

COSEWIC
Assessment and Status Report

on the

Oregon Lupine
Lupinus oregonus

in Canada



EXTIRPATED
2008

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:

COSEWIC. 2008. COSEWIC assessment and status report on the Oregon Lupine *Lupinus oregonus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 23 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Production note:

COSEWIC would like to acknowledge Todd Kohler and Matt Fairbarns for writing the status report on the Oregon Lupine, *Lupinus oregonus* in Canada. COSEWIC also gratefully acknowledges the financial support of the Garry Oak Ecosystem Recovery Team for the preparation of this report. The COSEWIC report review was overseen by Erich Haber, Co-chair, COSEWIC Vascular Plants Species Specialist Subcommittee, with input from members of COSEWIC. That review may have resulted in changes and additions to the initial version of the report.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur la lupin d'Orégon (*Lupinus oregonus*) au Canada.

Cover photo:

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Catalogue No. CW69-14/569-2009E-PDF
ISBN 978-1-100-12453-7



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COSEWIC Assessment Summary

Assessment Summary – November 2008

Common name

Oregon Lupine

Scientific name

Lupinus oregonus

Status

Extirpated

Reason for designation

The species has only been recorded from Oak Bay, Victoria, BC, where it was first collected in 1924. The last record of its existence in Canada is a collection made from the same area in 1929. The species has not been recorded since its last collection in the region in spite of extensive botanical surveys within southeastern Vancouver Island over the last several decades.

Occurrence

British Columbia

Status history

Designated Extirpated in November 2008. Assessment based on a new status report.



COSEWIC **Executive Summary**

Oregon Lupine *Lupinus oreganus*

Species information

Oregon Lupine *Lupinus oreganus* is a long-lived perennial of the bean family (Fabaceae). Its aromatic flowers have a slightly reflexed, distinctly ruffled upper petal (banner), and are yellowish-cream coloured, often showing shades of blue on the lower petal (keel). The upper calyx lip is short, yet not obscured by the reflexed banner when viewed from above. The leaflets tend to a deep green with an upper surface that is often hairless. The plants are 40 to 80 cm tall, with single to multiple unbranched flowering stems and basal leaves that remain after flowering.

Distribution

Globally, Oregon Lupine occurs in a narrow range west of the Cascades from Douglas County, Oregon to Lewis County, Washington, and into southern British Columbia. In Canada, it has only been found at one site in the vicinity of Victoria, British Columbia where it is now extirpated.

Habitat

Oregon Lupine occupies native upland prairies and open oak woodlands. Soils are damp to somewhat dry.

Biology

Oregon Lupine is a long-lived perennial and flowers from April to June. In its current range in the United States, plants enter dormancy in July, in response to summer drought, and are completely senescent by mid-August.

Flowers possess a pump or piston arrangement for cross-pollination by insects. Fruit and seed set is obligately dependent on insect vectors. It is unable to survive prolonged periods of shade. Clumps can be quite large, forming clones with seemingly individual plants 10 m or more apart being inter-connected by underground stems.

Population sizes and trends

Oregon Lupine has been collected from one locality in Canada. There have been no collections since 1929; this represented the last of seven collections of this species made in Canada. Because location data for these collections are vague, it is unclear whether the historic collections constitute one or more populations.

Limiting factors and threats

The need for a summer-dry sub-Mediterranean climate, which in Canada, only occurs on southeast Vancouver Island and some of the adjacent Gulf Islands, limited this species' occurrence in Canada. Present threats within its former habitat include habitat destruction, invasive species competition, fire suppression as well as recreational and maintenance activities.

Special significance of the species

Oregon Lupine is the focus of a major restoration effort in the Willamette Valley of Oregon. It is the primary host food plant for the endangered Fender's Blue Butterfly larvae.

Existing protection or other status designations

Oregon Lupine is not covered under the Convention on International Trade in Endangered Species. It is listed as threatened under the Endangered Species Act (USA) and has a world status of vulnerable in the 1997 IUCN Red Data Book. The IUCN also lists it as V, E, and Ex/E for Oregon, Washington and BC respectively. NatureServe globally ranks it as G5 (secure; the var. *oreganus* is relatively common in Oregon), with a US National status of N2 (imperiled), a Canadian National status of NH (historical record), and sub-national status ranks of S2 (imperiled), S1 (critically imperiled) and SX (presumed extirpated) in Oregon State, Washington State and British Columbia respectively. It is on the BC provincial red list, although British Columbia does not provide any legal protection for this species.



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

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2008

TABLE OF CONTENTS

SPECIES INFORMATION.....	4
Name and classification.....	4
Morphological description.....	5
Genetic description.....	6
Designatable units.....	7
DISTRIBUTION.....	7
Global range.....	7
Canadian range.....	8
HABITAT.....	10
Habitat requirements.....	10
Habitat trends.....	11
Habitat protection/ownership.....	12
BIOLOGY.....	13
Life cycle and reproduction.....	13
Herbivory.....	14
Physiology.....	14
Dispersal.....	14
Interspecific interactions.....	15
Adaptability.....	15
POPULATION SIZES AND TRENDS.....	15
Search effort.....	15
Abundance.....	15
Fluctuations and trends.....	15
Rescue effect.....	16
LIMITING FACTORS AND THREATS.....	16
Mowing.....	16
Herbivory.....	16
Trampling.....	16
SPECIAL SIGNIFICANCE OF THE SPECIES.....	17
EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS.....	17
TECHNICAL SUMMARY.....	18
ACKNOWLEDGEMENTS AND AUTHORITIES CONSULTED.....	20
Authorities consulted.....	20
INFORMATION SOURCES.....	20
BIOGRAPHICAL SUMMARY OF REPORT WRITERS.....	23
COLLECTIONS EXAMINED.....	23

List of Figures

Figure 1. Photograph of Oregon Lupine.....	6
Figure 2. Global range of <i>Lupinus oreganus</i> (including both var. <i>kincaidii</i> and var. <i>oreganus</i>).....	8
Figure 3. Canadian distribution of Oregon Lupine.....	9

List of Tables

Table 1. Records of Oregon Lupine on Vancouver Island.....	10
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SPECIES INFORMATION

Name and classification

Scientific name:	<i>Lupinus oregonus</i> Heller
Synonyms:	<i>Lupinus oregonus</i> Heller var. <i>kincaidii</i> C.P. Sm. <i>Lupinus sulphureus</i> Hooker ssp. <i>kincaidii</i> (C.P. Sm.) L. Phillips <i>Lupinus sulphureus</i> Hooker var. <i>kincaidii</i> (C.P. Sm.) C.L. Hitchc.
Common name:	Oregon Lupine, Kincaid's Lupine (for the variety known from Canada)
Family:	Fabaceae (bean family)
Major plant group:	Eudicot flowering plant

The proper taxonomic name for Oregon Lupine has a long and complicated history, and is still undergoing debate. Heller first described Oregon Lupine as *Lupinus oregonus* in 1911. In 1924 a new variety, *L. oregonus* var. *kincaidii* C.P. Smith, was described from Corvallis, Oregon, differing from the typical variety in its short upper calyx lip, not concealed by the reflexed sides of the long-clawed banner. Another taxon was later described (C.P. Smith) from a Eugene, Oregon, specimen as *L. leucopsis* Agardh. var. *hendersonianus* C.P. Smith. In a revision of the North American perennial lupines (Phillips 1955), *L. oregonus* var. *oreganus*, *L. oregonus* var. *kincaidii*, and *L. leucopsis* var. *hendersonianus* were reduced to a single subspecies of *L. sulphureus* (Phillips 1955). Another treatment by Isley (1998) described the taxon at the varietal level (*L. sulphureus* var. *kincaidii*) whereas Hitchcock *et al.* (1961) treated it as a full subspecies (*Lupinus sulphureus* ssp. *kincaidii*).

Dunn and Gillett (1966) called plants from the single known extirpated Canadian population on Vancouver Island, British Columbia, *Lupinus oregonus* var. *kincaidii*. In Western Oregon, two named varieties of *Lupinus oregonus* have been recorded; *L. oregonus* var. *kincaidii* from Corvallis and *L. oregonus* var. *oreganus* from Eugene. Since there is no evidence today that these two plants exist in W. Oregon as separate entities, or have in the past, there is no basis for using both varietal names (Wilson *et al.* 2003, Liston pers. comm. 2006). The name *L. sulphureus* ssp. *kincaidii* has been in common use in Oregon (as used in Hitchcock *et al.* 1961). According to a recent publication on Oregon Lupine (Wilson *et al.* 2003), the name *Lupinus oregonus* could be resurrected if future studies of morphological and molecular variation support a separation of *L. sulphureus* and the Willamette Valley plants. Meanwhile, authors of the most recent papers on Oregon Lupine have adopted the name *L. oregonus*, consistent with the 1966 treatment by Dunn and Gillett, as there is no strong evidence that there is a relationship between Oregon Lupine and *L. sulphureus* (Liston pers. comm. 2006). For these reasons, forthcoming publications from W. Oregon on the genetics of Oregon Lupine will likely use the name of *L. oregonus* (Liston pers. comm. 2006), consistent with the first description of this species by Heller in 1911.

Since there is only a single infraspecific taxon known from Canada, the species will be referred to in this report as *Lupinus oregonus* without reference to the varietal name.

Morphological description

Oregon Lupine is a long-lived perennial with a branched crown. It generally has numerous unbranched, 4-8 dm tall stems, which bear minute, appressed, stiff hairs and/or short silky hairs. It usually bears basal leaves that persist until after flowering. The lowermost leaf stalks are 3-5 times as long as the blades, although the leaf stalks of the upper stem leaves are sometimes shorter than the blades. The leaves have 9-11, rather narrowly oblanceolate leaflets. The leaflets are usually sharply pointed and 2.5-4 cm in length. The leaves vary from nearly equally short hairy with stiff hairs (or silky hairy) on both surfaces, to hairless above and sparsely to copiously hairy beneath.

The flowers are borne on short (4-10 mm long) stalks from a central axis at the tip of the stem, and may form whorls, or are less evenly distributed. The flowers are 9-12 mm long and yellowish to bluish or purple. Though rather numerous, the flowers are not closely crowded. The outer ring of floral parts (calyx) is fused into a two-lipped structure that is often noticeably silky and asymmetrical, but not truly sac-shaped or spurred. The upper lip of the calyx is two-toothed while the lower lip is entire. The corolla (ring of five petals) is bilaterally symmetric. The uppermost petal (banner) is slightly reflexed from the lateral petals (wings) and two lower petals (which are fused to form the keel). The banner is hairless or very sparsely hairy, the wings are hairless, and the keel usually bears a marginal fringe of short-stiff hairs (cilia), although it is sometimes hairless. The fruit is a 2-3 cm long pod containing four to five pinkish-brown seeds (Hitchcock *et al.* 1961).

With its low growing habit and unbranched inflorescence, Oregon Lupine is easily distinguished from other members of the genus that occur in the same range. It has a characteristic kink or ruffle in the banner, which combined with long leaf stalks and smooth upper leaf-surfaces makes it easy to identify (Figure 1).



Figure 1. Photograph of Oregon Lupine (critical characteristics of individual flower form cannot be seen in this image; photograph by Thomas N. Kaye, Institute for Applied Ecology, with permission).

Genetic description

Most of the new world species of lupine which have been cytologically investigated display a common chromosome number of $2n=48$ (Phillips 1957; Dunn and Gillett 1966). Although this number is considered tetraploid (Phillips 1957), isozyme studies in the genus *Lupinus* suggest that most loci do not show duplicate expression (Wolko and Weeden 1989). The base chromosome number for the new world species is $\chi = 6$ and consequently the New World lupines are regarded as a paleopolyploid series (derived from an ancient polyploid ancestor but evolved to become more diploid-like) (Dunn 1984). This is consistent with the specific chromosome count of $n=24$ that has been reported for Willamette Valley populations of Oregon Lupine (Phillips 1957).

Liston *et al.* (1995) inferred, from similarities among allozyme alleles, that local Oregon Lupine populations experienced frequent historical gene exchange that resulted in panmictic (random mating) populations. Today, the reproduction of Oregon Lupine appears to be limited by small population size. Outcrossing nearly doubles seed set (Severns 2003a), a pattern inconsistent with a well-mixed local metapopulation genetic structure. Furthermore, Kaye and Kuykendall (2001) found that Oregon Lupine seeds collected from a small population had a significantly lower germination rate (55%) compared with seeds collected from a relatively larger lupine population (95%); a symptom of inbreeding depression in other plant species (Menges 1991; Heschel & Paige 1995; Buza *et al.* 2000). Overall, populations of Oregon Lupine exhibit a high genetic similarity among populations (Wilson *et al.* 2003).

Designatable units

Historical collections are known from a single location within the Pacific National Ecological Area recognized by COSEWIC, therefore the species would have consisted of a single designatable unit.

DISTRIBUTION

Global range

Oregon Lupine has been found at 57 sites in the USA from Lewis County, Washington, south to Douglas County, Oregon (a distance of 400 km) (Figure 2). It occurs on 48 soil series sites throughout the Willamette Valley; four sites are in the Umpqua Valley of Douglas County, Oregon; and two small sites in Lewis County in southern Washington, 70 km north of the Willamette Valley (Wilson *et al.* 2003).

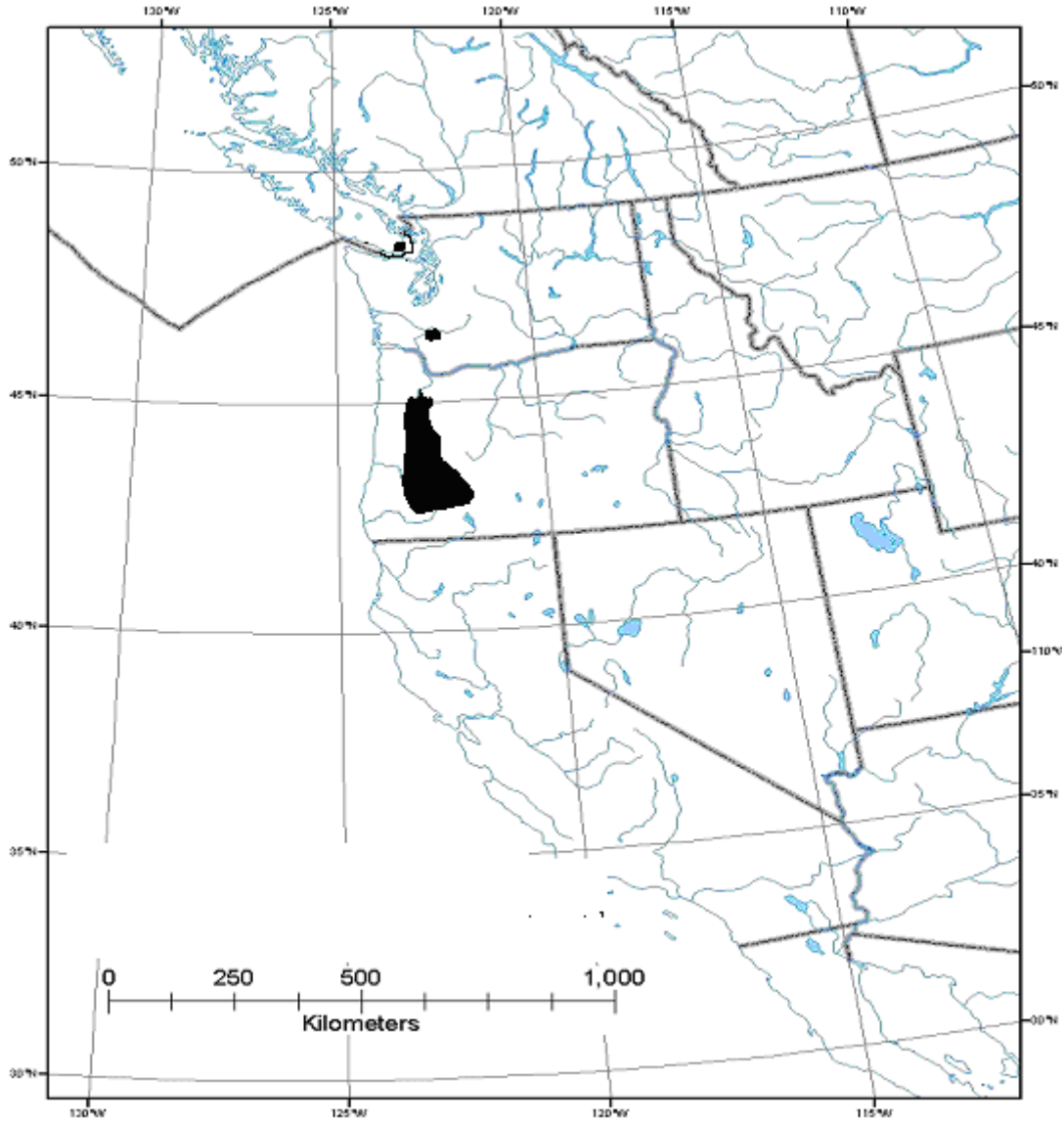


Figure 2. Global range of *Lupinus oregonus* (including both var. *kincaidii* and var. *oreganus*). Only var. *kincaidii* has ever been recorded in Canada.

Canadian range

In Canada, a single Oregon Lupine occurrence was known from the Victoria / Oak Bay region on Vancouver Island, British Columbia, Canada (Figure 3).

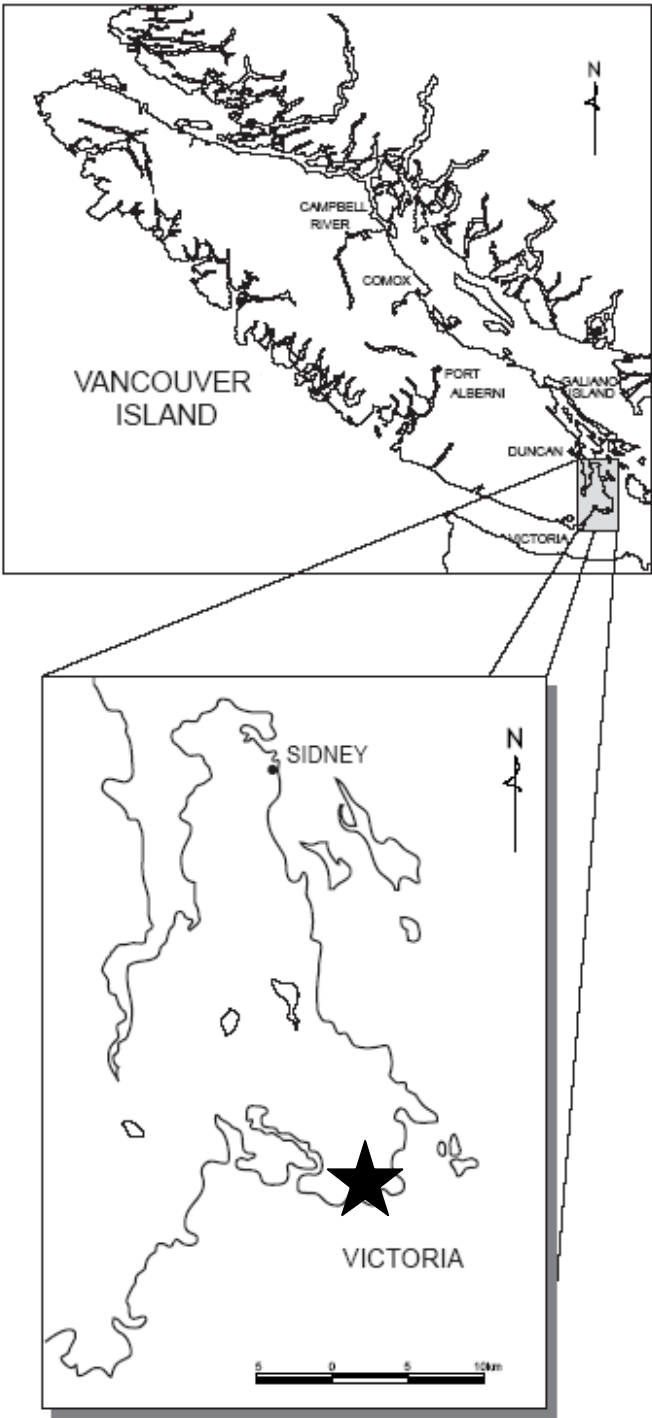


Figure 3. Canadian distribution of Oregon Lupine (star indicates the location of the single extirpated Canadian population).

There are 7 specimens of Oregon Lupine in the herbarium at the Royal British Columbia Museum (V) that were collected from the Victoria / Oak Bay region between 1924 and 1929 (Table 1). Extirpation probably occurred between 1930 and 1950, a period when there was little botanical study in the area (Ceska pers. comm. 2005). This extirpated, disjunct population of Oregon Lupine represents a range extension of over 260 km north of the nearest known present day population in Lewis County, Washington, USA.

Table 1. Records of Oregon Lupine on Vancouver Island

Date Collected	Location	Collector	Accession no.
June 16, 1924	Grassy Flat, Oak Bay Flat, Victoria	Rev. R. Connell	(V) 7453
May, 1925	Grassy Flat, Victoria	Rev. R. Connell	(V) 7634
July 11, 1927	Oak Bay, V.I.	Rev. R. Connell	(V) 8208
June 5, 1929	Victoria, BC	Mrs. Priestly	(V) 8704
June 5, 1929	Oak Bay, Victoria	Mrs. Priestly	(V) 40463
June 30, 1929	Oak Bay, V.I.	W.B. Anderson	(V) 8696
June 30, 1929	Oak Bay, Victoria	W.B. Anderson	(V) 40464

Specimens from Royal British Columbia Museum Victoria (V)

Dunn and Gillett (1966) raised the question of whether Oregon Lupine is a relict of a past warmer, drier period or introduced. Kaye (2000) concluded that the historic Victoria population was unlikely introduced, as it is neither showy, nor weedy, and thus unlikely to spread easily. Kaye reinforced this view with the observation that a number of other plant species were similarly disjunct between Oregon and Victoria savannas.

HABITAT

Habitat requirements

In British Columbia, Oregon Lupine probably occurred in coastal upland meadows (Kaye 2000, Kaye pers. comm. 2005). Douglas *et al.* (2002) described this habitat as: dry sites in the lowlands of the Coastal Douglas-fir biogeoclimatic zone. Suitable habitat was probably restricted to the maritime meadows of this zone: low elevation (<30 m), herb-dominated ecosystems, largely confined to coastal situations (<3 km of shoreline) along south-eastern Vancouver Island and a subset of islands in the Strait of Georgia, Haro Strait and the Strait of Juan de Fuca (Parks Canada Agency 2006). Soils in such sites are typically low in nitrates, moderately infertile, acidic and of postglacial origin (MacDougall *et al.* 2004).

The closest known population of Oregon Lupine occurs in Lewis County, Washington at the northern extent of its current range in the United States. There, it occurs in dry, open woods, banks, meadows and roadsides at local sites. Species associated with Oregon Lupine include *Camassia quamash*, *Cicendia quadrangulis*, *Deschampsia cespitosa*, *Pseudotsuga menziesii* and *Arbutus menziesii* (USFWS Federal Registry 2005).

Today, Oregon Lupine is found predominately in the Willamette Valley of Oregon, where it occupies native grassland habitats. There, Oregon Lupine occurs in native upland prairies and open oak woodlands on soils that are mesic (normal) to slightly xeric (dry). This upland prairie and oak savanna habitat is dominated by short, native bunch grasses and forbs. Populations occur on early seral upland prairie habitat (Schultz *et al.* 2003; Wilson *et al.* 2003).

Dry fescue prairies make up the majority of habitat for Oregon Lupine. Although Oregon Lupine is occasionally found on steep, south-facing slopes and barren rocky cliffs, it does not appear to be capable of occupying xeric sites which have *Danthonia californica* communities on the south-facing slopes. Oregon Lupine's distribution implies a close association with native upland prairie sites that are characterized by heavier soils and mesic to slightly xeric soil moisture levels. At the southern limit of its range, Oregon Lupine occurs on well-developed soils adjacent to serpentine outcrops where it is often found under scattered oaks. Overall, Oregon Lupine occurs on a broad variety of well-drained soil types (Wilson *et al.* 2003).

Habitat trends

Habitat destruction constitutes the greatest threat to Oregon Lupine in the U.S., with invasive species and fire suppression being secondary and tertiary, respectively (Wilson *et al.* 2003). In Canada, habitat loss was the primary threat in the past, but many of the remaining fragments of suitable habitat in Victoria and Oak Bay are now within municipal and regional parks, where they are protected from rapid development. In contrast, threats posed by invasive species and the consequences of fire protection have remained constant or increased.

Habitat invasion by exotic species

Most of the remaining maritime meadow habitat in Victoria and Oak Bay has been heavily altered through invasion by alien grasses and shrubs. A spatial analysis carried out in 2005 for the purpose of this report, using ortho-photographs and field visits, revealed that approximately 30% has been altered through invasion by exotic woody and semi-woody species (*Ulex europaeus*, *Cytisus scoparius*, *Rubus armeniacus*, *Hedera helix*) to such a degree that little native cover remains. One or more of these woody species has invaded almost all of the remaining 70% of maritime meadow habitats. Such species are projected to dominate the meadows over the next 10 years unless direct interventions occur. Over 90% of the maritime meadow habitats in Victoria and Oak Bay were also found to have a moderate to high cover of invasive, exotic herbs (primarily grasses such as *Anthoxanthum odoratum*, *Bromus* spp., and *Dactylis glomerata*).

Habitat changes related to fire

Fire suppression is another significant threat to maritime meadow sites. Historically, land management practices by indigenous people helped to maintain a diversity of floral communities on southeastern Vancouver Island. After the arrival of Europeans, this practice was eliminated and open Garry oak woodlands and meadows succeeded to shrubland and *Pseudotsuga menziesii* forests (MacDougall *et al.* 2004). Fire suppression is also confounded by and closely linked with habitat destruction and invasion by introduced species of plants.

Habitat loss

Less than 1% of the Coastal Douglas-fir biogeoclimatic zone remains in a relatively undisturbed state (Pacific Marine Heritage Legacy 1996). Garry oak ecosystems in the Victoria region have declined from 10,510 ha in 1800 to 512 ha in 1997 (Lea 2002) and even more has been lost since then. Surveys along a 500 m wide coastline strip of Victoria and Oak Bay (conducted in 2005 for this status report) revealed that less than 0.5 km² (approximately 5%) of the area remains undeveloped. Development pressure has concentrated on relatively level sites where maritime meadows once prevailed and only about 0.1 km² of maritime meadows remain in natural or near-natural condition.

Habitat protection/ownership

Virtually all of the remaining maritime meadow complexes in Victoria and Oak Bay occur within municipal and regional park boundaries, where residential and commercial development is prohibited, and native species are nominally protected. This has not prevented exotic species from invading maritime meadow habitats, despite occasional efforts to reduce the cover of invasive woody species such as *Ulex europaeus* and *Cytisus scoparius*.

BIOLOGY

The most extensive research on the biology of Oregon Lupine has occurred recently in the Willamette Valley of Oregon. As part of a multi-species recovery strategy, two species of plant (*Lupinus sulphureus* ssp. *kincaidii* and *Erigeron procumbens* var. *procumbens*) and one species of butterfly (*Icaricia icarioides fenderi*) are currently being examined to determine their critical habitats. Oregon Lupine is the primary host larval food plant for the endemic, endangered Fender's Blue Butterfly. As a result several studies have been conducted on the biology of these species. Therefore, much of the following information on the biology of Oregon Lupine draws from the most comprehensive review of this species by (Wilson *et al.* 2003).

Life cycle and reproduction

Oregon Lupine is a long-lived perennial. Under ideal conditions plants are capable of flowering in their second year (Severns 2003b), and some individuals flower every year thereafter (Wilson *et al.* 2003). Most (60%) flower in their third year (Severns 2003b, Wilson *et al.* 2003). In the Willamette Valley, populations flower from April to June, whereas the plants collected from the Victoria area flowered between May and July (Table 1). In its current range, plants enter dormancy in July, in response to summer drought, and are completely senescent by mid-August.

The flowers possess a pump or piston arrangement (for cross-pollination) and mature from the bottom to the top of the inflorescence (which also encourages cross-pollination by insects), as is common in other lupines (Kaye 1999, Wilson *et al.* 2003). Pollination of the relatively small flowers of Oregon Lupine appears to be carried out by small bees (Wilson *et al.* 2003). Bee species that commonly visit Oregon Lupine flowers include bumblebees (*Bombus mixtus* and *B. californicus*), and the European honeybees (*Apis mellifera*). Insect pollination appears to be critical for successful seed production (Wilson *et al.* 2003).

Inbreeding depression may limit seed set and seed fitness of smaller lupine populations (Severns 2003a; Wilson *et al.* 2003). Conservation of Oregon Lupine will likely require the outcrossing of populations by planting new individuals from different sources near existing populations and increasing pollinator connectivity between existing populations (Severns 2003a). In addition, sexual reproduction is necessary for population expansion and colonization of new sites (Kaye 1999). Oregon Lupine is capable of clonal growth and individuals can live for more than 25 years and can span up to 10 m (see dispersal section below).

Herbivory

Herbivorous insects, including stem and root borers, sapsuckers, and defoliators, feed on the vegetative structures of Oregon Lupine. Stem and root borers may include the larvae of several species of true weevils (Curculionidae) while sapsuckers include true bugs (Hemiptera), leafhoppers (Cicadellidae) and aphids (Aphididae) (Wilson *et al.* 2003). The larvae of Lycaenid butterflies, mainly Fender's Blues and Silvery Blues, may cause significant defoliation (Wilson *et al.* 2003). In one study, herbivory reduced seed production by almost half in the second growing year, and nearly one-fourth of the seed produced was consumed in the third growing year (Severns 2003a). The collections of Oregon Lupine at the Royal BC Museum (V) were recently investigated for the presence of Fender's Blue eggs. Although no eggs were seen, leaves showed evidence of herbivory by insects, likely by butterfly larvae (Kaye 2000).

Physiology

Oregon Lupine is a species of prairie or open areas and is unable to survive prolonged periods of shade (Wilson *et al.* 2003). It does not tolerate decrease in available light that results from increased canopy closure as prairies (and meadows) gradually transform into woodlands in the absence of disturbance (Shultz *et al.* 2003). Plants enter dormancy in July in response to summer drought. Soils are low in nitrates, moderately infertile, acidic and of postglacial origin (Wilson *et al.* 2003).

Dispersal

Oregon Lupine has no traits to promote long distance seed dispersal, and its pollinating insects typically travel relatively short distances (Wilson *et al.* 2003). Seed set and seed production are low, with few (but variable) numbers of flowers producing fruit from year to year. Fruits contain an average of 0.3–1.8 seeds (Liston *et al.* 1995), which are dispersed when the fruits open explosively upon drying.

Individual plants are capable of spreading by rhizomes (horizontal stems), producing clumps of plants exceeding 20 m in diameter (Severns 2003b). The long rhizomes do not produce adventitious roots, apparently do not separate from the parent clump, and the clumps may be short-lived, regularly dying back to the crown (Kuykendall and Kaye 1993). Vegetative spread of Oregon Lupine does not produce new ramets (Wilson *et al.* 2003).

Interspecific interactions

Oregon Lupine has symbiotic relationships with nitrogen fixing bacteria and mycorrhizal fungi that may be very important for early establishment and growth in the low nitrate soils associated with upland prairie habitat (Wilson *et al.* 2003). The identity of the bacterial symbiont has not been determined. Restoration projects may be more successful if seeds are inoculated with vesicular-arbuscular mycorrhizae (VAM) by adding small amounts of soil from sites currently supporting Oregon Lupine (Wilson *et al.* 2003). Oregon Lupine is the primary larval food plant for the Willamette Valley endemic butterfly, Fender's Blue Butterfly.

Adaptability

This species' ability to survive is limited by insect pollinators that are necessary for seed dispersal. Inbreeding depression results when the distance between host plants exceeds immigration of Fender's Blue Butterfly populations in Oregon (Wilson *et al.* 2003). There is little information on the longevity of Oregon Lupine seeds in the soil seed bank (Wilson *et al.* 2003).

POPULATION SIZES AND TRENDS

Search effort

Suitable sites have been surveyed repeatedly since the early 1980s in a series of projects designed to document the distribution of rare plants in open meadows on southeast Vancouver Island and the Gulf Islands. The principal investigators included Adolf and Oldriska Ceska, Chris Brayshaw, Hans Roemer, Harvey Janszen, Frank Lomer, Matt Fairbarns and the late George Douglas. During the past decade alone, over 500 person-days have been spent searching for rare species in suitable habitats. Oregon Lupine has not been observed during this search effort.

Oregon Lupine has not been observed in the nearby San Juan Islands (Atkinson and Sharpe 1993) or in recent, intensive surveys of small islets off the San Juans (Giblin pers. comm. 2006). Oregon Lupine has not been reported from the Olympic Peninsula despite detailed surveys (Buckingham *et al.* 1995).

Abundance

The last recorded collection of Oregon Lupine in Canada was made in 1929 and the species now appears to be extirpated in Canada.

Fluctuations and trends

As a perennial clonal species, Oregon Lupine would not likely undergo population fluctuations. The historic population has been extirpated.

Rescue effect

The nearest population is 260 km away. Given the limited ability of this species to disperse, the Canadian population is unlikely to be rescued by natural circumstances.

LIMITING FACTORS AND THREATS

Its need for a summer-dry sub-Mediterranean climate, which only occurs on southeast Vancouver Island and some of the adjacent Gulf Islands in Canada, limit Oregon Lupine. Clones can be quite large with one individual spanning up to 10 m. As a consequence, what appears to be a healthy population may actually consist of a small number of individuals with limited opportunities for outcrossing.

Apart from habitat threats (discussed above) the greatest threats to the recovery of Oregon Lupine in Canada are park management activities such as mowing, recreational activities, which result in trampling, and herbivory.

Mowing

Significant areas of maritime meadow in Victoria and Oak Bay are still mowed for aesthetic reasons or to create fire boundaries. Mowing causes direct damage to plants of maritime meadows and also encourages park visitors to roam more widely than they would if the vegetation was left unmown. Mowing regimes could be altered to prevent damage to species of interest and might, if carefully timed, be used to favour native rather than invasive herbaceous species.

Herbivory

Herbivory (see Biology section) poses a potential threat to the recovery of Canadian populations although the severity of this threat is unknown

Trampling

Trampling and related activities constitute a major threat to the recovery of Canadian populations because most of the maritime meadows in Victoria and Oak Bay occur in municipal and regional parks that receive heavy foot traffic from park visitors.

SPECIAL SIGNIFICANCE OF THE SPECIES

Oregon Lupine is the primary larval host food plant of the endangered Fender's Blue Butterfly, an endemic Lycaenid of the Willamette Valley of Oregon, USA. There is no evidence that this butterfly occurred in Canada, despite the historic presence of Oregon Lupine.

There is no specific information on First Nations use of *Lupinus oreganus* var. *kincaidii* or *L. oreganus* as a whole. Seeds of the closely related *L. sulphureus* were traditionally used to prepare an eye medicine and the plants themselves have been used for bedding and as flooring for sweathouses by bands in the intermountain area of Washington and British Columbia. *Lupinus sulphureus* is considered a favourite food of marmots in the same area, and the onset of flowering by *L. sulphureus* was used to signal when marmots were ready to eat (Turner *et al.* 1980).

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Oregon Lupine is not covered under the Convention on International Trade in Endangered Species (CITES 2006). In the USA it is listed as threatened under the Endangered Species Act (USFWS Federal Registry 2005). It has been designated as globally vulnerable, vulnerable in Oregon, endangered in Washington, and extirpated/endangered in BC (IUCN 1997). NatureServe (2005) globally ranks it as G5T2 (i.e., *Lupinus oreganus* is a globally secure species but variety *kincaidii* is globally imperiled), with a US National status of N2, and subnational status ranks of S2 (imperiled) in Oregon, S1 (critically imperiled) in Washington and SX (extirpated) in BC. It is on the BC provincial red list. British Columbia does not provide any legal protection for Oregon Lupine.

TECHNICAL SUMMARY

Lupinus oreganus

Oregon Lupine

Lupin d'Orégon

Range of Occurrence in Canada : formerly in SE Vancouver Island

Demographic Information

Generation time (average age of parents in the population)	yrs
Observed percent reduction in total number of mature individuals over the last 10 years.	Unknown
Projected percent reduction in total number of mature individuals over the next 10 years.	Unknown
Observed percent reduction in total number of mature individuals over any 10-years period, over a time period including both the past and the future.	Unknown
Are the causes of the decline clearly reversible?	
Are the causes of the decline understood?	
Have the causes of the decline ceased?	
Observed trend in number of populations n/a	
Are there extreme fluctuations in number of mature individuals? n/a	
Are there extreme fluctuations in number of populations? n/a	

Number of mature individuals in each population

Population	N Mature Individuals
Grand Total	0

Extent and Area Information

Estimated extent of occurrence (km ²)	0 km ²
Observed trend in extent of occurrence The population disappeared over 50 years ago.	
Are there extreme fluctuations in extent of occurrence? Unknown but unlikely	unknown
Estimated area of occupancy (km ²)	0 km ²
Observed trend in area of occupancy n/a	
Are there extreme fluctuations in area of occupancy? n/a	
Is the extent of occurrence or area of occupancy severely fragmented? n/a	
Number of current locations	0
Trend in number of locations All extirpated	
Are there extreme fluctuations in number of locations? n/a	
Observed trend in area of habitat n/a	

Quantitative Analysis

Ex.: % probability of extinction in 50 years
--

Threats (actual or imminent, to populations or habitats)

Habitat loss due to urban development and decline in habitat quality due to spread of invasive species, increased recreational use and fire suppression.
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Rescue Effect (immigration from an outside source)

Status of outside population(s) USA: threatened	
Is immigration known or possible?	No
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: Extirpated 2008 BC Red List

Status and Reasons for Designation

Status: Extirpated 2008	Alpha-numeric code:
Reasons for designation: The species has only been recorded from Oak Bay, Victoria, BC, where it was first collected in 1924. The last record of its existence in Canada is a collection made from the same area in 1929. The species has not been recorded since its last collection in the region in spite of extensive botanical surveys within southeastern Vancouver Island over the last several decades.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable.
Criterion D (Very Small Population or Restricted Distribution): Not applicable.
Criterion E (Quantitative Analysis): Not applicable.

ACKNOWLEDGEMENTS AND AUTHORITIES CONSULTED

The authors would like to acknowledge the Garry Oak Ecosystems Recovery Team for financial support and organization for this study. We would also like to thank Thomas Kaye, Mark Wilson and Aaron Liston of Oregon State University for providing invaluable information for this study.

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Ceska, Adolf. Botanist. Geobotanical Consulting. Victoria, B.C. Canada.

Fraser, Dave. Endangered Species Specialist. Biodiversity Branch. British Columbia Ministry of Water, Land and Air Protection. Victoria, British Columbia

Goulet, Gloria. Coordinator – Aboriginal Traditional Knowledge. Canadian Wildlife Service. Ottawa, Ontario.

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Liston, Aaron. Herbarium Director (OSC). Department of Botany & Plant Pathology Oregon State University. Corvallis, Oregon USA.

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COLLECTIONS EXAMINED

Royal BC Museum-visit
 University of Victoria-visit
 UBC-online database
 Canadian Museum of Nature (CAN)-Email correspondence (Bouchard 2005).
 Ministry of Agriculture (DAO)-online database