted:

- University of British Columbia herbarium
- Royal BC Museum herbarium
- University of Washington herbarium (e-mail contact with curator in 2004)
- Canadian Museum of Nature herbarium

## **Appendix 1. Description of fieldwork, survey techniques and documented locations from other sources**

### **Survey techniques**

Known Prairie Lupine sites on Mount Braden and Mount MacDonald were first surveyed in late April, 2007 to develop a search image for the species and to identify habitat attributes. Although it was expected that plants would either have new growth or be in a winter dormant state, no mature plants were found. After further investigation, small seedlings were located at each of the sites where Prairie Lupine had been previously recorded. Mount Braden and Mount MacDonald were re-surveyed three times following the initial survey. The report writer spent 23 hours and Roemer (2007) spent 31 hours visiting extant sites and searching adjacent habitat.

Herbarium specimens from the UBC herbarium and RBCM herbarium were used to assemble locations for historic Prairie Lupine. Extirpated populations at Beacon Hill and Mount Wells were visited during the summer and fall when lupines in other locations were at their most obvious. No plants were observed in either of these historic populations. Location data for other historic populations that have not been observed recently (Langford Plains, Oak Bay District/Cattle Point, Koksilah River Valley) was too vague to identify a search area. An inventory of species at risk in Cattle Point (Fairbarns 2004) did not find Prairie Lupine. The report writer spent 5 hours and Roemer (2007) spent 5 hours searching for extirpated populations.

Surveys for Prairie Lupine were also conducted by Roemer (2007) at other potential sites within the Sea to Sea planning area and in CRD Parks land. A priority list was developed based on key habitat characteristics of potential sites including size of grassland, proximity to known occurrences and similarity of elevation, habitat, and vegetation cover to known sites. Areas were identified using maps and air photos and familiarity with sites from prior visits to the area. Nine areas, some with several hill-top habitats were surveyed. Roemer (2007) spent approximately 47 hours searching potential habitat. Only two new subpopulations were found in the Mount MacDonald area closest to the confirmed locations: no plants were found in yet undiscovered locations (Roemer 2007).