Conservation Evaluation of Lemmon's Holly Fern, *Polystichum lemmonii*, a Threatened Fern in Canada*

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In Canada, Lemmon's Holly Fern, *Polystichum lemmonii*, is restricted to the Baldy Mountain area on the eastern side of the Okanagan River valley in south-central British Columbia. This population represents the northern limits of the species which ranges south through northern Idaho, Washington and Oregon to northern California. In British Columbia, *P. lemmonii* is associated with ultramafic rocky ridges within a montane forest at an elevation of 1900 m. The population in the Baldy Mountain area is relatively small, unprotected and potentially imperilled by mining exploration, forest road construction or wildfires.

Key Words: Lemmon's Holly Fern, *Polystichum lemmonii*, threatened, distribution, population size, British Columbia.

Lemmon's Holly Fern, *Polystichum lemmonii* Underw. [taxonomy and nomenclature follow Douglas et al. (1998a, b; 2000)], is a member of a cosmopolitan genus of over 175 species (Smith and Lemieux 1993; Wagner 1993). It is one of eight *Polystichum* species occurring in British Columbia (Ceska 2000) 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).

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

FIGURE 1. Illustration of *Polystichum lemmonii* (line drawing from Ceska 2000).

* The field work for the *Polystichum lemmonii* project was funded by the British Columbia Conservation Data Centre. The results appear in the British Columbia Conservation Data Centre database and a rare plant manual (Douglas et al. 2002). This information formed the basis for a Committee on the Status of Endangered Wildlife in Canada status report (Douglas 2003*) and the subsequent assessment of *threatened* (COSEWIC 2003*). The present paper also includes more recent information that will be used in a National Recovery Strategy for *P. lemmonii* (Douglas 2005).

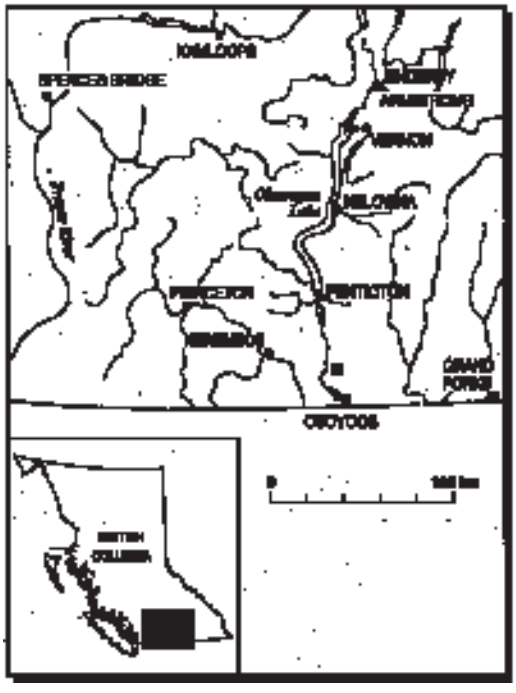

FIGURE 2. The small square indicates the location of *Polystichum lemmonii* in British Columbia.

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).

North American and Provincial Ranges

Polystichum lemmonii ranges from south-central British Columbia, sporadically south through Washington and Oregon to northern California (Smith and Lemieux 1993; Wagner 1993). In Canada, it is known only from the Baldy Mountain area in the Okanagan River valley in south-central British Columbia (Figure 2; Ceska 2000; Douglas et al. 2002).

Habitat

In western North America, *Polystichum lemmonii* occurs on sites where ferromagnesian or ultramafic rocks outcrop (Kruckeberg 1969; Wagner 1993). There are a number of ultramafic rock outcrops in western British Columbia but only the two small, adjacent ridges, at an elevation of 1900 m, in the Baldy Mountain area support the latter species (Figure 3). These dunite rock outcrop habitats are also characterized by shallow soils thus creating xeric microclimates that exclude many nearby species adapted to more mesic microclimates or non-ultramafic soils (Figure 4). These ridges, therefore, have a typically depauperate ultramafic flora and lack a tree cover in contrast to the

FIGURE 3. Aerial view of the ultramafic east ridge. Most *Polystichum lemmonii* plants occur on the north side of these east-west oriented ridges. The west ridge is slightly longer.

surrounding montane forests. The most prominent species on the ridge include Common Juniper (*Juniperus communis*), Indian's Dream (*Aspidotis densa*), Alpine Sandwort (*Minuartia obtusiloba*) and Yarrow (*Achillea millefolium*).

Biology

There is a limited amount of information on the biology and ecology of *Polystichum lemmonii.* The ultramafic habitat, however, has been well-studied by Kruckeberg (1969). Plants of ultramafic substrates are adapted to tolerate low levels of calcium, nitrogen, phosphorus and molybdenum and high levels of magnesium, chromium and nickel (Kruckeberg 1969).

Wagner (1979) has provided some genetic information. *P. lemmonii* is a tetraploid (2n = 82) and thought to be one of the parents of both *P. kruckebergii* and *P. scopulinum*.

Sporophytes of *P. lemmonii*, as with most evergreen fern species, often retain significant numbers of mature spores over the winter that are then released the following spring (Farrar 1976). *P. lemmonii* also grows vegetatively by subterranean rhizome elongation often resulting in large clumps of clones. Because of the dry site conditions, which are not ideal for spore germination or gamete fertilization, most reproduction is probably by rhizome elongation (Walker 1979). Prothalli were not observed at the site.

Long-distance dispersal of spores of *P. lemmonii* is evident by the distance to the nearest locations of the species in the adjacent state of Washington in the United States. *P. lemmonii* occurs in the Twin Sisters Range of Washington and in the Wenatchee Mountains (Kruckeberg 1969), a distance of about 205 km to the southwest and 225 km to the south of Baldy Mountain, respectively. The Tulameen River ultramafic site, where both *P. kruckebergii and P. scopulinum* occur (Kruckeberg 1969; Douglas and Labrecque 2003*), does not contain *P. lemmonii* even though the Tulameen River site is halfway between Baldy Mountain and the Twin Sisters Range. Reproduction of *P. lemmonii* at 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).

Population Attributes

The 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. A collection by D. M. Britton in 1987 (at Department of Agriculture, Ottawa) mentions a population size of "perhaps a thousand plants". This would indicate that the population has remained relatively stable for at least 15 years.

Provincial, National and Global Ranks

The British Columbia Conservation Data Centre has ranked this species as S1 and placed it on the British Columbia Ministry of Sustainable Resource Management Red-list (Douglas et al. 2002). This is the most critical category for imperilled rare native vascular plants in British Columbia. A rank of S1 is considered "critically imperilled 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" (Douglas et al. 2002). Since the species is restricted to British Columbia, the National rank is N1. Globally, *Polystichum lemmonii* is ranked G4 and is frequent to common in its range and apparently secure.

Threats and Protection

The most direct threat to *Polystichum lemmonii* is mining exploration. At the present time the entire area is occupied by active mining claims and exploration could occur with short notice. Additional threats include the potential use of the rock outcrop for forest road construction and the possibility of intense wildfires. Extremely high forest fuel loads in the the area may lead to wildfires similar to that experienced in the region in 2003. Introduced species are of no concern at this site due to the ultramafic properties of the soils.

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 a Wildlife Habitat Area but this status has yet to be proposed. *Polystichum lemmonii* could be a candidate species for protection under the provincial *Wildlife Amendment Act* as it is currently Red-listed by the British Columbia Conservation Data Centre.

Evaluation

The British Columbia Conservation Data Centre considers *Polystichum lemmonii* to be threatened/endangered in British Columbia (Douglas et al. 2002) and the Committee on the Status of Endangered Wildlife in Canada has assessed the species as threatened (COSEWIC 2003). Just over 850 plants are known from a single site in Canada at the Baldy Mountain area of south-central British Columbia. The prognosis for this species is not good since ultramafic rock outcrops often attract mineral exploration and the entire area is covered by active mineral claims. These rock outcrops could also be of potential use as a quarry for road building materials. The extremely high forest fuel loads in the adjacent area could also support wildfires. Establishment of a Wildlife Habitat Area and removal of the active mineral claims would remove the major threats at the site.

FIGURE 4. *Polystichum lemmonii* plants are conspicuous among the low vegetation on the ultramafic soils.

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