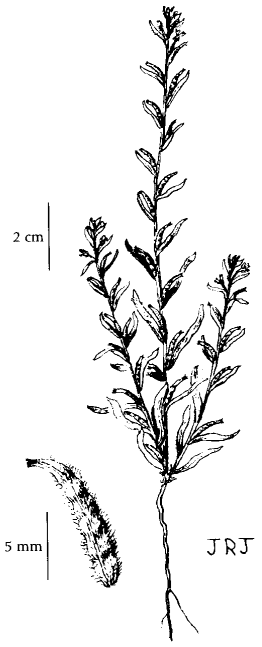
COSEWIC
Assessment and Status Report

on the

Brook Spike-primrose
Epilobium torreyi

in Canada



ENDANGERED
2006

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

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

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Production note:

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Brook spike-primrose — Illustration by Jeanne R. Janish with permission from University of Washington Press.

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COSEWIC
Assessment Summary

Assessment Summary – April 2006

Common name
Brook spike-primrose

Scientific name
Epilobium torreyi

Status
Endangered

Reason for designation
Although no plants have been seen at the two known sites after intensive directed surveys, there is still the possibility that some seeds may remain in the soil seed bank given the relatively short period of time since the last observation of plants in 1993, or that previously overlooked populations may be found.

Occurrence
British Columbia

Status history
Designated Endangered in April 2006. Assessment based on a new status report.

COSEWIC
Executive Summary

Brook Spike-primrose
Epilobium torreyi

Species information

Brook spike-primrose (*Epilobium torreyi*) is an erect, annual herb from a taproot. Its leaves are narrow, toothless or nearly so, and nearly stalkless. The lower leaves are oppositely arranged, and lack hairs, while the reduced upper leaves are alternate and hairy. The small, pink or white flowers are arranged in a leafy, terminal spike. The seeds, which lack the tuft of hairs typical of most species in the genus, are contained in cylindric, hairy, 4-chambered capsules.

Distribution

Globally, brook spike-primrose has been found from southern British Columbia to northwest California, east to Idaho and Nevada. In Canada, it has only been found in the vicinity of Victoria, British Columbia.

Habitat

In Canada, brook spike-primrose has been found in seasonally moist meadows and open sites that dry out during the summer.

Biology

Brook spike-primrose has cleistogamous flowers in which self-pollination occurs in the bud before the flower opens. It flowers and fruits in mid- to late summer and seeds probably germinate the following spring. The seeds of most species in this genus bear a fluffy coma that aids in wind dispersal, but seeds of brook spike-primrose lack a coma. Its capsules dehisce in the late fall and the seeds fall to the ground probably as the capsules are shaken during winter rains.

Population sizes and trends

Brook spike-primrose has been collected from two sites in Canada. One population has not been observed since 1966 and the other has not been observed since 1993. Neither site has been visited regularly and either may have been extirpated as recently as 2000.

Limiting factors and threats

The primary threat to brook spike-primrose in Canada comes from habitat alteration. This includes destruction and alteration of the habitat by residential and agriculture development, physical disturbance of sites by heavy equipment, invasion of sites by aggressive, alien invasive weeds and by natural encroachment of native Douglas-fir trees into open areas.

The nearest reported population is from Orcas Island, Washington. The site is approximately 16 km from the nearest point in Canada and 37 km from the nearest historic location in Canada. Brook spike-primrose is not known from elsewhere in the San Juan Islands, and the next nearest location appears to be in Thurston County, approximately 150 km to the south. There is little chance of seed coming from United States populations because the seeds lack adaptations for long-distance dispersal.

Special significance of the species

The seeds have been used as a food by some Aboriginal cultures in portions of the species' range.

Existing protection or other status designations

Brook spike-primrose is not covered under the Convention on International Trade in Endangered Species (CITES), the Endangered Species Act (USA) or the IUCN Red Data Book. NatureServe ranks it globally as G5 (demonstrably widespread, abundant and secure), and it is ranked S1 (critically imperiled) in British Columbia (the only Canadian province or territory where it has been observed). British Columbia does not provide any legal protection for brook spike-primrose.

COSEWIC HISTORY

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

COSEWIC MANDATE

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

COSEWIC MEMBERSHIP

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

DEFINITIONS
(2006)

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

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

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

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

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

COSEWIC Status Report

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2006

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SPECIES INFORMATION

Name and classification

Scientific name:	*Epilobium torreyi* (S. Wats.) Hoch & Raven
Synonym:	*Boisduvalia stricta* (Gray) Greene
	Oenothera densiflora Lindl. var*. tenella* Gray
	Oenothera torreyi Wats.
Common name:	brook spike-primrose
Family:	Onagraceae (Evening Primrose Family)
Major plant group:	Eudicot flowering plant

There are no infraspecific taxa recognized in *Epilobium torreyi*. Many older floras place it in the genus *Boisduvalia* (*B. stricta*) which differs from *Epilobium* by lacking a tuft of silky hairs (coma) at the summit of each seed. Hoch and Raven (1992) did not feel this distinction warranted separation at the genus level so in their definitive treatment they included the species within the genus *Epilobium*.

Morphological description

Epilobium torreyi is an annual herb from a taproot (Figure 1). Stems are ascending to erect, 10-60 cm tall. Larger plants are branched from the base with the outer tissue of the lower stem peeling, but most Canadian plants are unbranched and too small to peel. Plants are greyish with spreading hairs, and leaves are opposite only near the base. Leaves are linear or narrowly lanceolate, reduced above, entire or remotely fine-toothed, hairy but nearly glabrous near the base and nearly stalkless. The flowering inflorescence is loose to somewhat crowded in a leafy, terminal spike, and glandular; inflorescence leaves are similar to others but entire and smaller. Flowers are fertilized in the bud and do not open. Petals are 1-3 mm long, pink or white and the sepals are 0.7-2 mm long. Stigmas are generally subcapitate, rarely 4-lobed. Capsules are cylindric, about 8-13 mm long, flexible, curved near the tip, long-hairy, short-beaked and 4-chambered. The valve adheres to the partitions and the axis breaks up as the seeds are shed. Each chamber of the capsule holds 6-8 seeds, 1-1.5 mm long. Seeds are smooth and without a tuft of hairs (Douglas and Meidinger 1999).

Epilobium torreyi may be mistaken for *E. densiflorum*, also a rare species in British Columbia. The two species may occur together. Table 1 summarizes significant differences between the two species.

Table 1. Character comparison: *Epilobium densiflorum* vs. *E. torrey*.

Character	*Epilobium densiflorum*	*Epilobium torreyi*
Petal length	(2.5) 3–8 (12) mm	1-3 mm
Capsules	slenderly fusiform, beakless	narrower with prominent, curved beak
Internal septa	completely free from valves	adherent to valves
Flowers	crowded (inflorescence elongating in fruit)	usually not crowded
Leaf shape	lanceolate to ovate	linear to narrowly lanceolate

Based on Scoggan 1979.

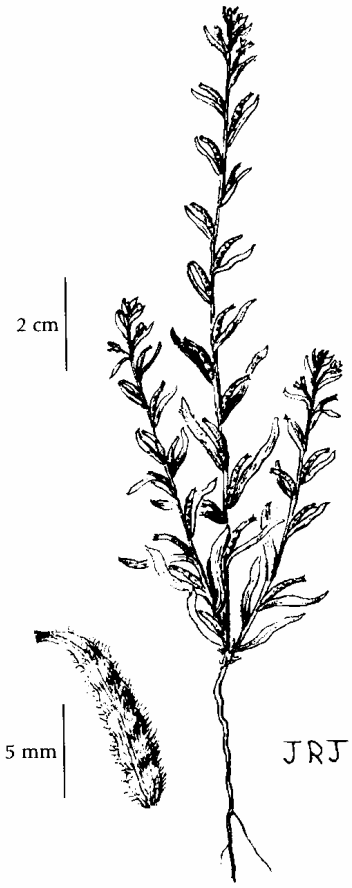

Figure 1. Illustration of *Epilobium torreyi*. Illustrated by Jeanne R. Janish with permission from University of Washington Press.

Genetic description

Epilobium torreyi has a gametic chromosome number of n=9. Closely related species have a gametic chromosome number of 10, and *E. torreyi* has apparently evolved, through aneuploidy, from ancestors with n=10. Such aneuploidy changes in chromosome numbers in the Onagraceae appear to have been correlated with adaptation to increasingly xeric conditions (Raven 1979).

DISTRIBUTION

Global range

Epilobium torreyi formerly ranged from British Columbia through south central and eastern Washington, Oregon (on both sides of the Cascades) to northwest California

(rare in the Central Valley and along the coast), and in western Idaho and northeastern Nevada (Hitchcock *et al*. 1961; Raven and Moore 1965; Hoch 1993; see Figure 2). Hoch (1993) reports this species to occur at elevations from sea level to 2,600 m.

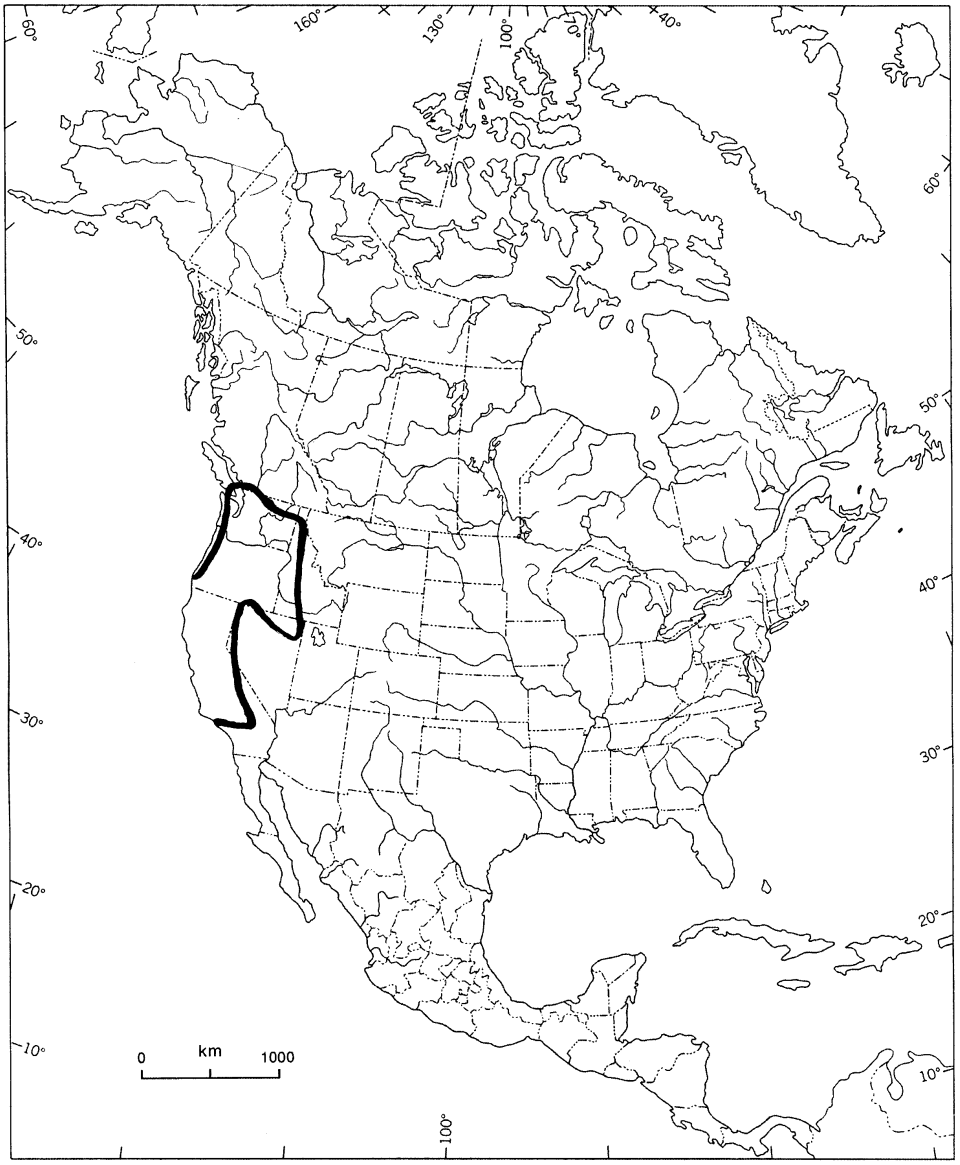

Figure 2. North American distribution of *Epilobium torreyi*.

Canadian range

In Canada, *Epilobium torreyi* was restricted to two localities (Figure 3) in the vicinity of Victoria, British Columbia (V, UVIC, CDC, HERB database). These two

populations were disjunct from the next nearest population in Washington State in Thurston County, 150 km away. The species was at the northern extent of its range in North America and it no longer occurs at either site in British Columbia.

The two localities were approximately 20 km apart. Both populations were less than 20 m across so the former extent of occurrence is estimated at 0.4 km^2. The former combined area of occupancy of the two populations was less than 50 m^2.

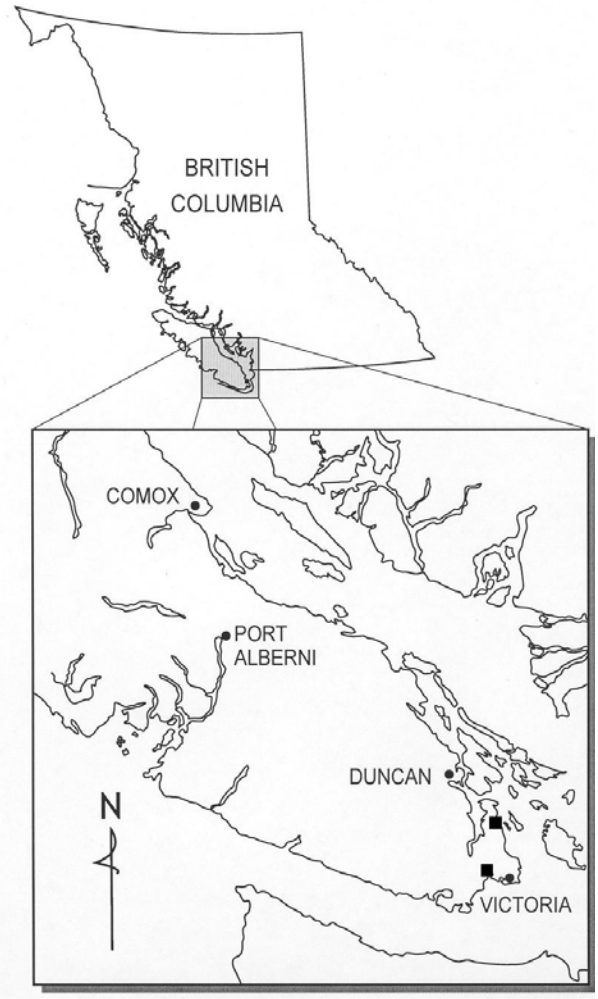

Figure 3. Canadian distribution of *Epilobium torreyi*. Solid squares indicate the two populations, both extirpated, which are about 20 km apart.

HABITAT

Habitat requirements

In Canada, *Epilobium torreyi* occurred on moist grasslands and open slopes associated with Garry oak ecosystems in the lowland Coastal Douglas-fir biogeoclimatic

zone (Douglas and Meidinger 1999, Fuchs 2001). The populations occurred on clay-rich, marine sediments that were wet during the winter months and very dry in the summer. The great fluctuations in moisture conditions discouraged growth by woody plants and many herbs; consequently the vegetation was open at both sites. There are no records of vegetation composition at the McTavish Road site but the Craigflower meadow site, during years immediately before its extirpation, was dominated by a mix of native and exotic herbs along with a sparse cover of invasive shrubs such as *Cytisus scoparius* and *Crataegus monogyna*.

In Oregon, *Epilobium torreyi* occurs on moist, low ground (Peck 1961; Gilkey and Dennis 1967). In California, it occurs along stream banks and on moist slopes below 2600 metres (Hoch 1993). *Epilobium torreyi* has been observed on seasonally moist sites that dry out during the summer, sometimes before flowering has ended (Davis 1952, Raven and Moore 1965).

Habitat trends

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 1,800 to 512 ha in 1997 (Lea 2002); even more has been lost since then, and most of what remains has been heavily altered through invasion by alien grasses and shrubs. Habitats suitable for *Epilobium torreyi* have probably suffered proportional declines in area and quality due to their association with Garry oak ecosystems (Fuchs 2001).

Habitat protection/ownership

British Columbia does not have any general legislation specifically protecting the habitat of species at risk.

The Craigflower Meadow population (extirpated) occurred within Thetis Lake Regional Park. The Capital Regional District (CRD) has recently given the conservation and management of rare threatened and endangered plants and wildlife, and their supporting habitats, precedence over all other park uses (Capital Regional District Parks 2000). The McTavish Road population (extirpated) occurred on private land and even if it could be reintroduced, the habitat would have no legal protection.

BIOLOGY

General

Epilobium torreyi is an annual forb (herbaceous flowering plant) that flowers and fruits in mid- to late summer and probably germinates in the following autumn or winter.

Reproduction and dispersal

The species flowers in June and July (Hitchcock *et al*. 1961). Most flowers are cleistogamous, self-pollination occurring in the bud before the flower opens (Raven 1979).

The seeds of *E. torreyi* are irregularly angular and fusiform (Raven 1976) and the seed surface cells are concave with radial walls that are longitudinally striate and irregularly thickened (Seavey *et al*. 1977). The loculicidal capsules dehisce in the late fall and the seeds fall to the ground probably as the capsules are shaken during winter rains (Raven 1976). *Epilobium torreyi* lacks two critical characteristics that aid wind dispersal by seeds of most other species in the genus: an obovoid, flattened shape and a coma (Raven 1976). The scarcity of herbarium collections suggests that *Epilobium torreyi* has been a scarce species within its Canadian range since the early days of European settlement, despite the unexceptional nature of the habitats where it has been found.

Germination and seedling ecology

Seedlings have glabrous, round, opposite connate leaves similar to other *Epilobium* species. Seeds germinate when there is abundant water and may be submerged for a time (Raven and Moore 1965; Raven 1976). The genus requires light for germination and can germinate over a range of temperatures (Baskin and Baskin 1998). As for other native annual willowherbs, seed germination would occur in the autumn or winter unless the seeds become buried and subsequently become part of the seed bank (Grimes 1981).

Physiology

Although this species germinates in moist places, it matures and reproduces under xeric conditions. This makes it well-adapted to survive the gradual onset of summer drought characteristic of southeast Vancouver Island.

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

Adaptability

This species is not known in the horticultural trade and there has been no research on the artificial propagation or seed germination for the species.

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 in

southeast Vancouver Island and the Gulf Islands. The principal investigators included Adolf and Oldriska Ceska, Chris Brayshaw, Hans Roemer, Harvey Janszen, Frank Lomer, George Douglas and Matt Fairbarns. During the past decade alone, over 500 person-days have been spent searching for rare species in suitable habitats.

This most recent survey effort (2004) includes two searches specifically for *Epilobium torreyi*, involving approximately 60 hours, not including travel time. These directed searches examined historic locations of *Epilobium torreyi* and extant/historic locations of other rare species (*E. densiflorum, Navarretia intertexta*) which occur at the historic Craigflower Meadow location of *E. torreyi*. The following areas were searched by M. Fairbarns in July 2004: Craigflower Meadow, View Royal; McTavish Road, North Saanich; Khenipson Road, near Duncan; Somenos Creek, near Duncan; Vantreight Farms, Central Saanich; Whitehead Park, Saanich; Willow Way, Central Saanich; Layritz Park, Saanich; University of Victoria; White Rapids Road, Nanaimo; Rithets Bog, Saanich; Viaduct Flats, Saanich; Uplands Park, Oak Bay (sites mapped in Figure 4).

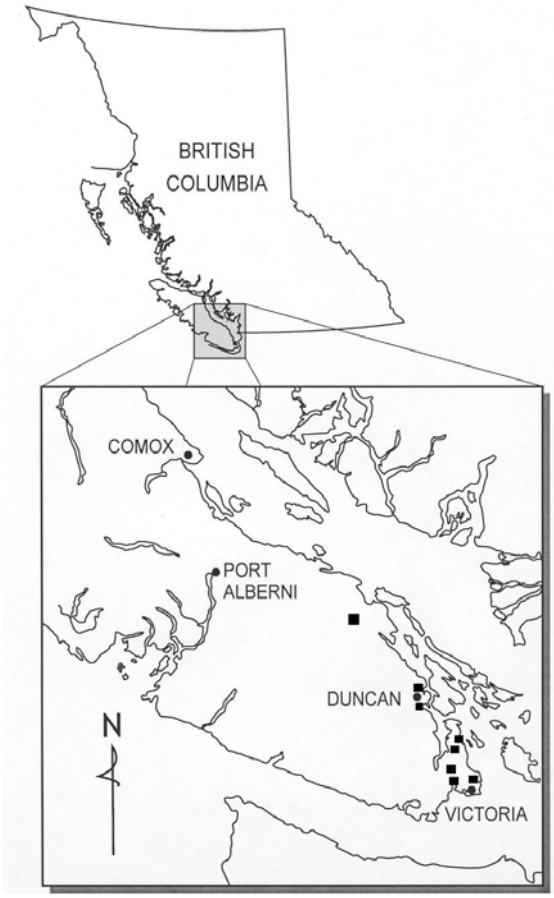

Figure 4. Search effort for *Epilobium torreyi*. Black squares indicate location of one or more sites searched.

Abundance

Both reported populations of *Epilobium torreyi* in Canada are presumed extirpated based on surveys in 2001-04 (Table 2). The Craigflower Meadows population was last observed in 1993 and has not been observed in subsequent surveys including detailed examinations in 2001, 2003 and 2004. The McTavish Road population was observed once in 1966, but subsequent searches (including careful surveys in 2001 and 2003) have failed to rediscover the population. The habitats favoured by this species have been the subject of extensive botanical investigation for many years.

Fluctuations and trends

Both historic populations have been extirpated.

Table 2. *Epilobium torreyi* population data.

Population	Last Observation	Population Extent (summary of colonies or sub-populations)	Number of Individuals
Craigflower Meadows, Thetis Lake Regional Park	O. & A.Ceska 1993	1 colony, over an area of about 10 m²	50-100
	O. & A.Ceska 2001	n/a	extirpated
	Fairbarns 2003, 2004	n/a	extirpated
McTavish Road, Bazon Bay Drainage North Saanich	N. Turner 1966	unknown	no count
	N. Turner 2001	n/a	extirpated
	Fairbarns 2003, 2004	n/a	extirpated

Rescue effect

The nearest reported population is from Orcas Island, Washington. The site is approximately 16 km from the nearest point in Canada and 37 km from the nearest historic location in Canada. The Orcas Island collection was documented to be in an atypical habitat (Atkinson and Sharpe 1993). *Epilobium torreyi* is not known from elsewhere in the San Juan Islands and the next nearest location appears to be in Thurston County, approximately 150 km to the south.

There is little chance of seed dispersal, even from plants on Orcas Island, since the seeds lack a coma or any other structure to aid in long-distance dispersal.

LIMITING FACTORS AND THREATS

Epilobium torreyi is limited by 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. In British Columbia, the species was found in moist grasslands and on open slopes. Weak seed dispersal mechanisms limit its ability to spread to suitable, unoccupied habitats. It is further limited by its apparently weak competitive ability as evidenced by its decline in weedy areas.

Threats to the species are the degradation/loss of habitat mainly through alteration by residential and agricultural development. Habitat has also been altered by physical disturbance of sites by heavy equipment, by the introduction of alien invasive plants and natural encroachment of native Douglas-fir trees into open areas (due to fire suppression).

The extirpation of *Epilobium torreyi* in Canada appears to be the result of its inherent rarity (i.e., small disjunct populations at the northern extent of its range in North America) and the degradation/loss of habitats where it formerly occurred. The main sources of habitat degradation have been invasion by alien plant species and physical disturbance of sites by humans.

The Thetis Lake Park population originally occupied a small area within Craigflower Meadows. Prior to designation of the area as a park, the City of Victoria planted *Abies grandis* (Grand fir) on this site. As well, the site has been invaded by *Crataegus monogyna* (English hawthorn) and many alien invasive forbs and grasses. This has a serious impact on the habitat and may be responsible for the extirpation of the species.

The North Saanich occurrence was in an open, grassy meadow along the eastern end of McTavish Road. Much of this stretch has been converted to residential use and the remainder is either forested, used for intensive agriculture or has suffered from ditching and invasion by highly competitive non-native grasses (e.g., *Agrostis capillaris*) and shrubs (e.g., *Rubus armeniacus*). These alien invasive species have directly affected many native plant species by reducing light levels and competing for water and nutrients. Alien invasive plants have also had an indirect impact by gradually increasing levels of soil organic matter and nitrogen which may facilitate site invasion by other competitors including native species (D'Antonio and Vitousek 1992).

SPECIAL SIGNIFICANCE OF THE SPECIES

The species is possibly a relict from the Hypsithermal Interval of warm, dry climate 4,000-6,000 years b.p. If not extirpated, the species could have been genetically significant as it is disjunct from the U.S. populations. The species is not known in cultivation but the seeds have been used as a food by some Aboriginal cultures in portions of the species' range (Native American Ethnobotany, web site accessed Dec. 2004).

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Epilobium torreyi is not covered under the Convention on International Trade in Endangered Species (CITES), the Endangered Species Act (USA) or the IUCN Red Data Book. It is ranked globally as G5: demonstrably widespread, abundant and secure. The Montana Natural Heritage Program ranks it as SH (historic, possibly

extirpated) in their state. *Epilobium torreyi* is ranked SNR (reported without comment) in California, Idaho, Nevada, Oregon and Washington (NatureServe 2004).

In British Columbia, it is currently ranked as S1 (critically imperiled); however, its rank may soon be revised to SH based on the most recent surveys (J. Penny, pers. comm. 2004). Its national rank in Canada is N1 (NatureServe 2004) and that rank should be revised in accordance with the BC rank as it does not occur in any other province or territory. British Columbia does not provide any legal protection for *Epilobium torreyi*.

TECHNICAL SUMMARY

***Epilobium* torreyi**
brook spike-primrose épilobe de Torrey
Range of Occurrence in Canada: British Columbia

Extent and Area Information	
Extent of occurrence (EO)(km²)	<<1 km^2 if still extant
• *Specify trend in EO*	Decline: Craigflower Meadow population seemingly disappeared between 1993 and 2001. McTavish Road population seemingly disappeared between 1966 and 2001.
• *Are there extreme fluctuations in EO?*	No
• *Area of occupancy (AO) (km²)*	unknown if still present in seed bank
• *Specify trend in AO*	decline
• *Are there extreme fluctuations in AO?*	No
• *Number of known or inferred current locations*	2 possibly extirpated
• *Specify trend in #*	decline – now presumed extirpated
• *Are there extreme fluctuations in number of locations?*	No
• *Specify trend in area, extent or quality of habitat*	Declining in extent as a result of urban and rural development. Declining in quality as a result of human activity and invasive species.
Population Information	
• *Generation time (average age of parents in the population)*	seven months
• *Number of mature individuals*	0
• *Total population trend:*	decline and now presumed extirpated
• *% decline over the last/next 10 years or 3 generations.*	possibly 100%
• *Are there extreme fluctuations in number of mature individuals?*	n/a
• *Is the total population severely fragmented?*	n/a all presumed extirpated
• *Specify trend in number of populations*	decline
• *Are there extreme fluctuations in number of populations?*	No
List populations with number of mature individuals in each: both presumed extirpated	
Threats (actual or imminent threats to populations or habitats)	
Existing threats: habitat loss through urban and rural development; habitat deterioration due to human activities and invasive species	
Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* **USA:** healthy but disjunct	
• *Is immigration known or possible?*	Not without assistance
• *Would immigrants be adapted to survive in Canada?*	Possibly
• *Is there sufficient habitat for immigrants in Canada?*	Little remaining
• *Is rescue from outside populations likely?*	No
Quantitative Analysis [provide details on calculation, source(s) of data, models, etc]	n/a
Current Status COSEWIC: Endangered (2006)	

Status and Reasons for Designation

Status: **Endangered**	**Alpha-numeric code**: D1
Reasons for Designation: Although no plants have been seen at the two known sites after intensive directed surveys, there is still the possibility that some seeds may remain in the soil seed bank given the relatively short period of time since the last observation of plants in 1993, or that previously overlooked populations may be found.	
Applicability of Criteria	
Criterion A: (Declining Total Population): n/a	
Criterion B: (Small Distribution, and Decline or Fluctuation): n/a	
Criterion C: (Small Total Population Size and Decline): n/a	
Criterion D: (Very Small Population or Restricted Distribution): Although the species is seemingly recently extirpated in Canada, there is the possibility that there is a sufficient number of seeds in the soil seed bank that some could germinate and develop into mature plants, thereby meeting a status of Endangered if conditions improved.	
Criterion E: (Quantitative Analysis): n/a	

ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

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Authorities Contacted

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Matt Fairbarns has a B.Sc. in Botany from the University of Guelph (1980). He has worked on rare species and ecosystem mapping, inventory and conservation in western Canada for approximately 20 years.

Brenda Costanzo has an M.Sc. (Botany) from the University of Victoria (1984). She was the Assistant Curator of the Herbarium at the University of Victoria (UVIC) from

1989 until 2001. Brenda has done extensive field work in botany and recently worked on the preparation of fact sheets for “Plants at Risk in Garry Oak and Associated Ecosystems” for the Garry Oak Ecosystems Recovery Team (GOERT). She is currently the Plant at Risk Recovery Team Coordinator in the Biodiversity Branch at the Ministry of Water, Land and Air Protection in Victoria.

Adolf Ceska, Pro. Biol. (=M.Sc.), Charles University in Prague, and Ph.D. (Victoria) is a botanist and plant ecologist, recently semi-retired and now working as a free-lance consultant. He was formerly a Visiting Assistant Professor, at the University of Victoria, Curator of Botany in the Royal British Columbia Museum and Program Ecologist, Conservation Data Centre. He is the author of several floristic and taxonomic papers and treatments, co-inventor of a computer technique for vegetation classification and an electronic publisher of BEN (Botanical Electronic News). He has a personal herbarium of over 30,000 specimens which is deposited in the Royal British Columbia Museum.

Oldriska Ceska, Pro. Biol. (=M.Sc.) Charles University in Prague. Oldriska Ceska is a field botanist with extensive experience throughout the Pacific Northwest. Mrs. Ceska has over 35 years experience in ecological research, mycology, and botany, with special emphasis on rare plant inventory and surveys. As a chemotaxonomist she developed techniques for chemical identifications of water milfoils and discovered the as yet undescribed chemical compound coriandrin from cilantro. She has participated in numerous floristic and vegetation studies throughout British Columbia, focusing on cryptogams, fungi, and taxonomically difficult plants. She has taken part in many professional field trips throughout the Pacific Northwest in Washington, Oregon, and northern California. She has authored or co-authored over 50 papers, many of them in reviewed scientific journals.

COLLECTIONS EXAMINED

The following collections were consulted:

- Royal British Columbia Museum herbarium (V)
- University of Victoria herbarium (UVIC)
- University of British Columbia herbarium (UBC)