COSEWIC STATUS REPORT

ON

Apple Moss
(*Bartramia stricta*)

René J. Belland

THREATENED
1997

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OF GERED WILDLIFE
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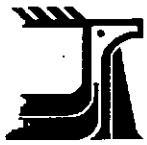
Cover illustration: Apple Moss - Illustration is "adapted from A.J. Grout, 1955. *Moss flora of North America north of Mexico.* Volume 2, Newfane, VT.".



Apple Moss

Reason for status: Highly restricted disjunct populations with low numbers and small size occurring within a recognized habitat at risk.

Occurrence: British Columbia

NOTES

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COSEWIC

A committee of representatives from federal, provincial and private agencies that assigns national status to species at risk in Canada and the chairs of the scientific species specialist groups

COSEPAC

Un comité de représentants d'organismes féderaux, provinciaux et privés qui attribue un statut national aux espèces canadiennes en péril ainsi que des président(e)s des groupes des spécialistes scientifiques.

COSEWIC Status Report

on

Apple Moss
(*Bartramia stricta*)

by

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Description

Bartramia stricta is a small moss, 1-3cm high, that is characterized by its glaucous green color, globose, ribbed sporangium, and straight, erect leaves when wet or dry.

Distribution

Bartramia stricta is a species restricted to low elevation, mediterranean-like climates. In Canada, the species is known only from one site on Vancouver Island. Elsewhere in North America, the species is found only in northern California.

Population size and dynamics

The population size of *Bartramia stricta* in the U.S. has not been documented. In Canada, the species is known from only one site, where the total size of all populations is greater than $1.5m^2$. There is no information regarding the dynamics of these populations in the past.

Habitat

In the only Canadian site known for the species, it grows on a low elevation, south-facing, rocky slope in open stands dominated by *Quercus garryana*. The site is dry, and warm. *Bartramia stricta* occupies two microhabitats within the site. The species grows either on well humified soil that appears to be disturbed, or in crevices of rock outcrops. Thus the species requires micro-habitats free of competition from grasses and herbs. Both the habitat and microhabitat of the species in British Columbia are similar to those in northern California where the species is more frequent.

General biology

There is little known of the biology of *Bartramia stricta*. At the Canadian site, the species appears to produce spores successfully and regularly. The species has been collected with sporangia frequently since 1975, and several of the populations seen in 1996 were sporulating.

Limiting factors

Limited availability of potential habitat, combined with destruction and alteration of this habitat are the main limiting factors for the species. *Bartramia stricta* is restricted to warm, dry sites with mediterrranean-like climates in North America. In Canada these are mainly dominated by *Quercus garryana*

vegetation and are found only on eastern Vancouver Island and some of the Gulf Islands. In recent years these habitats have undergone significant destruction and alteration because of urban development.

Protection

Bartramia stricta is not currently protected by legislation for the protection of rare or endangered species. However, the only known site for the species is currently protected by virtue of its presence on fenced public land.

Conclusions

It is recommended that *Bartramia stricta* be designated **Threatened** in Canada, reflecting the species' limited occurrence to one Canadian site, and its restriction to a habitat that is increasingly being destroyed or significantly altered by rapid urban development. This severely limits the potential sites where the species might establish in Canada.

Note

Precise locality citations have been removed from this status report. Detailed information is on file with the COSEWIC Secretariat and/or the Co-chair, Vascular Plants, Mosses and Lichens Species Specialist Group. An addendum to this report by René Belland, documenting a second site for *Bartramia stricta*, is appended to this report. Detailed coordinates for the populations have been removed from the addendum but are available at the discretion of COSEWIC.

Résumé

Description

Bartramia stricta est une petite mousse de un à trois cm de hauteur caractérisée par sa couleur vert glauque, son sporange cannelé et globuleux et ses feuilles érigées et droites, qu'elles soient mouillées ou sèches.

Distribution

Bartramia stricta est une espèce qui ne croit qu'à faible élévation et dans un climat méditerranéen. Au Canada, on la trouve à un seul endroit sur l'île de Vancouver. Ailleurs en Amérique du Nord, on la trouve seulement au nord de la Californie.

Taille et dynamique de la population

Le nombre de spécimens de *Bartramia stricta* aux États-Unis n'est pas documenté. Au Canada, on ne la trouve qu'à un seul endroit où le total de toutes les populations dépasse un mètre et demi carré. Il n'y a pas d'information sur la dynamique passée de ces populations.

Habitat

Dans le seul site connu de l'espèce au Canada, elle pousse à faible élévation, sur une pente rocheuse exposée, dans un peuplement clair dominé par *Quercus garryana*. Le site est sec et chaud. *Bartramia stricta* occupe deux microhabitats sur ce site. Cette espèce pousse dans un sol bien humide qui semble avoir été perturbé, ou dans les crevasses d'affleurements rocheux; elle a donc besoin de microhabitats libres de toute concurrence des graminées et des herbes. L'habitat et le microhabitat de l'espèce en Colombie-Britannique sont semblables à ceux du nord de la Californie où l'espèce est plus abondante.

Biologie générale

On sait très peu de choses sur la biologie de *Bartramia stricta*. Au site canadien, l'espèce semble produire régulièrement des spores et, depuis 1975, elle a été fréquemment prélevée avec des sporanges; plusieurs des populations observées en 1996 sporulaient.

Facteurs limitants

Le peu d'habitat potentiel, combiné à la destruction et à la modification de cet habitat, sont les principaux facteurs limitatifs de l'espèce. En Amérique du Nord, *Bartramia stricta* ne croît que dans des sites chauds et secs à climat

méditerranéen. Au Canada, ces sites sont principalement dominés par *Quercus garryana* et ils sont limités à l'est de l'île de Vancouver et à certaines îles du Golfe. Ces habitats ont subi, ces dernières années, beaucoup de destruction et de modification provoquées par l'aménagement urbain.

Protection

Bartramia stricta n'est actuellement protégée par aucune loi de protection des espèces rares ou en danger de disparition. Toutefois, seul site connu de l'espèce est protégé du fait qu'il se trouve sur un terrain public clôturé.

Conclusions

On recommande que *Bartramia stricta* soit désignée comme **menacée** au Canada, reflétant sa présence limitée à un seul site et à un habitat qui est de plus en plus détruit ou gravement modifié par l'aménagement urbain débridé, ce qui limite énormément les sites où l'espèce pourrait s'implanter.

Remarque

La description des emplacements précis a été éliminée de ce rapport de situation, mais l'information détaillée est conservée aux dossiers du Secrétariat du CSEMDC ou du président du sous-comité pour les plantes vasculaires, les mousses et les lichens. René Belland a préparé un addendum annexé au présent rapport faisant état d'un deuxième site de *Bartramia stricta.* Les coordonnés détaillés des populations ont été éliminés de l'addendum, mais le CSEMDC peut les fournir le cas échéant.

Species Information

Name and classification

Scientific name: *Bartramia stricta* Bridel

Bibliographic Citation: Musc. Rec., 2(3) : 132. 1803.

Pertinent Synonyms: None

Common name: Apple Moss

Family Name: Bartramiaceae

Major Plant Group: Mosses

There are only four species of *Bartramia* in Canada: *Bartramia ithyphylla* Brid., *B. halleriana* Hedw., *B. pomiformis* Hedw, *B. stricta* Brid. All four species occur in British Columbia.

Description

Bartramia stricta Brid.

General: Plants erect, in dense, mostly glaucous-green tufts, 1-3 cm high, brownish and tomentose below.

Leaves: Erect when moist, rigid and erect when dry; narrowly lanceolate, with slender apex, 2.5-3.5 cm long; base not sheathing; margins plane or narrowly recurved below, finely serrulate above.

Leaf Cells: Upper cells similar throughout, linear, strongly papillose, 4-6 μm wide; basal cells longer, 7-10 μm, slightly papillose.

Seta: 1-1.5 cm long, straight.

Capsule: Erect, ovoid, 1.4-2.0 mm long, with narrow grooves or furrows when dry.

Sexuality: Synoicous (bisexual, both male and female reproductive structures on one plant).

Peristome: Single, teeth lanceolate, about 0.2 mm long, finely papillose in lines above, more coarsely papillose below.

Illustrations: Smith (1978), Fig 221:10-13; Grout (1955) 3(III): plate 67, K (see habit sketches and photos, Figures 1-2).

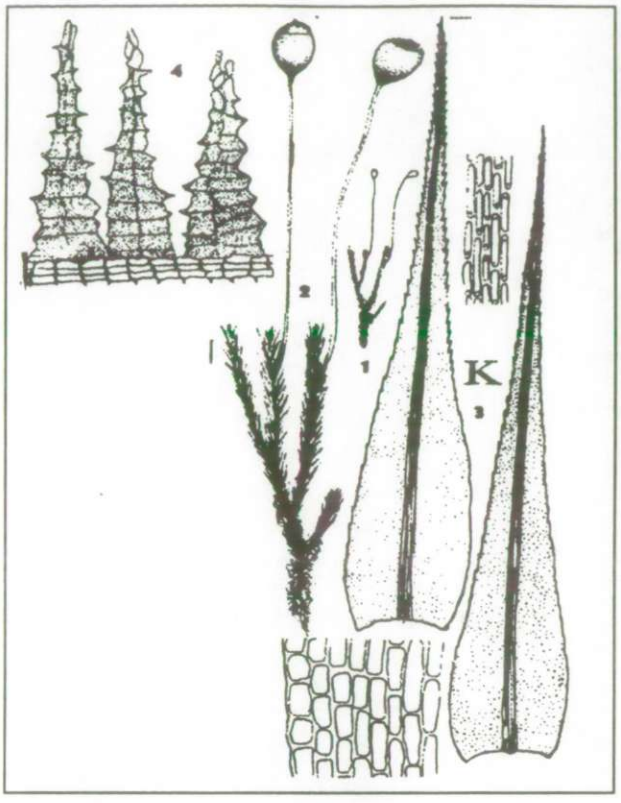

Figure 1. Habit sketch of *Bartramia stricta*. 1-2, growth form and sporophyte; 3, leaves and leaf cells (above, upper leaf cell; below, basal cells); 4, peristome (from Grout 1955).

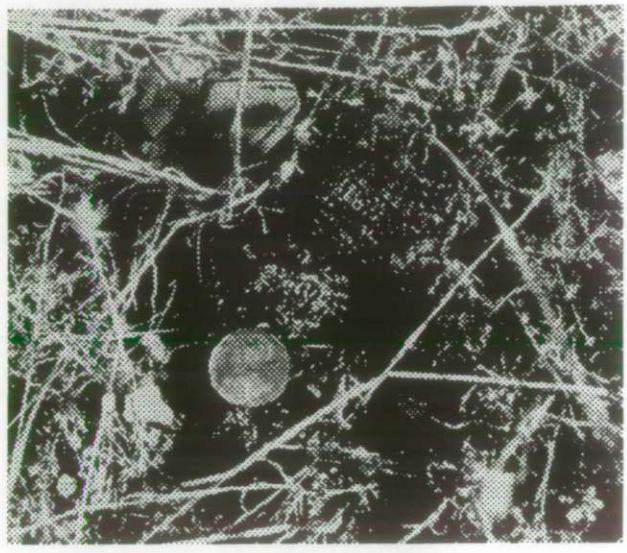

Figure 2. A close-up view of *Bartramia stricta*, showing its relatively small size. The 'strict' stiff leaves that resemble the cone shape of a pencil tip are distinctive.

Comments: The furrowed, globose capsule (sporangium) is a distinctive feature of the mosses belonging to the family Bartramiaceae, which is represented by five genera in Canada. All five are found in British Columbia. The genus *Bartramia* (apple mosses) can be distinguished from the other four genera in this family by its erect spreading leaves (that separates this genus from *Conostomum*), lack of reddish-brown rhizoids on the stem (that occur only on *Anacolia*), non-triangular stems (that differentiate *Bartramia* from *Plagiopus*), and occurrence in dry habitats (from which it differs from *Philonotis*).

The relatively small size, straight erect leaves wet or dry, and non-clasping leaf bases distinguish the species from other the three species of *Bartramia* found in British Columbia. From *B. halleri* and

B. pomiformis, *B. stricta* differs by its much smaller size, and erect, non-crisped leaves. From the similarly sized *B. ithyphylla*, *B. stricta* is differentiated by the presence of non-clasping leaf bases and habitat; *B. stricta* is strictly a low elevation species, whereas *B. ithyphylla* is a sub-alpine/alpine species found mainly at high elevations.

Habitat

There are no detailed published descriptions of the ecology and habitat of *Bartramia stricta* for any part of its world range. References to habitat of the species in floras are short, or non-existent. When such descriptions are given, they are usually very general. For instance, in Great Britain, Smith (1980) describes the species as found mainly on "...soil in rock crevices and ledges and in soil banks..." In western North America, the habitat is "On moist soil and crevices, chiefly in the mountains" (Grout 1955) and "On soil over rock in the mountains" (Lawton 1971). In northern California *B. stricta* grows on "... on thin soil over boulders in low (50-350m) elevation *Quercus-Pseudotsuga* forest" (D. Norris, pers. comm. 1996).

Bartramia stricta appears to be restricted to mediterranean climates (Schofield 1976), thus it is not surprising that the only site from which the species is known in Canada is in southwestern British Columbia (Nanaimo area). This site is a steep, dry, south-facing slope dominated by open stands of *Quercus garryana* (Garry oak) with occasional intervening stands of *Pseudotsuga menziesii* (Douglas Fir) and *Arbutus menziesii* (Arbutus) (Figure3) . The site is owned by the Department of National Defence, and access to the site is restricted by the presence of a 2m high, barbed wire fence along the entire property limit.

Bartramia stricta occupies two distinct microhabitats at the Nanaimo site. The first is exposed, humified, soil that appears disturbed and is relatively free from colonization of grasses and other vascular plants or lichens (Figure4). Frequent moss associates include *Bryum capillare*, *Bryum miniatum*, *Ceratodon purpureus*, *Didymodon vinealis*, *Entostodon fascicularis*, *Philonotis fontana*, *Polytrichum juniperinum*, *Racomitrium elongatum*, *Timmiella crassinervia*, and *Weissia controversa*. Four of these species, *C. purpureus*, *E. fascicularis*, *P. juniperinum*, and *W. controversa*, are indicative of disturbed habitats, while *P. fontana* and *B. miniatum* indicate possible seepage. Many populations occur also on stony soil, which discourages vascular growth, thereby producing exposed microhabitats (Figure 5).

The second microhabitat occupied by *B. stricta* at Nanaimo site is crevices on rock outcrops. In these, *B. stricta* grows on either thin soil within the crevices or directly attached to the rock (Figure 6). Associated moss species

include *Bryum miniatum*, *Ceratodon purpureus*, *Polytrichum juniperinum*, *Racomitrium elongatum*, *Timmiella crassinervia*, and *Weissia controversa*.

Figure 3. General vegetation at the Nanaimo site. In the foreground are herb meadows; the background trees are *Quercus garryana* and *Arbutus menziesii* A major population of *Bartramia stricta* is found on soil behind the small rock outcrop that is pictured right center.

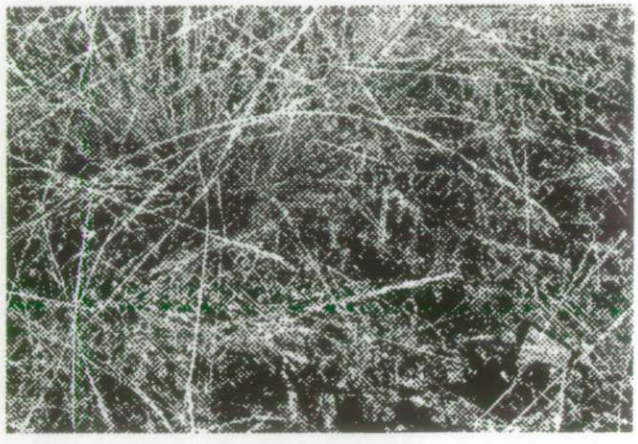

Figure 4. Exposed soil micro-habitat of *Bartramia stricta*. Note the more open area on the right. A small patch of *B. stricta* is growing just below the pen (just right of center).

Figure 5. The micro-habitat of *Bartramia stricta* on stony soil. A patch of the species can be seen at the tip of the pen (upper-right of center).

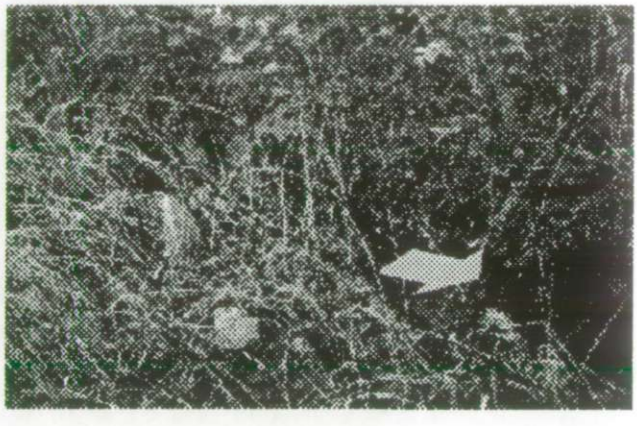

Figure 6. The micro-habitat of *Bartramia stricta* on a small rock face. The species is pictured at the arrow.

Distribution

Historical range in North America

There is no information on the historical range of *Bartramia stricta* in North America.

Bartramia stricta shows wide disjunctions in its world range. The species is widely distributed in the Mediterranean region of Europe and is known also from Australia and Tasmania (Smith 1980). In North America, *Bartramia stricta* is found only in western North America, where is occurs in southwestern British Columbia and northern California (Figure 7). The species is reported from Idaho, Montana, and Colorado (Lawton 1971). However, the Montana record was incorrectly determined, the Idaho and Colorado records are also in error (J. Christy, pers. comm. 1996).

Canadian range

Bartramia stricta is known only from one site in Canada, in the Nanaimo area. The species was last collected from this locality in 1996 (by R.J. Belland). A summary of the collections made of the species from the Nanaimo site is given in Table 1.

Table 1. Summary of collections made of *Bartramia stricta* from the Nanaimo site.

Collector	Year	Sporangia?
Schofield, W.B.	1975	Yes
Schofield, W.B.	1976	No
Straley, G.B.	1977	Yes
Schofield, W.B.	1978	Yes
Belland, R.J.	1996	Yes

Ryan (1996) listed a second British Columbia site for the species, at Pedder Bay, west of Victoria. Two extensive searches for the species in 1996 did not relocate any populations of *B. stricta* there. It is likely that the Pedder Bay specimens are misdetermined and represent small forms of *Anacolia menziezii*, a moss that occurs in the habitat cited by Ryan (1996). In addition, vouchers of the species curated at the University of British Columbia herbarium from the Pedder Bay locality no longer exist under the name *B. stricta*, possibly indicating that the voucher has been revised to some other name.

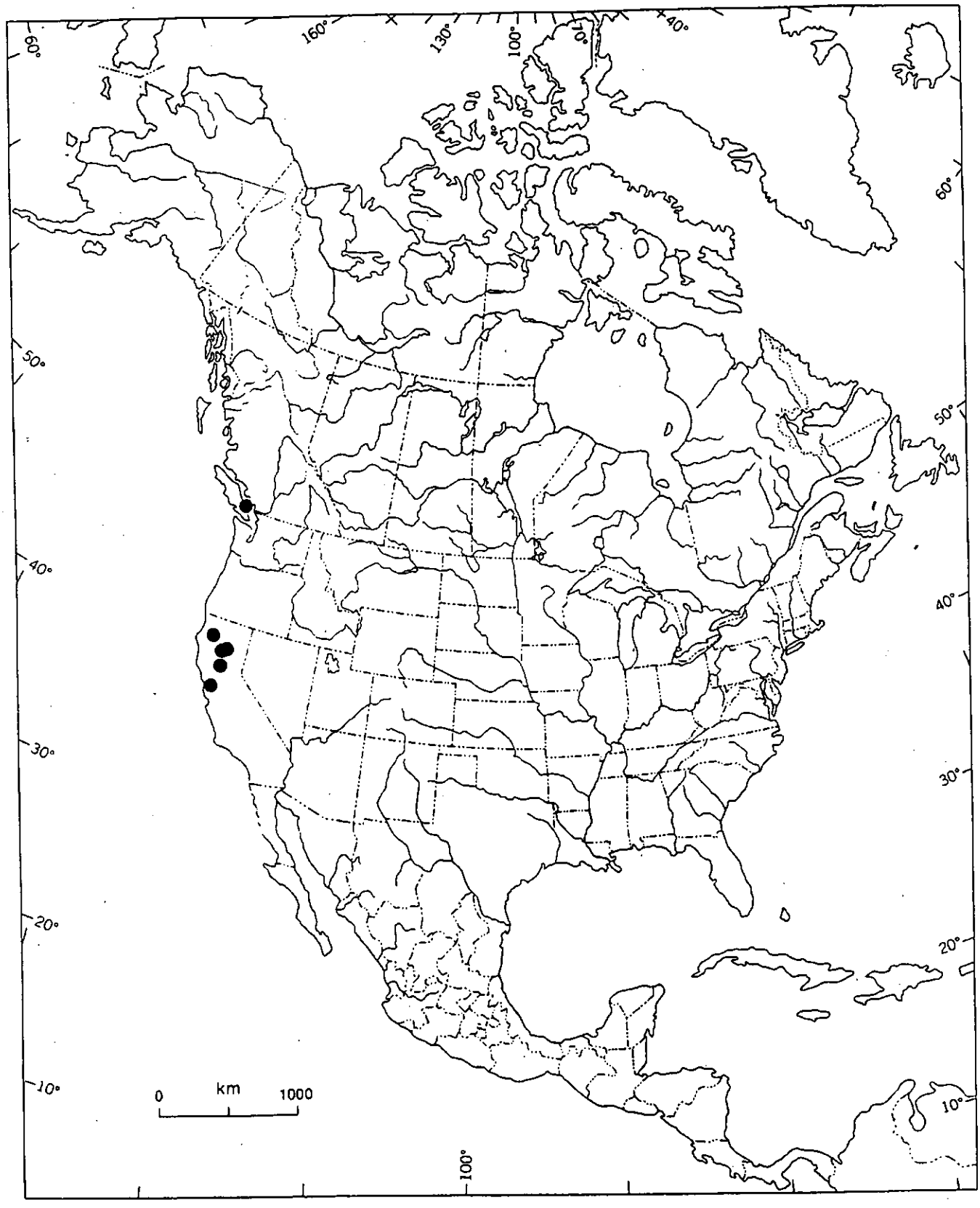

Figure 7. The North American distribution of *Bartramia stricta* Bridel (modified from a map courtesy Dan Norris).

General biology and reproductive capacity

There is no published information about the general biology and reproductive capacity of *Bartramia stricta*, with the exception of field observations on microhabitat (see Habitat, section 3) and sporulation data obtained from herbarium vouchers.

As with many species of moss, the primary means of dispersal and reproduction is by spores. *Bartramia stricta* has a synoicous sexuality, meaning that both male and female reproductive structures are found in close proximity on the same plant. This situation ensures successful fertilization and consequent production of sporangia and spores. *B. stricta* appears to produce spores regularly at the Nanaimo site. Of the five specimens collected over 20 years, four contain plants with sporangia, indicating that the populations are reproducing regularly (Table 1).

Special significance of the species

The Nanaimo site is the only one known for this species in Canada. The species shows a significant gap in its western North America distribution, where it occurs disjunctively to northern California.

It should be noted here that several additional rare species are known from the Nanaimo site. Most are ranked S2 (6-20 sites in B.C) by the Conservation Data Center, but one species is S1 rank (1-5 sites in B.C). Among the vascular plants are included *Allium geyeri* var. *geyeri* (S2), *Meconella oregana* (S2), *Montia howellii* (S2). Other rare mosses found here include: *Bryum capillare* var *torquescens* (S2), *Funaria muehlenbergii* (S2), *Entostodon fascicularis* (S2), *Ptychomitrium gardneri* (S2), *Tortula laevipila* (S1).

Population numbers, size and trends

The small size of *Bartramia stricta* makes it impossible to document every plant at a site. Therefore the summary of population parameters in Table 2 gives a conservative estimate of the species population health at the Nanaimo site.

As with many mosses, it is not possible to count individual plants. Mosses tend to grow as groups of individuals that occur in patches on their substrate. To determine the population health of *B. stricta* we measured the size of each patch that was encountered. At the Nanaimo site, 183 patches were found (Table 2). These varied in size from $1cm^2$ to $4m^2$ (see). While single patches were located, most patches were found in groups growing in suitable microhabitats. Of the 15 groups documented, only three consisted of a single patch, while the remaining 12 groups included from 2 to 33 patches. In almost half of the groups, at least one individual in a patch had produced sporangia.

Table 2. Population parameters for *Bartramia stricta* at the Nanaimo site.

Group	Area Covered by Group (m^2)	No of Patches	Average Size (cm^2)	Total Size (cm^2)	Sporophytes ?
1	3	20	7.5	150	—
2	<1	1	0.5	0.5	—
3	150	21	15	321	—
4	9	13	36	464	Yes
5	25	4	37	147	Yes
6	15	26	79	2052	Yes
7	15	18	160	2886	Yes
8	4	6	5	30	—
9	4	4	7	29	—
10	12	28	259	7258	—
11	2	2	27	53	—
12	15	33	37	1235	—
13	8	5	63	317	Yes
14	<1	1	24	24	Yes
15	<1	1	4	4	—

Limiting factors

Suitable habitat appears to be the limiting factor for the survival of this species in British Columbia (and Canada). *Bartramia stricta* is a temperate (mediterranean) species requiring warm, mainly xeric sites. While the species is not known to be specifically associated with *Quercus garryana* stands elsewhere within its range, such vegetation is characteristic of the warm, xeric conditions that may indicate potential *B. stricta* habitat in southwestern British Columbia. This vegetation type is restricted in Canada to southeastern Vancouver Island and some of the Gulf Islands. Presently, intense pressure from urban expansion and development threaten many of the *Q. garryana* stands, and thus severely limits the potential establishment of *B. stricta* in this habitat. While *Q. garryana* stands on rocky slopes similar to those at Nanaimo site are less at risk, they may eventually be developed with increasing land prices as urbanization pressures increase and land prices rise. It should be noted that the landowners of the

Nanaimo site are keenly aware of the presence of rare plants and communities on their property. They have taken steps to conserve the site (A. Robinson, pers. comm., 1997), by commissioning studies (e.g., Radcliffe *et al.* 1994) and erecting a fence to protect the site from motorcycle traffic.

Assessment of Status

Present legal protection or other status

International status

Bartramia stricta has not been globally ranked by the Nature Conservancy (U.S.).

National and provincial status

In British Columbia, *Bartramia stricta* is ranked as an S1 species by the Conservation Data Center (1995), which indicates that the species is "Critically imperiled because of extreme rarity (5 or fewer extant occurrences or very few remaining individuals) or because of some factor(s) making it especially vulnerable to extirpation or extinction". The species is included on the British Columbia Ministry of Environment (MOE List) "Red List", making this moss a candidate for legal designation as endangered ("Any indigenous species, subspecies or variety facing extirpation or extinction in British Columbia") or threatened ("Any indigenous species, subspecies or variety likely to become endangered if limiting factors are not reversed").

In addition, several Garry Oak plant communities are included on the British Columbia Ministry of Environment (MOE) 'Red List', and thus also face possible extirpation or extinction, or that are threatened in British Columbia. The communities and their rankings (CDC ranking/MOE ranking) are as follows: Douglas Fir-Garry Oak-Onion Grass (S1S2/RED), Garry Oak-Arbutus (S2?/RED), Garry Oak-Brome (S1/RED), Garry Oak-Ocean Spray (S2/RED). All four communities occur at the Nanaimo site (A. Ceska, pers. comm 1997). Radcliffe *et al.* (1994) list the site as Garry Oak Grassland, which may include both Garry Oak-Ocean Spray and Garry Oak-Brome, noting that the site does not fit comfortably into either community type. In any case, it is stressed here that the plant community type(s) in which *Bartramia stricta* occurs is considered critical habitats.

Assessment of status and author's recommendations

The prognosis for *Bartramia stricta* is fair to good. The species is presently protected on federal land that is protected by barbed wire fencing and strict access. In addition, *B. stricta* appears to be reproducing regularly, and populations have been found at the Nanaimo site consistently over the last 20 years.

Bartramia stricta should be ranked as a threatened species for the following reasons:

1. The species is known from only one site in Canada.

2. The populations represent the most northerly populations for this species in North America.

3. The potential habitat type in which the species could occur in Canada is rapidly being destroyed or altered by urban development.

4. The community types in which *Bartramia stricta* occurs at the Nanaimo site are considered critical/endangered habitat in British Columbia. This, combined with the occurrence at the site of numerous other rare or endangered plants, suggests that the species exist there because of a unique combination of environmental/historic factors not present elsewhere in British Columbia.

Although the first two criteria would place the species in the vulnerable category, the ecology of *Bartramia stricta* to a restricted habitat that is currently being destroyed or modified by man suggests the potential habitat for the continued presence of this species is extremely limited. While the species' only known populations are presently protected on public land, natural catastrophe could extinguish their presence in Canada. We therefore recommend that the species be assigned threatened status.

Recommended critical habitat

The critical habitat for *Bartramia stricta* in Canada are *Quercus garryana* dominated rocky slopes, or similar sites with mediterranean-like climates.

Information Sources

Literature cited

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Record of fieldwork conducted

Field work was conducted on two separate occasions, to confirm and document the presence of the *Bartramia stricta* at previously known sites. Since both sites were small in the area, it was possible to search them carefully with one day of field work devoted to each.

Other information sources

Collections consulted

Collections at the University of British Columbia (UBC), the University of ?Alberta (ALTA, and the Provincial Museum of Alberta (PMA & UAC) were examined for vouchers. The distributional maps are based on collections at UC Berkeley, and UBC.

Knowledgeable individuals

Dr. Wlf Schofield. Dept. Botany, Univ. of Btitish Columbia, Vancouver, B.C., V6T 1Z4
- information concerning the general ecology of the *Bartramia stricta* at the Nanaimo site. He also participated in field work at Pedder Bay.

Dr. Arthur Robinson. Pacific Forestry Service, 506 Burnside Road, Victoria, British Columbia, V8Z 1M5.
- details of the vegetation at the Nanaimo site.

Dr. Dan Norris. Box 265, Hansville, Washington, U.S.A. 98340
- ecological and distributional information on the species in California.

Dr. David Jamieson. Dept. Biology, Fort Lewis College, Durango, Colorado, U.S.A. 81301
- distributional information of the species in Colorado.

Judy Harpel. P.O. Box 490, Brush Prairie, Washington, U.S.A. 98606
- distributional information and status of the species status in Washington.

John Christy. The Nature Conservancy, 1205 NW 25th Avenue, Portland, Oregon, U.S.A. 97210
-distributional information and status of the species in Montana, Idaho, Oregon, and Colorado.

Dr. Adolf Ceska. B.C. Conservation Data Centre, 780 Blanshard Street, Victoria, B.C., V8V 1X5
- plant communities of the Nanaimo site.

Summary of materials on file

Letters from knowledgeable individuals and photos are on file with COSEWIC.

Maintenance of status report

The author is willing to maintain or receive information on the species for future updating of the report.

Acknowledgements

The author thanks Dr. Wilf Schofield for advice and accompaniment in the field. The assistance of Nathalie Djan-Chekar, B.C. Conservation Data Centre, for accompanying the author in the field on both field trips, is greatly appreciated. Thanks also to Dr. Arthur Robinson, Pacific Forestry Centre, for his assistance in providing access to the Department of National Defence lands.

Biographical summary of author

Dr. René J. Belland has extensive experience with bryophytes in many parts of Canada. He has 14 years of field experience in Atlantic Canada where he studied the bryophyte flora of the Gulf of St. Lawrence. This work included a detailed study of disjuncts in that region, as well as preparing inventories and analysing the floras (including rare species) in eight national parks. Seven years were spent working on the mosses of British Columbia. Dr. Belland has been with the University of Alberta since 1993, where he is currently involved in biodiversity projects that include modeling biodiversity patterns in the Rocky Mountains and in British Columbia. In addition, he has worked closely with the Alberta Natural Heritage Information Center to develop the provincial bryophyte tracking list, and has also worked with COSEWIC on bryophyte related projects.

COSEWIC
Status Report on the Apple Moss *Bartramia stricta* Brid. In Canada

ADDENDUM

by

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Funding provided by the Canadian Wildlife Federation

Introduction

Since the submission of the status report of *Bartramia stricta* in early January of 1997, a second station for the species was discovered. The purpose of this addendum is to document the presence of the species at this site, and to provide additional comments regarding the Pedder Bay site.

So far as is presently known, *Bartramia stricta* (Fig. 1) appears to be restricted to Garry Oak (*Quercus garryana*) woodlands in Canada which are found only in southwestern British Columbia. From a bryological perspective, these habitats are of interest because they harbour several species of Mediterranean affinity that reach their northern limits in British Columbia. For this reason, the habitat attracts bryologists and collections have been made from them whenever possible. Based on records in the author's UBC herbarium database, ten Garry Oak woodlands have been collected for bryophytes, but in only two has *B. stricta* been found, despite deliberate searches for it (W.B. Schofield, pers. comm. 1997). Of these, eight Garry Oak woodlands have been collected by the well-known bryologist W.B. Schofield (Colewood, Mt Maxwell, Nanoose Hill, Royal Oak, Tsuhalem Mtn, William Head, Thetis Lake, Mt Tolmie), while at least two additional sites (Clovelly Terrace and the present site) have been collected by other workers.

Location

The site is located at Mary Hill, on southern Vancouver Island. Location details are given in Table 1.

Site Description

The top and upper slopes of Mary Hill are surrounded by a chain link fence with a locked gate. All populations were located within this fenced area of federal lands on the south-facing slopes of Mary Hill.

The lower slopes of Mary Hill comprises dry Douglas Fir (*Pseudotsuga menziezii*) and Garry (*Quercus garryana*) oak forests. The upper slope and apex of the hill largely comprises open and exposed rock outcrops with scattered Garry oak, Douglas Fir, and Arbutus (*Arbutus menziesii*). Scotch Broom (*Cytisus scoparius*) forms dense thickets wherever soils are sufficiently deep. Much of the south-facing slope is largely comprised of rock outcrops that form a series of sloping ledges and small cliffs. Soils are shallow or absent. The ledges are typically dominated by introduced grasses, thickets of broom, and scattered patches of the moss *Racomitrium canescens*. The cliffs are mostly bare except for scattered patches of lichens and mosses.

General Habitat

The populations occurred in single patches or in groups of patches (see Section 7, p. 9 of main report) within small areas (< 25m^2). All populations were restricted to crevices or small ledges on bare vertical rock faces that are somewhat protected from direct precipitation. Fragmentation of patches appears to be common and, barring abundant litter, fragments (comprising a few stems) seem to become established at the base or rock faces where they form new patches.

Those patches that appear to be exposed to sunlight were smaller in size than those patches found in slightly more sheltered microhabitats. The distinctive bright yellowish green colour of the species made patches easy to recognize. The leaf tips of some plants also had a reddish tinge (possibly those in more exposed microhabitats).

Description of the population groups

Four groups of patches were located, with each patch representing many individual plants. The population parameters for each group is summarized in Table 2. Each group was localized relative to three permanent plots that have been established by Dr. Richard Hebda for the Ecological Restoration Program at the University of Victoria. All are located at different elevations on the south-facing slope of Mary Hill.

Group 1.

The *Bartramia stricta* population was located along the northern edge of the middle plot (the first and third plots are located upslope and downslope of the middle plot, respectively) about 2.5 m. from the northwest corner of the plot marked by a steel post (GPS reading 48° 20' 37" N; 123° 32' 51" W).

The general habitat comprised open and exposed south-facing rock outcrops consisting of a series of sloping ledges and rock faces (Fig. 2). The sloping ledges are dominated primarily by grasses (generally introduced species) with scattered Garry oak and dense patches of broom. Rock faces are dominated by *Racomitrium elongatum* and *Selaginella wallacei.*

Two patches of *Bartramia stricta* were found. The largest patch (about 5 cm wide and 12-14 cm long) was located directly on the vertical rock face that runs along the north side of Dr. Hebda's middle plot. The rock face generally has an aspect of 176° but the *Bartramia* population occurred on a rock face with an aspect of 120°. The population was slightly protected above from direct precipitation by jutting rock. No other species were associated with *Bartramia* except the lichen *Puntelia subrudecta* which formed scattered patches around the patch of *Bartramia.*

This patch of *Bartramia* had many sporophytes (about 3-4 capsules/cm^2) comprising fully formed capsules that were still green and had not quite matured. Only a single old capsule from the previous year was present although old seta from the previous year were also present. Some capsules appeared to have been chewed off (evident by setae with missing capsules) by insects and a black insect larva was observed on one seta.

A second patch (about 4 cm x 8 cm) was located directly below at the base of the rock face growing directly on humus and fine litter. It was not closely associated with any other species. Only fourteen immature capsules were present in this patch.

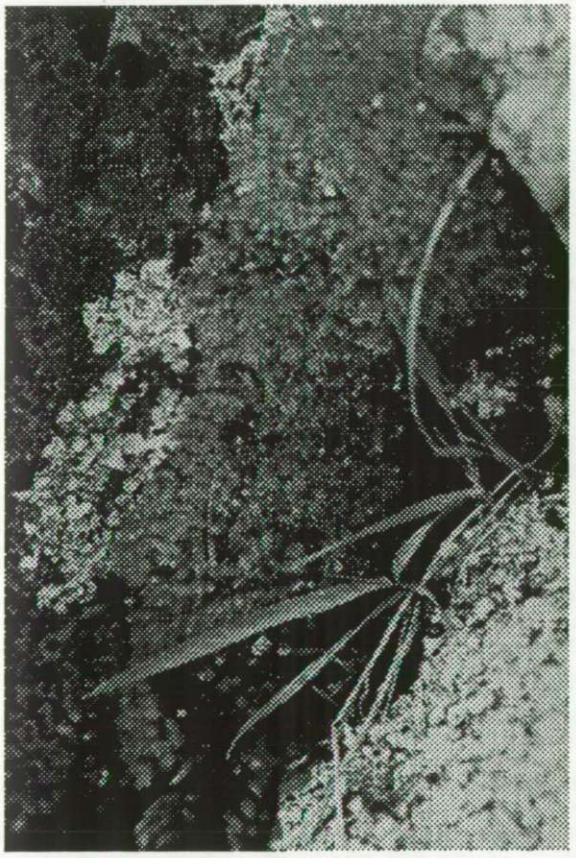

Figure 1. Close-up photo of *Bartramia stricta* showing the small globose sporangia (fruit) and erect leaves (photo M.W. Ryan).

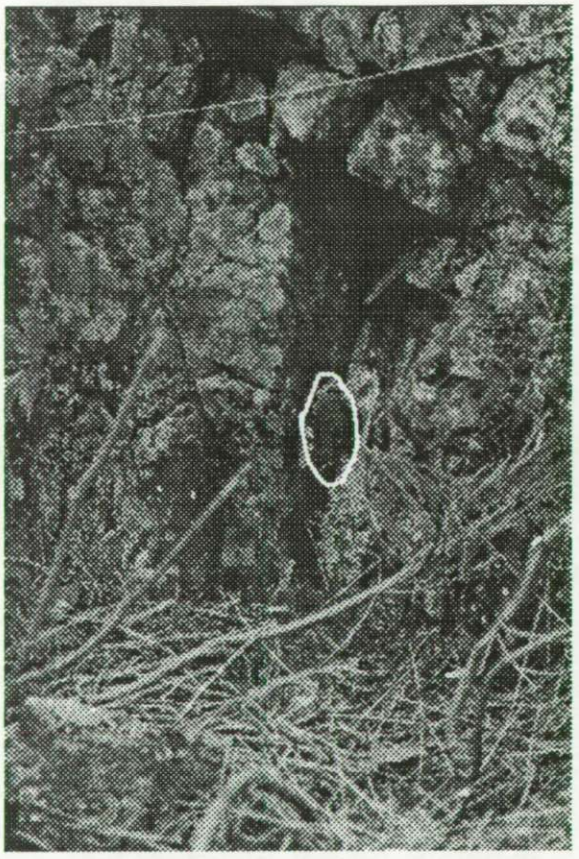

Figure 2. Habitat of group 1, showing a large patch of *Bartramia stricta* (circled). A close-up of this patch is shown in Fig. 1 (photo M.W. Ryan).

Group 2.

The second group is located downhill (due south) of Group 1 and about 20 m upslope of the chain link fence that surrounds the middle and upper slopes of Mary Hill. (GPS reading 48° 20' 36" N; 123° 32' 49" W).

The general habitat is similar to that of Group 1. The area is open and exposed and comprises a series of rock faces and sloping ledges on very shallow soil. Ledges are dominated by introduced grasses, scattered patches of broom, and patches of *Racomitrium elongatum*. All patches were slightly protected from direct precipitation by slightly projecting bedrock above the patches.

Five patches were found. The four smallest (2 cm x 3 cm to 3 cm x 5 cm in area) occurred on a vertical rock face (aspect 178°). Most populations were not growing with or near other species although one patch was established next to a small amount of *Bryum capillare* and *Racomitrium* cf. *heterostichum* and a another patch was established adjacent to *Punctelia subrudecta*, *Cladonia* sp., and a grass (probably *Poa pratensis*). No new or old capsules or setae were present except for one patch (2 cm x 4 cm) which had nine old setae from the previous year.

The fifth patch (5 cm x 5 cm) was established at the base of the rock face directly below the other four patches. It was growing directly on rock (about 30% angle of inclination) with nearby *Selaginella wallacei* and some type of a grass (probably *Poa pratensis*). No capsules were present.

Group 3.

This group was located about 20 m east of Group 2 just upslope of the chain link fence. The general habitat is the same as that for the previous two groups although there is a Garry oak grove about 5 m east of the *Bartramia* populations. (GPS reading 48° 20' 39" N; 123° 32' 55" W). All patches are slightly protected from direct precipitation by slightly projecting bedrock above the patches.

This group had the largest numbers of patches of *Bartramia stricta* and were found in an area encompassing 0.75 m^2 (Figure 4). About 25 separate patches, ranging in size from about 3 cm x 3 cm to 5 cm x 10 cm, occurred in crevices or on small ledges on the rock face (aspect 179°). Most populations were growing in isolation but some had nearby *Selaginella wallacei*. One patch grew adjacent to *Mimulus alsinoides* and *Saxifraga occidentalis* and a second patch occurred with a small amount of *Bryum miniatum*. Although this latter species is often found in seeps, this habitat was not very seepy.

A single patch occurred on humusy soil at the base of the rock face and was associated with a small amount of *Sedum spathifolium*, a single *Hypochoeris radicata*, and a few stalks of a grass (again, probably *Poa pratensis*).

All patches were sterile but about 10 old setae from the previous year were counted amongst all patches.

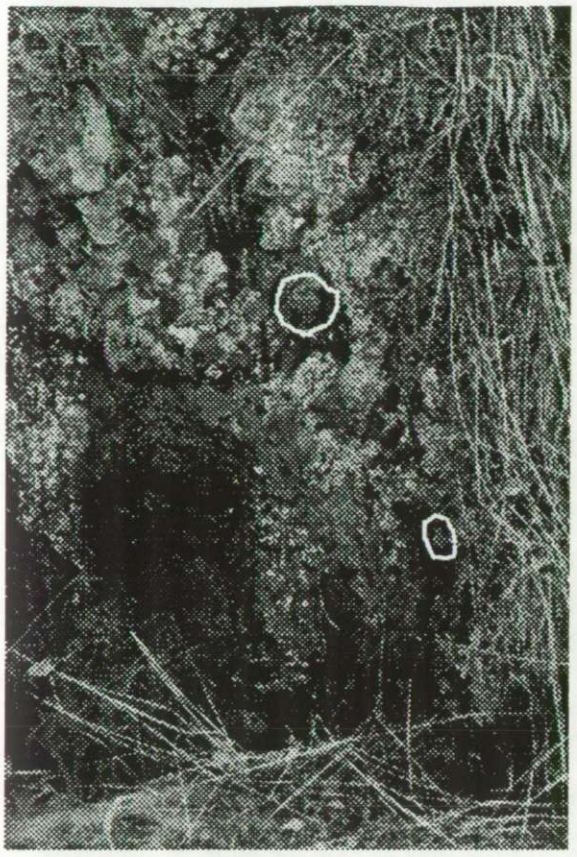

Figure 3. Habitat of group 2. Two patches of *Bartramia stricta* are circled (photo M.W. Ryan).

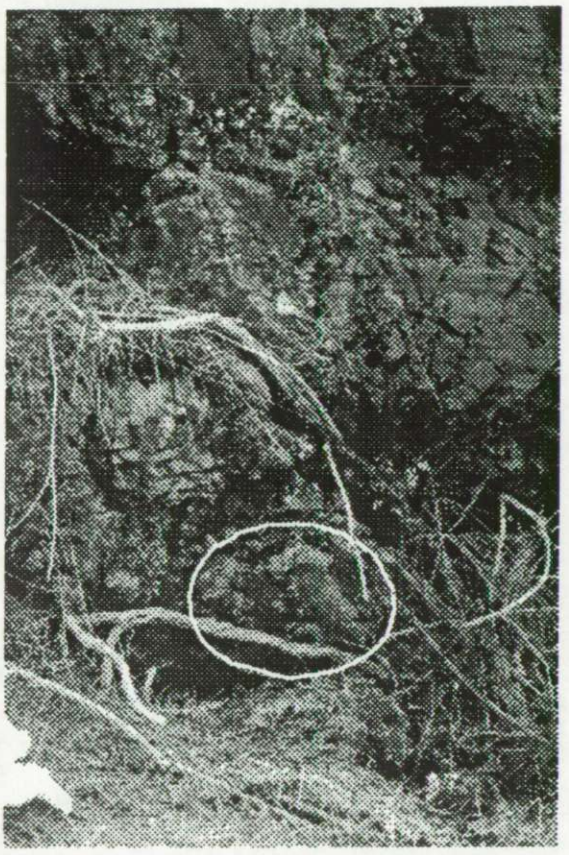

Figure 4. Habitat of group 3. This site harboured the largest number of patches (25, circled) (photo M.W. Ryan).

Group 4.

This site was located upslope from Site 3 and about 20 m north of Dr. Richard Hebda's third plot (located downslope of the other two plots). (GPS reading 48° 20' 42"; 123° 32' 55" W).

The general habitat is similar to that of the other sites. The patches occur on the vertical surface of a rock face that mainly faces due south. There is a small indentation in the rock outcrop where water seeps down the rock face. The single patch of *Bartramia stricta* (about 4 cm x 10 cm) was located above the seep on a vertical rock face with an aspect of 100° where it is somewhat protected from direct precipitation by projecting bedrock Ten immature, fully-formed capsules were present.

Small pieces (comprising a few stems) of *Bartramia stricta* had broken off from this single patch and were lying on litter at the base of the rock face. It is unlikely these plants will become established at the base of the rock face (as they appear to have at the other three sites) because of the occurrence of Garry oak leaf litter which accumulates at the base of the rock face and is very slow to decay and will likely smother any plants.

Table 1. Details of the Mary Hill location for *Bartramia stricta* in Canada .

Locality	Location	Description	Dates of observation	Land Owner
Mary Hill	Mary Hill, 49°20'37"N, 123°32'51"W	*Douglas Fir/ Garry Oak* open woodland on steep, xeric, south facing slope, elevation xx-xx m asl.	March 21, 1997 (M.W. Ryan)	Department of National Defence

Table 2. Population parameters for *Bartramia stricta* at the Mary Hill site.

Group	Area Covered by Group (m^2)	No of Patches	Average Size (cm^2)	Total Size (cm^2)	Sporophytes?
1	n/a	1	60-70	60-70	Yes
2	?	5	10-17	49-85	Yes
3	0.75	25	9-50	225-1250	Yes
4	n/a	1	40	40	Yes

Comments on the Pedder Bay site

In the status report of *Bartramia stricta*, it was stated that the species had been reported from Pedder Bay (also known as Ash Point), also on Vancouver Island. The report notes that no voucher had been located for the site, and that several searches for the species had failed to locate the species. A recent communication with Dr W.B. Schofield (Univ. British Columbia, 1 April, 1997) has revealed that the voucher had "resurfaced", thus confirming that the species had

once been found at the Pedder Bay site. A recent survey of Pedder Bay by Mike Ryan, however, did not find the species. Ryan's comments of the site, "that the vascular vegetation has likely taken over areas where this species once occurred or have altered the microclimate (primarily by shading) so that *Bartramia* no longer persists at this site." also reflect the observations and opinion of the author, and of W.B. Schofield (pers. comm. April 1997). We therefore conclude that *Bartramia stricta* has been extirpated at the Pedder Bay site.

Summary of Materials on File

The original data, photos, and report submitted to the author by M. Ryan, are on file with COSEWIC.

Acknowledgments

The author is grateful to Mike Ryan for having graciously provided the data on this additional site for *Bartramia stricta*, and for having provided this addendum in draft form.

Photo Captions

Captions for the photographs* included with this addendum are as follows:

Photo 1. Mary Hill. Group 1. *Bartramia stricta* is the green patch just below the center of the photo.

Photo 2. Mary Hill. Group 2. *Bartramia stricta* is the green patch just below the center f the photo. A second patch is visible about 2.5cm below, and 1cm to the right of the previous patch.

Photo3. Mary Hill. Group 3. This group contained the largest number of patches. These are visible as yellow-green patches on the lower part of the cliff, just above the large dead twig (see Fig. 4 in text).

Photo 4. Mary Hill. Close-up of *Bartramia stricta,* showing the distinctive globose sporangia, and the stiff, erect leaves.

- All photographs by Mike W. Ryan.

Appendix 1. Precise locality citations for extant and historic populations of *Bartramia stricta* Bird (on file with the Chair, Vascular Plants, Mosses and Lichens Species Specialist Group).

MANDATE

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 groups: fish, amphibians, reptiles, birds, mammals, molluscs, lepidoptera, vascular plants, mosses and lichens.

MEMBERSHIP

COSEWIC is comprised of representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada, Fisheries and Oceans, Canadian Museum of Nature), three national conservation organizations (Canadian Nature Federation, Canadian Wildlife Federation, and World Wildlife Fund Canada) and the chairs of the scientific species specialist groups. The Committee meets annually in April 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.
Vulnerable (V)	- 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.
Indeterminate (I)	- A species for which there is insufficient scientific information to support status designation.

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. COSEWIC meets annually in April each year. Species designated at this meeting are added to the list.

Environment Canada
Canadian Wildlife Service

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Service canadien de la faune

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