COSEWIC
Assessment and Status Report

on the

Lemmon's Holly Fern
Polystichum lemmonii

in Canada

THREATENED
2003

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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COSEWIC 2003. COSEWIC assessment and status report on Lemmon's holly fern *Polystichum lemmonii* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 13 pp.

Douglas, G.W. 2003. COSEWIC status report on Lemmon's holly fern *Polystichum lemmonii* in Canada, *in* COSEWIC assessment and status report on Lemmon's holly fern *Polystichum lemmonii* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-13 pp.

For additional copies contact:

COSEWIC Secretariat
c/o Canadian Wildlife Service
Environment Canada
Ottawa, ON
K1A 0H3

Tel.: (819) 997-4991 / (819) 953-3215
Fax: (819) 994-3684
E-mail: COSEWIC/COSEPAC@ec.gc.ca
http://www.cosewic.gc.ca

Également disponible en français sous le titre Rapport du COSEPAC sur la situation du polystic de Lemmon (*Polystichum lemmonii*) au Canada

Cover illustration:
Lemmon's holly fern — Courtesy of University of Washington Press.

Catalogue No. CW69-14/334-2003E-PDF
ISBN 0-662-35371-4
HTML: CW69-14/334-2003E-HTML
0-662-35372-2


Recycled paper

COSEWIC
Assessment Summary

Assessment summary – May 2003

Common name
Lemmon's holly fern

Scientific name
Polystichum lemmonii

Status
Threatened

Reason for designation
This species consists of a single small population occurring within a geographically highly restricted area of specialized habitat. The habitat consists of shallow soils over serpentine bedrock high in heavy metals. The population is considerably disjunct from other such populations in the adjoining state to the south and occurs in an area potentially subject to mineral extraction.

Occurrence
British Columbia

Status history
Designated Threatened in May 2003. Assessment based on a new status report.

COSEWIC
Executive Summary

Lemmon's Holly Fern
Polystichum lemmonii

Species Information

Polystichum lemmonii is an evergreen, perennial, tufted fern arising from a short, stout rhizome. The decumbent to ascending fronds are 10-40 cm long, 3-7 cm wide and 2-pinnate. The 20-35 pinnae on each side of the rachis are ovate with rounded pinnules. The ultimate segments are entire or weakly toothed. The round sori are attached near the midvein with entire or minutely toothed indusia.

Distribution

Polystichum lemmonii ranges from southcentral British Columbia, south sporadically through Washington and Oregon to northern California. In Canada, it is known only from the Baldy Mountain area on the eastern side of the Okanagan River valley in southcentral British Columbia.

Habitat

In western North America, *P. lemmonii* is restricted to sites where ferromagnesian or ultramafic rocks outcrop. Although a number of ultramafic rock outcrops occur in western British Columbia, only the two small ridges in the Baldy Mountain area support the latter species. These rock outcrop habitats are also characterized by shallow soils and a sparse groundcover, creating xeric microclimates that also exclude many nearby species adapted to more mesic microclimates. Therefore, these ridges have a typically depauperate ultramafic flora and lack a tree cover. This is in contrast to the surrounding montane forests dominated by Douglas-fir (*Pseudotsuga menziesii*). Conspicuous species on the ridges include: Indian's dream (*Aspidotis densa*), alpine sandwort (*Minuartia obtusiloba*) and yarrow (*Achillea millefolium*).

Biology

Other than general information, there is a limited amount of data on the biology of *P. lemmonii.* Sporophytes of *P. lemmonii* often retain significant numbers of mature spores over winter, to be released the following spring. *Polystichum lemmonii* also grows vegetatively by subterranean rhizome elongation, resulting in large clumps of clones. At the study site surveyed, *P. lemmonii* occurs on dry, sandy to gravelly, rapidly drained soil; such conditions are not ideal for either spore germination or gamete fertilization. Therefore, it

can be inferred that most reproduction at the site is by simple rhizome elongation, likely because the species is stressed here at the edge of its range. No prothalli were observed at the site.

Plants of ultramafic habitats are adapted to tolerate low levels of calcium, nitrogen, phosphorus and molybdenum and high levels of magnesium, chromium and nickel.

Population Sizes and Trends

The single population of *P. lemmonii* occurs on two adjacent, rocky ridges. The ridges, which are about 280 and 200 m long by 50 m wide are separated by a distance of 160 m. A 2001 count of all plants in the population by the author revealed a total of 853 plants over 2.4 ha. A collection by D.M. Britton in 1987 (at Department of Agriculture, Ottawa) mentions a population size of “perhaps a thousand plants”. This information would indicate that the population has remained relatively stable for at least the last 15 years. The population examined contained numerous younger plants that appeared vigorous.

Limiting Factors and Threats

The most direct threat to *Polystichum lemmonii* is from either mining exploration or road construction. Due to the ultramafic properties of the soils, introduced species are of no concern at this site.

Special Significance of the Species

Polystichum lemmonii belongs to a relatively small group of species with a restricted Pacific Coast range that have their northern limits in southwestern British Columbia. The importance of these peripheral populations, especially with respect to their genetic characteristics, has yet to be studied adequately. Peripheral populations are often genetically and morphologically divergent from central populations and may have an evolutionary and ecological significance out of proportion to the percentage of the species they represent.

Summary of Status Report

There is no specific legislation for the protection of rare and endangered vascular plants in British Columbia. The Conservation Data Centre has ranked this species as S1 and placed it on the British Columbia Ministry of Sustainable Resource Management red list. This is the most critical category for imperiled rare native vascular plants in the province. A rank of S1 is considered “critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factors making it especially vulnerable to extirpation or extinction". Globally, *P. lemmonii* is ranked G4 and is frequent to common in its range.

The population in the Baldy Mountain area is on public land but is not part of a protected area. It is conceivable that this area could qualify as an ecological reserve but this status has yet to be proposed.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* 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.

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.

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Canada

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

COSEWIC Status Report

on the

Lemmon's Holly Fern
Polystichum lemmonii

in Canada

George W. Douglas[1]

2003

[1] PO Box 9993 Stn. Prov. Govt.
Victoria BC
V8W 9R7

TABLE OF CONTENTS

List of figures

SPECIES INFORMATION

Name and classification

Scientific name:	*Polystichum lemmonii* Underw.
Synonym:	*Polystichum mohrioides auct. non* (Bory) C. Presl.
	Polystichum mohrioides (Bory) C.Presl. var. *lemmonii* (Underw.) Fern.
Common name:	Lemmon's holly fern
Family:	Dryopteridaceae
Major plant group:	fern

Description

Lemmon's holly fern, *Polystichum lemmonii* Underw.,[1] is a member of a cosmopolitan genus of over 175 species (Smith and Lemieux 1993). It is one of eight *Polystichum* species occurring in British Columbia (Ceska 2000; Douglas *et al*. 2002b) and nine occurring in Canada (Cody and Britton 1989; Wagner 1993). Generally, American authors treated *P. lemmonii* as a synonym *of P. mohrioides* (Bory) C. Presl. until Wagner (1979) demonstrated that the North American plant was different from the South American plant. *Polystichum lemmonii* was first recorded in Canada by Cody and Britton (1984). The absence of earlier records in Canada prior to 1984 likely reflects the lack of botanical fieldwork on these ridges consisting of a relatively depauperate flora. The species' occurrence on two nearby ridges would indicate that it has been present for some time allowing it to spread from what was likely a single long distance dispersal event.

Polystichum lemmonii is an evergreen, perennial, tufted fern arising from a short, stout rhizome (Figure 1; Ceska 2000). The decumbent to ascending fronds are 10-40 cm long, 3-7 cm wide and 2-pinnate. The 20-35 pinnae on each side of the rachis are ovate with rounded pinnules. The ultimate segments are entire or weakly toothed. The round sori are attached near the midvein with entire or minutely toothed indusia.

In British Columbia, *P. lemmonii* may be confused with either Kruckeberg's holly fern (*P. kruckebergii*) or Mountain holly fern (*P. scopulinum*). It may be distinguished from the latter two species by the lack of spines on the teeth of the ultimate segments of the pinnae (Hitchcock *et al.* 1969; Wagner 1993; Ceska 2000).

1 Taxonomy and nomenclature follows Douglas *et al.* (1998a, b; 2000).

Figure 1. Illustration of *Polystichum lemmonii*. (Courtesy of University of Washington Press.)

DISTRIBUTION

Global range

Polystichum lemmonii ranges from southcentral British Columbia, south through Washington and Oregon to northern California (Figure 2; Smith and Lemieux 1993; Wagner 1993).

Canadian range

In Canada, it is known only from the Baldy Mountain area on the eastern side of the Okanagan River valley in southcentral British Columbia (Figure 3; Ceska 2000; Douglas *et al.* 2002a, b).

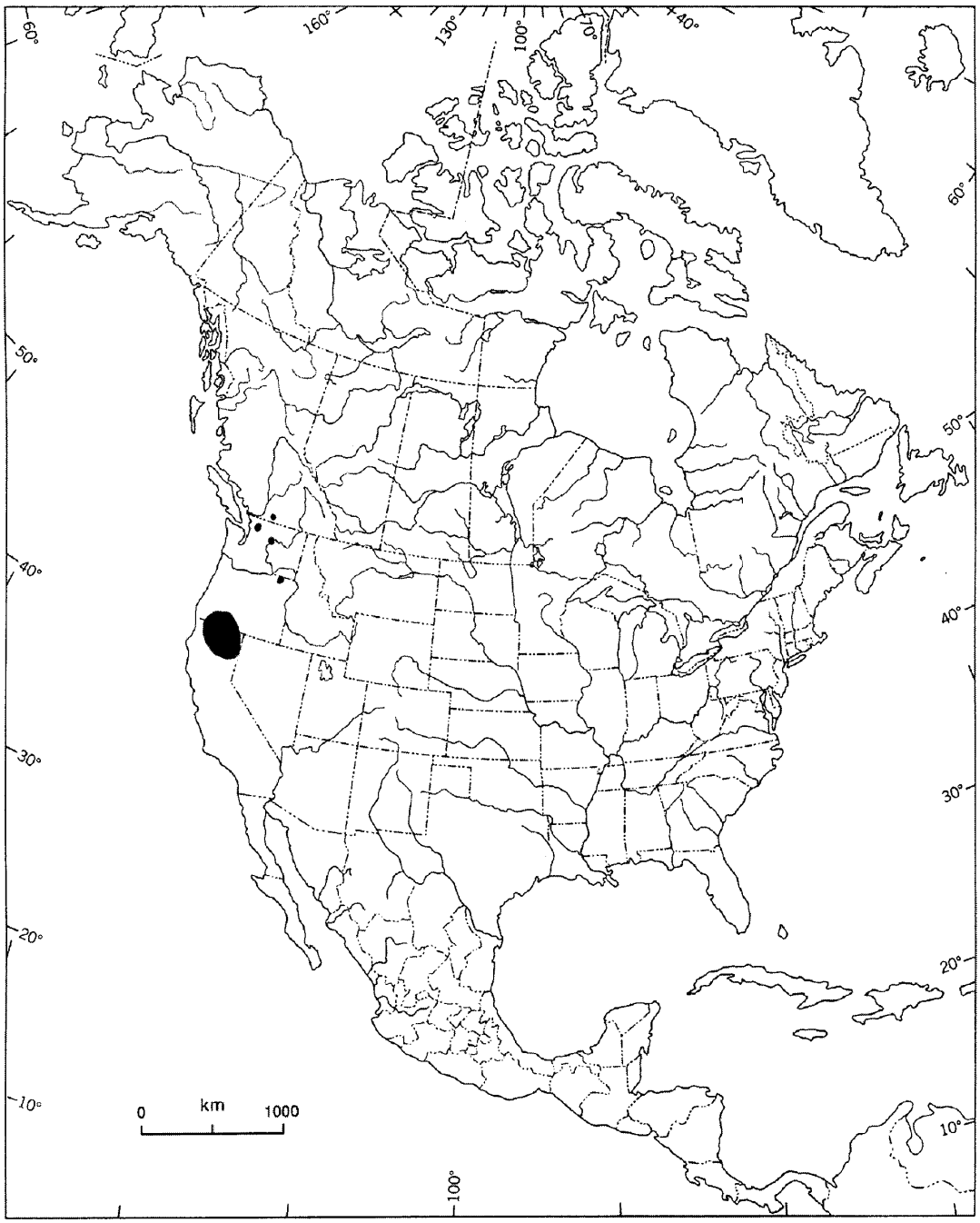

Figure 2. Distribution of *Polystichum lemmonii* in North America.

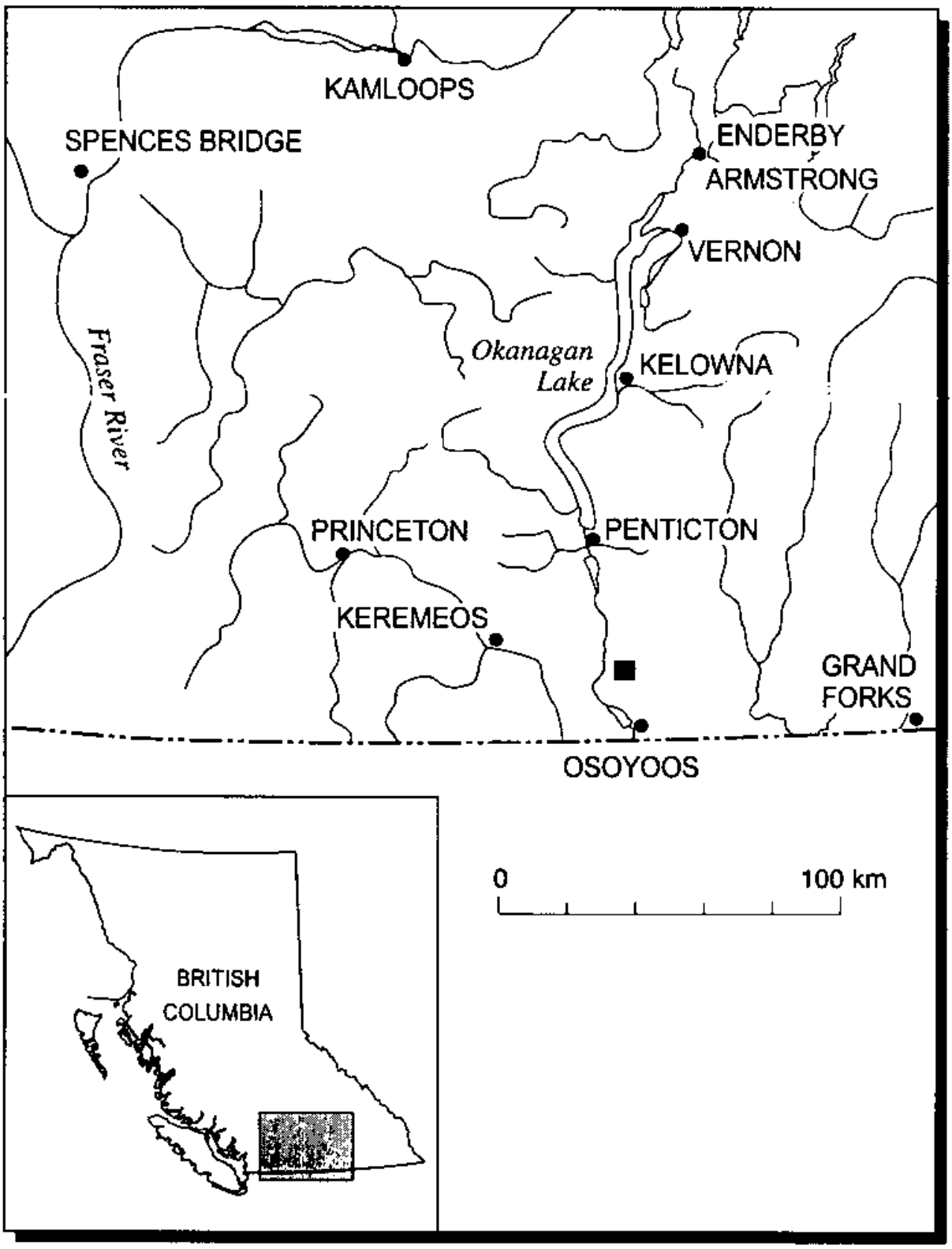

Figure 3. Location (■) of *Polystichum lemmonii* in British Columbia.

HABITAT

Habitat requirements

In western North America, *Polystichum lemmonii* is restricted to sites where ferromagnesian or ultramafic rocks outcrop (Kruckeberg 1969; Wagner 1993). Although a number of ultramafic rock outcrops occur in western British Columbia, only the two small ridges in the Baldy Mountain area support the latter species. These rock outcrop (dunite) habitats are also characterized by shallow soils and a sparse groundcover, creating xeric microclimates that also exclude many nearby species adapted to more mesic microclimates. Therefore, these ridges have a typically depauperate ultramafic flora and lack a tree cover. This is in contrast to the surrounding montane forests dominated by Douglas-fir (*Pseudotsuga menziesii*). Conspicuous species on the ridges include: Common juniper (*Juniperus communis*), Indian's dream (*Aspidotis densa*), alpine sandwort (*Minuartia obusiloba*) and yarrow (*Achillea millifolium*).

Trends

Habitat trends are mainly dependant on the development activities at the sites. The most direct threat to *Polystichum lemmonii* is either mining exploration or forest road construction.

Protection/ownership

There is no specific legislation for the protection of rare and endangered vascular plants in British Columbia. The Conservation Data Centre has ranked this species as S1 and placed it on the British Columbia Ministry of Sustainable Resource Management Red list. This is the most critical category for imperiled rare native vascular plants in the province. A rank of S1 is considered "critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factors making it especially vulnerable to extirpation or extinction". Globally, *P. lemmonii* is ranked as G4 and is frequent to common in its range. The species has been reported for Washington and Idaho (SR) and is ranked S4 in Oregon.

The population in the Baldy Mountain area is on public land but is not part of a protected area. It is conceivable that this area could qualify as an ecological reserve but this status has yet to be proposed.

BIOLOGY

General

Other than general information, there is limited data on the biology of *Polystichum lemmonii.* However, the ultramafic habitat has been well-studied by Kruckeberg (1969). Plants of ultramafic habitats are adapted to tolerate low levels of calcium, nitrogen, phosphorus and molybdenum and high levels of magnesium, chromium and nickel (Kruckeberg 1969).

The successful long-distance dispersal of spores of *P. lemmonii* is evident by the distance to the nearest locations of the species in the adjacent US state of Washington. *P. lemmonii* occurs in the North Cascades Range of Washington in the Twin Sisters Range and the Wenatchee Mountains (Kruckeberg 1969), a distance of about 150 km to the southwest and 235 km to the south of Baldy Mountain, respectively. It is of interest to note, however, that the Tulameen River ultramafic site, where both *P. kruckebergii and P. scopulinum* occur (Kruckeberg 1969; Douglas *et al.* 2002b), does not contain *P. lemmonii* even though the Tulameen River site is halfway between Baldy Mountain and the Twin Sisters Range. The fact that both the Baldy Mountain and Twin Sisters sites are dunite outcrops, while the Tulameen River site is an olivine clinopyroxenite outcrop, may have a bearing on the distribution of *P. lemmonii.* Reproduction of *P. lemmonii* on the ultramafic ridges of the Baldy Mountain area is evident since about 30 percent of the 853 plants counted were relatively young (plant tufts less than four cm wide).

Some genetic information is available for the species. *Polystichum lemmonii* is a tetraploid (2n = 82) and thought to be one of the parents of both *P. kruckebergii* and *P. scopulinum* (Wagner 1979).

Reproduction

Sporophytes of *P. lemmonii,* as with other overwintering ferns, often retain significant numbers of mature spores over winter, to be released the following spring (Farrar 1976). *Polystichum lemmonii* also grows vegetatively by subterranean rhizome elongation, resulting in large clumps of clones. At the study site surveyed, *P. lemmonii* occurs on dry, sandy to gravelly, rapidly drained soil; such conditions are not ideal for either spore germination or gamete fertilization. Therefore, it can be inferred that most reproduction at the site is by simple rhizome elongation, likely because the species is stressed here at the edge of its range (Walker 1979). No prothalli were observed at the site.

Survival

About 30 percent of the 853 plants counted were relatively young (plant tufts less than four cm wide). The remainder of the plants are in clumps of various ages that appear to be increasing in size.

Physiology

Unknown

Movements/dispersal

The species spreads vegetatively by subterranean rhizome elongation and potentially disperses more widely by airborne spores.

Nutrition and interspecific interactions

Unknown.

Behaviour/adaptability

Unknown.

POPULATION SIZES AND TRENDS

The single population of *P. lemmonii* occurs on two adjacent, rocky ridges. The ridges, which are about 280 and 200 m long by 50 m wide are separated by a distance of 160 m. A 2001 count of all plants in the population by the author revealed a total of 853 plants over 0.72 ha. Although a collection by D.M. Britton in 1987 (at Department of Agriculture, Ottawa), mentions a population size of “perhaps a thousand plants” but the estimate was likely not based on a detailed count. This information would indicate that the population has remained relatively stable for at least 15 years. The population examined in 2001 also contained numerous younger plants that appeared vigorous.

LIMITING FACTORS AND THREATS

The most direct threat to *Polystichum lemmonii* is either mining exploration or forest road construction. The population is adjacent to an old gold mine. Ultramafic rock outcrops often attract mineral exploration and the rock outcrops could also be of use as a quarry for road building materials. Due to the ultramafic properties of the soils, introduced species are presently of no concern at this site.

SPECIAL SIGNIFICANCE OF THE SPECIES

Polystichum lemmonii belongs to a relatively small group of species with a restricted Pacific Coast range that have their northern limits in southwestern British Columbia. The importance of these peripheral populations, especially with respect to their genetic characteristics, has yet to be studied adequately. Peripheral populations are often genetically and morphologically divergent from central populations and may

have an evolutionary and ecological significance out of proportion to the percentage of the species they represent (Mayr 1982; Lesica and Allendorf 1995). The protection of genetically distinct peripheral populations may be important for the long-term survival of the species as a whole (Lesica and Allendorf 1995).

SUMMARY OF STATUS REPORT

There is no specific legislation for the protection of rare and endangered vascular plants in British Columbia. The Conservation Data Centre has ranked this species as S1 and placed it on the British Columbia Ministry of Sustainable Resource Management Red list. This is the most critical category for imperiled rare native vascular plants in the province. A rank of S1 is considered “critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factors making it especially vulnerable to extirpation or extinction". Globally, *Polystichum lemmonii* is ranked G4 and is frequent to common in its range.

The population in the Baldy Mountain area is on public land but is not part of a protected area. It is conceivable that this area could qualify as an ecological reserve but this status has yet to be proposed.

Just over 850 plants are known from the site in the Baldy Mountain area of southcentral British Columbia. The prognosis for this species is not good since ultramafic rock outcrops often attract mineral exploration. These rock outcrops could also be of use as a quarry for road building materials.

TECHNICAL SUMMARY

Polystichum lemmonii
Lemmon's holly fern polystic de Lemmon
Occurrence: BC

Extent and Area information	
• *extent of occurrence (EO)(km²)*	2.4 ha
• *specify trend (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in EO (> 1 order of magnitude)?*	No
• *area of occupancy (AO) (km²)*	2.4 ha
• *specify trend (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in AO (> 1 order magnitude)?*	No
• *number of extant locations*	1
• *specify trend in # locations (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	No
• *habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat*	Stable
Population information	
• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	Years-unknown
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	853
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	Stable
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)*	-
• *are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?*	-
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?*	All individuals found within a small and relatively isolated area
• *list each population and the number of mature individuals in each*	Baldy Mountain – 853
• *specify trend in number of populations (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	No
Threats	
– Road building or mining development	
Rescue Effect (immigration from an outside source)	Low
• *does species exist elsewhere (in Canada or outside)?*	USA
• *status of the outside population(s)?*	G5
• *is immigration known or possible?*	Possible
• *would immigrants be adapted to survive here?*	Unknown
• *is there sufficient habitat for immigrants here?*	Few ultramafic areas
Quantitative Analysis	

ACKNOWLEDGEMENTS

I would like to thank Kathy Paige for her participation in the fieldwork, Louise Bacon and Jenifer Penny for office assistance and Graham Nixon (BC Geological Survey) for discussion of ultramafic rock types.

Funding provided by the British Columbia Conservation Data Centre.

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THE AUTHOR

George W. Douglas has an M.Sci. (Forestry) from the University of Washington and a Ph.D (Botany) from the University of Alberta, Edmonton. George has worked with rare plants for over 20 years. He was senior author of *The Rare Plants of the Yukon* (1981), co-authored *The Rare Plants of British Columbia* (1985) and was senior author of the *Rare Native Plants of British Columbia* (1998, 2002). He is also the senior editor for the *Illustrated Flora of British Columbia* (1998-2002) and has been the program botanist for the British Columbia Conservation Data Centre since its inception in 1991. George has written or co-written 22 COSEWIC status reports during this period.

COLLECTIONS EXAMINED

Herbarium specimens housed at the Royal British Columbia Museum in Victoria (V) were viewed and verified.