Parks Canada - Technical Reports in Ecosystem Science

Report 39

The Bryophytes of Haida Gwaii: A baseline species inventory, review and analysis.

by

T.E. Golumbia[1,2] and P. M. Bartier[1]

2004

[1] Gwaii Haanas National Park Reserve and Haida Heritage Site
P.O. Box 37, Queen Charlotte, BC V0T 1S0

[2] Current address: Gulf Islands National Park Reserve
2220 Harbour Road, Sidney, BC V8L 2P6

National Library of Canada cataloguing in publication data

Golumbia, T.E. (Todd E.), 1960-

The bryophytes of Haida Gwaii : a baseline species inventory, review and analysis

(Parks Canada-Technical Reports in Ecosystem Science ; report 39)
Includes an abstract in French.
Includes bibliographical references.

ISSN 1200-3298: 38
ISBN 0-662-35840-6
Catalogue No. R61-2/19-39/2004E

1. Bryophytes – British Columbia – Queen Charlotte Islands – Geographical distribution.
2. Bryophytes – British Columbia – Gwaii Haanas National Park Reserve and Haida Heritage Site – Geographical distribution.

I. Bartier, P. (Patrick), 1960- .
II. Parks Canada. Atlantic Region.
III. Title.
IV. Series: Technical reports in ecosystem science ; no. 39.

QK532.65B7B79 2004 588'.0971112 C2004-980205-4

Published by authority of the Minister of Canadian Heritage

Contents

List of Figures

List of Tables

List of Appendices

Abstract

As part of the natural resources description and analysis of Gwaii Haanas National Park Reserve and Haida Heritage Site, this report and the associated databases provides a history of the bryological research on Haida Gwaii (Queen Charlotte Islands) and a synthesis of the existing records of bryoflora for the archipelago. The bryophytes of Haida Gwaii were last summarized in 1989 and, as a result of additional fieldwork, a thorough review of existing literature and museum collections, and the revision of several genera since 1989, the mosses have increased from 328 to 395 species and the hepatics (liverworts) from 136 to 180 species. In addition to the documentation of bryophyte diversity, this report describes the species known from Haida Gwaii with respect to their geographic significance, their characteristics and their preferred habitats across the archipelago. An evaluation of species significance identifies distributions of special significance, rare and uncommon species, and potential threats to bryoflora. Management recommendations are provided with respect to research, inventory and monitoring to address information shortfalls and management issues that may affect the bryoflora of Haida Gwaii.

Résumé

Partie intégrante de la description et de l'analyse des ressources naturelles de la réserve du parc national Gwaii Haanas et du site du patrimoine haïda, ce rapport et cette banque de données présentent l'historique de la recherche bryologique sur Haida Gwaii (les îles de la Reine-Charlotte) et une synthèse des connaissances actuelles sur la bryoflore de l'archipel. Le dernier inventaire des bryophytes de Haida Gwaii date de 1989. Suite à une étude sur le terrain, à un examen poussé de la littérature spécialisée et des collections dans les musées, et à la révision depuis 1989 du statut de plusieurs genres, le nombre d'espèces de mousses est passé de 328 à 395, et celui des hépatiques de 136 à 180. En plus de dresser un tableau de la diversité des bryophytes, ce rapport donne les caractéristiques, l'importance géographique et les habitats préférés des espèces connues de l'archipel. Il contient une évaluation de l'importance des espèces qui permet de connaître la distribution des espèces rares, inhabituelles ou d'une importance particulière, ainsi que les menaces qui pèsent sur la bryoflore de Haida Gwaii. On y trouve des recommandations sur la gestion des recherches, des inventaires et de l'observation qui abordent le manque de connaissances et les questions de gestion pouvant avoir un impact sur la bryoflore de Haida Gwaii.

Acknowledgements

This report relies on detailed information found primarily in reports and publications by Dr. W.B. Schofield, University of British Columbia Herbarium and Dr. W.S. Hong, University of Great Falls Montana. Specifically, we have utilized and expanded upon *An assessment of the bryophytes of Haida Gwaii* (Schofield and Hong 2002) which forms the foundation of this work. Creation of the database used in support of this report is based on collections housed in herbaria located at the Royal British Columbia Museum, the Univeristy of British Columbia, the New York Botanical Gardens, the University of Washington Herbarium, the Swedish Museum of Natural History, the University of Great Falls, and Gwaii Haanas. The cooperation granted us, by these experts in the field, is greatly appreciated and without a doubt, the knowledge of Haida Gwaii bryoflora has been acquired, almost exclusively, through their long history and dedication to research on this archipelago. The database described within is primarily based on the extensive field collections of W.B. Schofield and W.S. Hong and their students. We have incorporated this information with the full approval of W.B. Schofield and W.S. Hong and are deeply indebted. The task of reviewing scientific names and authorities of all taxa has been undertaken by W.B. Schofield. Completion of the database and compilation of this manuscript was financed by the Parks Canada Agency. W.B. Schofield, Peter Achuff and Norman Sloan kindly reviewed and commented on the report in its entirety. However, any and all errors remaing in this report are soley the responsibility of the authors.

Preface

Haida Gwaii (the Queen Charlotte Islands) harbours a luxuriance of mosses and liverwort vegetation. Besides the luxuriance, there are numerous species that exhibit unusual distribution patterns, or that are restricted in the world to this archipelago. Several are unknown elsewhere in North America. Some species appear to represent survivors from pre-glacial time. Such plants are unusual in Canada, a country that, for the most part, was thoroughly glaciated up to 15,000 years ago. Of particular importance is the high degree of these remarkable species which are protected within Gwaii Haanas Park Reserve and Haida Heritage Site.

It is invaluable, therefore, to have a summary of what is known of these plants, ably compiled in this publication. It provides a baseline upon which to build. In such complex and rugged terrain access is equally complex. There is little doubt that there are more species that await discovery, especially near the mountains and on the west coast. These small plants are invaluable sources of information needed to decipher the biotic history of western North America.

Dr. Wilfrid B. Schofield
Professor Emeritus, Department of Botnay, University of British Columbia
Vancouver, British Columbia

INTRODUCTION

One might ask why document the bryoflora of Haida Gwaii (Queen Charlotte Islands)? To most, this group of plants, the bryophyta, comprising the liverworts or hepatics (Hepaticopsida), mosses (Bryopsida or Musci) and hornworts (Anthocerotopsida), are virtually unknown in comparison with the vascular plants. However, in comparison, the bryoflora diversity on Haida Gwaii (575 documented species) rivals that of the vascular plants (665 species (Lomer and Douglas 1999)). With respect to abundance, the lush landscapes of Haida Gwaii, known by some as the "misty isles" could easily be referred to as the "mossy isles" given the extensive bryophyte stands across most habitats. The grandeur of these stands may be on a different physical scale in comparison with the majestic cedar, hemlock and spruce forests, however, they are equally interesting from both a scientific and natural history perspective.

The bryophytes are generally flat or prostrate but can have a central stem up to 30 cm in length. They are leaf-bearing, but vascular tissue is poorly developed (Abercrombie et al. 1992). Bryophytes are found in most terrestrial environments where plants exist, are global in distribution and occur in all climatic regimes with the exception of permanent ice (Gignac 2001). Bryophytes are poikilohydric: a condition in which the plant is unable to compensate for fluctuations in availability of water or rates of evaporation. As a result bryophytes have adapted to survive this wide variety of environments due to their ability to grow during periods when water is available and to suspend metabolism otherwise. They also do not need to rely on a root system, as they are able to take up water and nutrients through their whole surface (Gignac 2001). This allows them to grow in the absence of soil for rooting and they are often found on hard surfaces such as rock or tree boles. Many species have evolved to capitalize on a narrow geographic range and are restricted to specific habitats although there are many that are more cosmopolitan.

The rich bryophyte flora of Haida Gwaii (Figure 1) is recognized as characteristic of the islands and ranges from extensive peat bogs to lush carpets of mosses and liverworts on the forest floor and thick epiphytic growth on logs, standing trees and rocky outcrops. The oceanic climate provides a moist temperate environment that favours bryophyte growth. Along with this, there is a great diversity of substrata and micro-habitats for a diversity of species as well as a long and continuous period of colonization including refugia from glacial periods. The archipelago supports at least 395 species of mosses and 180 species of liverworts. This represents approximately half of the species known to occur in British Columbia and it increases by 74 mosses and 44 liverworts the number noted in Schofield (1989). A summary taxonomic breakdown is provided in Table 1 and a full species listing is found in Appendix A.

The bryoflora of Haida Gwaii was most recently reviewed by Schofield (1989) and has been updated here. This review was initiated with the creation of an extensive database derived from specimens in the herbarium of the University of British Columbia, the hepatic herbarium of W.S. Hong (University of Great Falls, Montana), the Royal British Columbia Museum and the New York Botanical Gardens. A review of the database was undertaken by W.B.

Table 1. Taxonomic summary of bryophytes known to occur on Haida Gwaii. Refer to Appendix A for a full listing of species.

	Number of Taxa	
Taxonomic Level	**Mosses**	**Liverworts**
Species[1]	395	180
Genus	158	63
Family	48	33

1 includes taxa at the subspecific and variety level

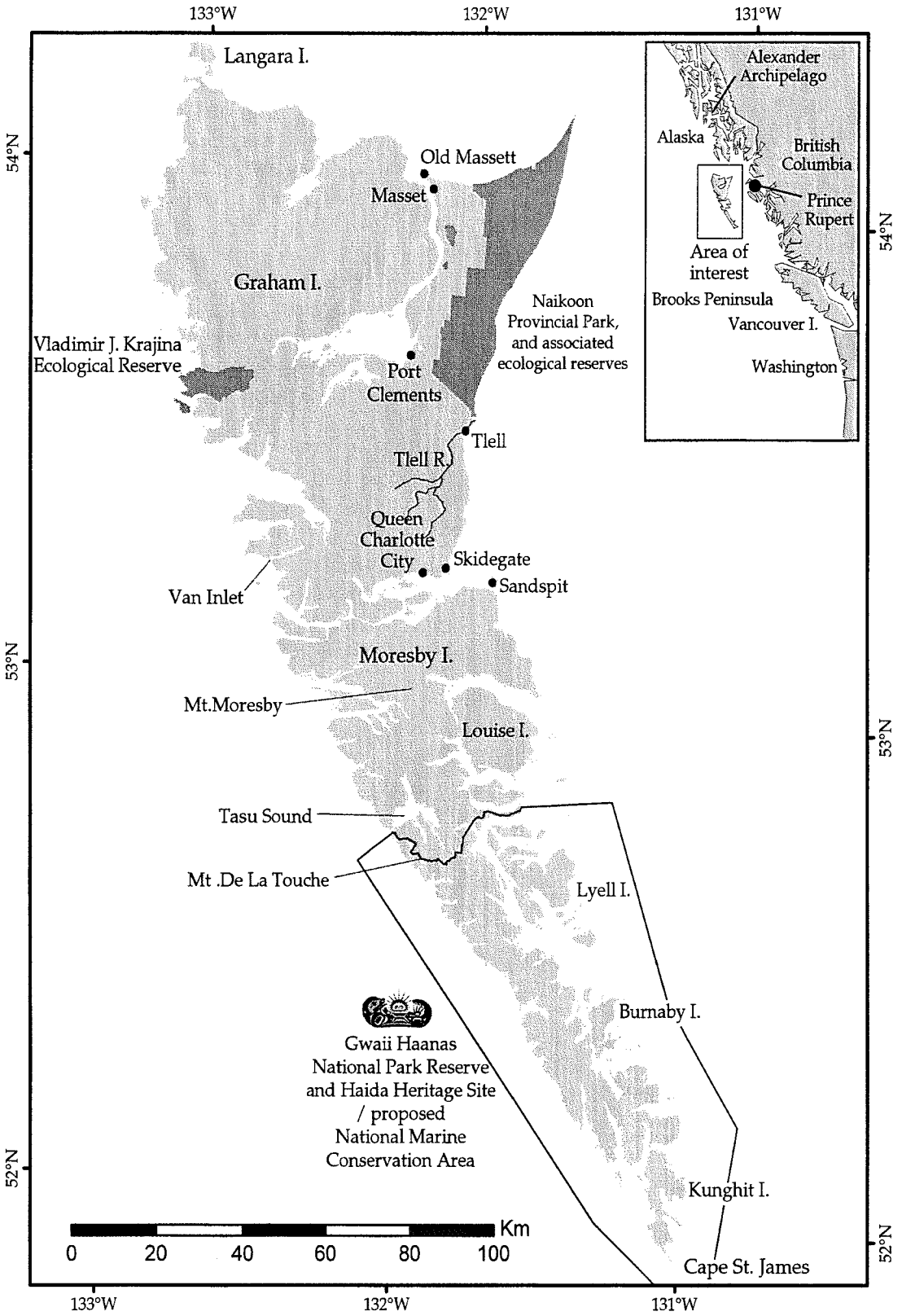


Figure 1. The location of the Haida Gwaii archipelago on the west coast of North America with major islands, communities and protected areas depicted. Place names mentioned in the text are included.

Schofield and W.S. Hong (Schofield and Hong 2002) to provide an annotated listing of species and species groups with information on the ecology and biogeography where such information was available. These accounts have been fully incorporated. Our intent in doing so was to expand the discussion by providing additional background and contextual material where appropriate, and by presenting additional conservation and management issues related to the bryoflora of Haida Gwaii. Although the focus of this study is Gwaii Haanas National Park Reserve and Haida Heritage Site (Gwaii Haanas) the area of interest and scope of research is the entire archipelago of Haida Gwaii from which collections have been made. This has been done to reflect an "ecosystem approach" and recognizes the bioregional nature of the archipelago.

RATIONALE

The flora and fauna of the northern temperate rainforest region of the Pacific coast is reasonably well documented. However, there is a lack of basic information synthesis and species checklists on a regional basis for many groups, including the bryophytes. This baseline level of information is essential for monitoring the ecosystems of the region, for identifying real or potential threats and for establishing priorities for conservation and management.

As part of the Parks Canada Natural Resource Management Process (NRMP), a resource description and analysis is a compilation document providing information on the heritage resources to aid park management planning, conservation strategy development, and interpretation and service planning. The data collected is a baseline of the bryophyte resources found within Gwaii Haanas and the adjacent region identifying focal species or other ecosystem elements that could contribute to ecosystem research or monitoring programs.

The purpose of this project is to integrate historic and more current inventory data and analysis in a standard format within one database structure and technical report. The products will be fully integrated in a digital GIS format for use in output of hard copy publications, as well as interactive multi-media communications. The project has three phases reflecting 1) a descriptive integration of information and creation of a spatial database; 2) the generation of supporting analysis based on the spatial database; and 3) the production of graphics to illustrate comparative or summary analyses. These components will form the basis for a continuing "description" and periodic "analysis" of the bryophyte resources of Haida Gwaii. This serves as a broad based review for the lay public through to specialists. While the document is technical in its format, it will also be used as a public document and to formulate more non-technical public communications products.

HISTORY OF BRYOLOGY IN HAIDA GWAII

The first bryophyte collections for Haida Gwaii were by Robert Brown. These collections were part of a geological expedition in 1868 and were published by Dickie (1868). Twenty-seven species of mosses and liverworts were identified but it seems likely that several were mis-identified with three in particular that could not have been collected on Haida Gwaii (Schofield 1989). Several other early explorers also collected bryophytes. Dawson (1880) lists 13 species that he collected in 1878; the New York Botanical Garden Specimen Catalog (www.nybg.org/bsci/hcol/) lists 1 bryophyte collected by Keen in 1898 and 7 collected by Spreadborough in 1910; and Osgood (1901) lists 17 bryophytes he collected in 1900. C.F. Newcombe collected bryophytes in 1898, among which were some mis-identifications (Schofield 1965). Botanical investigations were not again published until the late 1950s and 1960s when the Plant Research

Institute began a comprehensive review of vascular plants (Calder and Taylor 1968). Although the focus of these expeditions was vascular flora, Dr. Herman Persson accompanied them and obtained a large collection of bryophytes, now located in Stockholm and published in part (Persson 1958). Other collections in the 1960s include those by A. Vaarama, a Finnish bryologist (University of Turktu), A.J. Sharp, an American (University of Tennessee), Z. Iwatsuki of Japan (Hattori Botanical Laboratory) and H. Sjors of Sweden (University of Uppsala) (Schofield 1989). In 1975, D.H. Vitt, D.G. Horton and R. Andrus undertook bryophyte collections on Haida Gwaii including several species of interest (Schofield 1989).

The most extensive collections of bryophytes on Haida Gwaii has been by W.B. Schofield and were carried out from 1961 to 1985 resulting in over 12,000 specimens now housed at the University of British Columbia (UBC) Herbarium. Since the late 1980s, Dr. W.S. Hong, has undertaken extensive collecting of liverworts resulting in over 2,300 specimens which are maintained at the University of Great Falls Herbarium, Montana as well as the Royal British Columbia Museum and Gwaii Haanas National Park Reserve and Haida Heritage Site.

AREA DESCRIPTION

Haida Gwaii encompasses over 300 islands ranging from 50 to 130 km offshore of mainland British Columbia. The largest islands are Graham Island and Moresby Island. Other large islands include Louise Island, Lyell Island, Burnaby Island and Kunghit Island. In total, the archipelago makes up approximately 1 million hectares.

The marine transgression and glacial history of Haida Gwaii are the basis of a long standing "glacial refugium" hypothesis and Haida oral history proposing that extensive areas of Haida Gwaii were ice free during past glacial periods (Josenhans et al. 1997). Ice-free nunataks (ice-free rocky peaks) existed at sites such as Mount De La Touche on the northern boundary of Gwaii Haanas (Heusser 1989). Coastal refugia are also suspected at several locations (Clague 1989). More recent research indicates that lower sea levels would have resulted in exposure of vast areas now submerged in the shallow Hecate Strait (Fedje 1993; Josenhans et al. 1995).

The evidence for a refugium in Haida Gwaii is summarized in Byun *et al.* (1999) and its primary argument includes the presence of endemic and disjunct taxa. While much of the biota now present arrived post-glacially from the continent by various dispersal mechanisms, Haida Gwaii is host to a significant number of endemic fauna and flora including several bryophyte species. These taxa could not have evolved their distinct characteristics in the short post-glacial period, and must have been isolated in refugia during the late Wisconsin glaciation. There are also several disjunct species that would have previously had a large global distribution, but now have a fragmented distribution and are found only in scattered sites that experienced ice-free conditions during the last glaciation (Schofield 1989). Paleobotanical investigations across Haida Gwaii indicate that lowland glaciation was over 14,000 to 15,000 YBP (years before present) ago (Warner et al. 1984; Mathewes 1989; Fedje 1993). Cold tundra-like conditions ensued. Approximately 10,000 YBP, the climate moderated to conditions warmer and drier than today. By about 7,500 YBP, a warm moist climate was re-established. This was followed by a cool moist period (approximately 5,000 YBP), which is present today.

Description of the present day climate for the region is based on Environment Canada climate normals (Environment Canada, 1998) for Sandspit and Cape St. James. The rugged and complex topography on the

archipelago results in considerable variability in local climate although some general trends can be observed.

The Queen Charlotte Ranges provide a significant rain shadow effect on the leeward eastern side of the archipelago, resulting in a generally drier local climate characterized by a warm, moderately wet to dry spring and summer followed by a very wet fall and a cool rainy winter. Mean temperatures are 11.4°C in summer and 4.8°C in winter. Mean annual precipitation is 1,359 mm, with 95% falling as rain. The very wet rainy season (October -December) makes up 41% of the annual mean. Snow pack along the coast is usually ephemeral in nature, but can be significant at higher elevations. Wind is also a significant climatic factor in the region.

The windward west coast is characterized by the moderating effect of the Pacific Ocean. Mean annual summer and winter temperatures of 11.1°C and 7.8°C, respectively. The orographic effect of the Queen Charlotte Ranges results in regular cloud and fog cover and precipitation is high throughout the year. Monthly precipitation in winter and summer is 167 mm and 98 mm respectively. Mean annual precipitation is 1,542 mm, with 96% falling as rain. Some locations have considerably more rain for example, at Tasu Sound (Figure 1), 4,218 mm of annual rainfall have been reported (Green and Klinka 1994). As well, winds are significantly stronger in this region.

There is considerable variety in terrain, from the lowlands of eastern Graham Island - mainly situated on sandy deposits, to the hills and mountains of much of the western spine of the islands. This higher terrain has considerable variety of rock-types, of particular importance in determining the bryoflora. Three ecosections are recognized (Demarchi 1996) which coincide, more or less, with the subzones of the Coastal Western Hemlock biogeoclimatic zone described by Krajina (1965), Pojar et al. (1987) and Green and Klinka (1994). The Very Wet Hypermaritime Coastal Western Hemlock (CWHvh) subzone represents the windward west coast, and is dominated by boggy woodlands. The Wet Hypermaritime Coastal Western Hemlock (CWHwh) subzone represents the leeward eastern side of the archipelago and is the proverbial coastal temperate rainforest dominated by large hemlock, spruce and cedar trees. The Queen Charlotte Lowlands and Skidegate Plateau ecoregions are contained within the CWHwh and the Windard Queen Charlotte Ranges ecoregions are contained within the CWHvh as well as the subalpine and alpine zones (described below). The physiographic regions divide the archipelago longitudinally in a Northwest to Southeast orientation (Figure 2). The Queen Charlotte Lowlands is represented on Northeast Graham Island. The Skidegate Plateau and the Windward Queen Charlotte Ranges extend further south and are represented in Gwaii Haanas.

The subalpine Mountain Hemlock zone occurs above the CWHwh and CWHvh subzones, usually at elevations above 550 to 600 m. The climate of this area is typified by cool, wet summers and very wet, cold winters. Colder temperatures result in snow pack lasting into mid summer. At elevations above 650 m, the Alpine Tundra zone may occur although zonal boundaries are highly variable. This zone does not reflect true alpine climate (wide temperature extremes, short frost-free periods) but has been described as "oceanic alpine" (Banner et al. 1983) and is characterized by heavy precipitation, deep, wet and long-lasting snow pack and exposure to high winds and cool, humid air. Both of these high elevation zones are limited in their extent on Haida Gwaii. The larger peaks are concentrated on north central Moresby Island and southern Graham Island with 45 peaks over 1,000 m. The highest peak (Mount Moresby) reaches 1,164 m and the highest in Gwaii Haanas

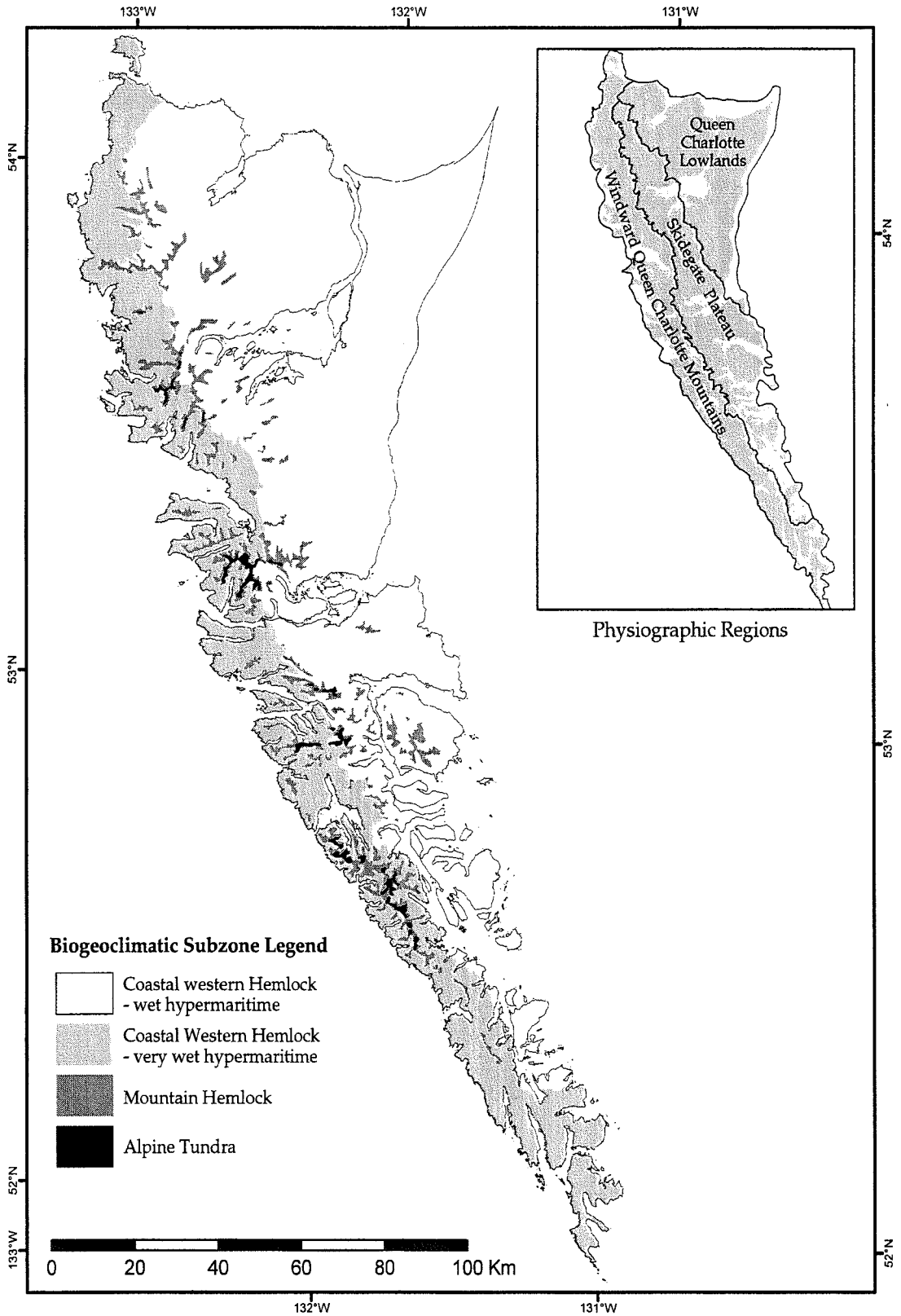


Figure 2. Biogeoclimatic subzones recognized on the Haida Gwaii archipelago. The inset map depicts the physiographic regions (ecoregions). These boundaries have been derived by the British Columbia Provincial Government.

(Mount De La Touche) is 1,118 m. Table 2 summarises the spatial extent of the biogeoclimatic zones across the archipelago.

Table 2. Summary of biogeoclimatic units on Haida Gwaii. Zones are expressed in hectares (ha) and relative extent (percent of the total area).

Biogeoclimatic Unit	Area (hectares)	Area (% Total)
Coastal Western Hemlock - wet hypermaritime	639,197	64
Coastal Western Hemlock - very wet hypermaritime	305,201	30
MountainHemlock	52,751	5
Alpine Tundra	9,908	1
Total	1,007,057	100

METHODS

This review was based solely on existing information and did not involve any field surveys. We started with the Haida Gwaii database records from the UBC Herbarium and added accessable records from five other collections as listed in Table 3. In addition, a number of non-herbarium records were considered from Banner and Pojar (1983), Cannings (1975), Hong (1993, 1995, 1999, 2002A, 2002B), Lewis (1982), Oikos Ecological Services Ltd. (1998), Ryan (1996), Schofield (1972, 1976, 1988B, 1992), Schofield and Hong (2002), and Vana and Hong (1999).

Table 3. Numbers of specimens according to bryophyte collections used in this report.

Bryophyte Collection	Specimens
University of British Columbia (UBC)	11,015
Dr. W.S. Hong Collections (H)	1,488
Royal British Columbia Museum (BCM)	952
New York Botanical Garden (NYB)	787
Sweden Natural History Museum (SM)	174
University of Washington (UW)	46

A relational database with several tables, as outlined below, was created in support of the analysis presented in this report. The relational tables in the database include:

- **Taxonomic table**: This table contains scientific names, authorities, synonyms and higher taxonomic associations (Family, Group: moss or hepatic). In creating the table we adopted the nomenclature recommendations of Schofield and Hong (2002). Nomenclature used in the forgoing report is based mainly on Anderson *et al.* (1990) for the mosses, Anderson (1990) for *Sphagnum* and Stotler and Crandall-Stotler (1977) for the liverworts. Major exceptions based on publications that have appeared since these checklists were compiled include the following: *Apotreubia hortonae* (Schuster and Konstaninova 1995); *Bryolawtonia vancouverensis* (Norris and Enroth 1990); *Buckiella undulata* (Ireland 2001); *Calycularia* (Davison and Smith 1992); *Campylopus japonicus* (Frahm 1993); *Dendrobazzania griffithiana* (Schuster and Schofield 1982); *Ditrichum flexicaule* (Frisvoll 1985); *Eremonotus myriocarpus* (Godfrey and Schofield 1979); *Jungermannia evansii* (Vana and Hong 1999); *Jungermannia schusterana* (Godfrey and Godfrey 1979); *Kurzia trichoclados* (Hong 1988B); *Meiotrichum lyallii* (Merrill 1992); *Nardia japonica* (Godfrey 1977); *Racomitrium heterostichum* (Frisvoll 1988); *Scapania ornithopodioide* (Schofield and Crum 1972); *Schistidium* (Blom 1995); *Schofieldiella* (Buck 1997); *Sphagnum pacificum* (Flatberg 1989); *Sphagnum rubiginosum* (Flatberg 1993); *Takakia* (Smith and Davison 1993); *Thuidium assimile* (Touw 2001).

- **Taxa by source table**: This table lists all bryophyte taxa according to any publication or collection that lists those taxa as occurring in Haida Gwaii. This database contains over 3,600 records and provides a "crude" checklist and literature review of bryophytes for Haida Gwaii.

- **Voucher specimen table**: This table contains bryophyte records of taxa that are backed up by the existence of a specimen. Each record in this table typically contains detailed information such as collector, habitat, collection date, and collection location. The records for this table were obtained from Hong's specimen list held at Gwaii Haanas and from databases maintained by the UBC Herbarium, the Royal British Columbia Museum, the New York Botanical Garden, the University of Washington Herbarium and the Sweden Museum of Natural History.

- **Voucher location table**: This table contains latitude/longitude coordinates for the voucher specimen records. The coordinates were created based on the location description of voucher specimens. Information in this table allows the specimens to be mapped based by taxonomic groupings. The accuracy of the locations was less than +/- 500 metres with a few exceptions, but this accuracy is considered acceptable for the scale of analysis performed in this report. To avoid duplicate locations, voucher locations in close proximity were treated as a single location (see Figure 3).

- **Habitat table**: This table lists taxa according to their characteristic habitats. The habitat descriptions and the assignment of taxa to these habitats are based on the analysis of Schofield and Hong (2002).

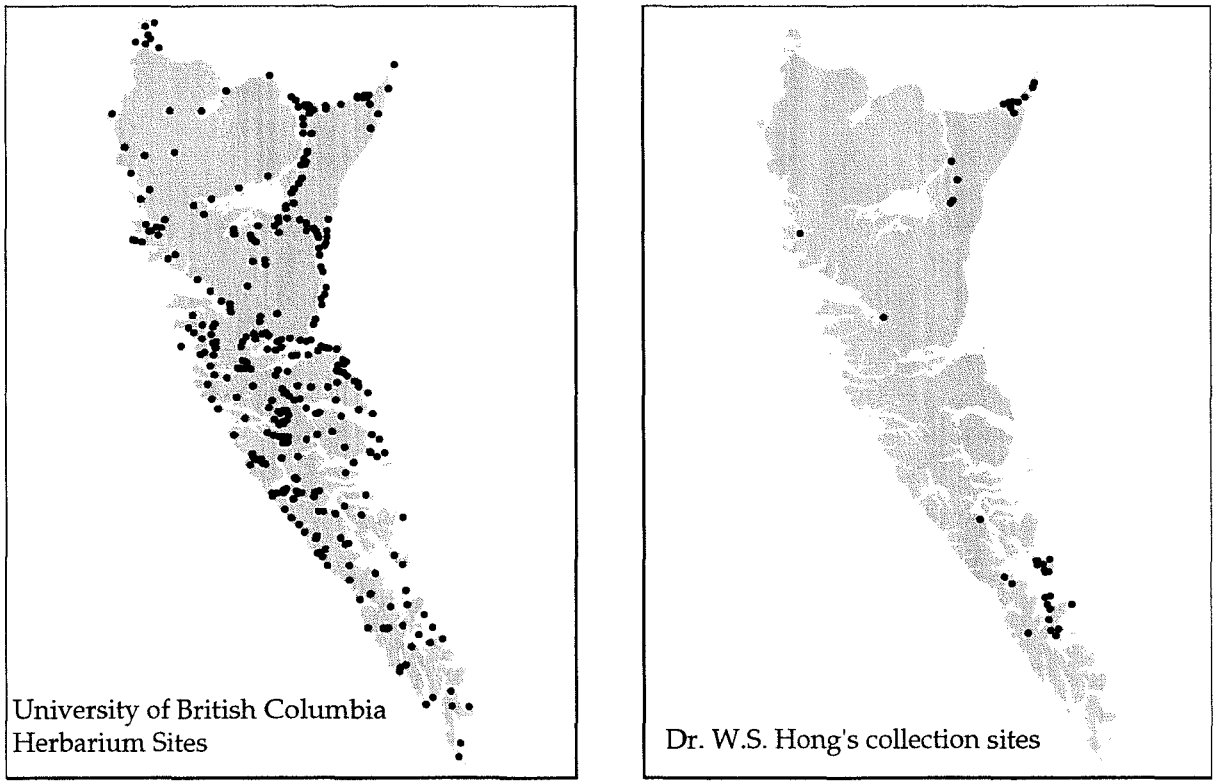


Figure 3. Locations of Haida Gwaii bryophyte collections used in this report.

- **Geographic element table**: This table lists taxa according to their biogeographical distributions. The biogeographical categories are based on Schofield and Hong (2002) and the assignment of taxa to these categories is based largely on Schofield and Hong (2002). However much additional biogeographical information was added from other sources, including the "Bryophyte Flora of North America" (http://ridgwaydb.mobot.org/bfna/bfnamenu.htm). This web site presents provisional, peer-reviewed treatments of bryophytes, before eventual publication as chapters in bound volumes of the "Flora of North America" by Oxford University Press.

- **Status table:** These tables list British Columbia Conservation Data Centre tracking list information for mosses and the "provisional list of hepatics potentially at risk".

Based on the database outlined above it was possible to create range maps for species of interest and to geographically overlay the information with other information such as physiographic ecosection. For each physiographic element, the geo-referenced sample points were analysed to determine the number of species that occur in each element. A 250 meter buffer was used to recognize the imprecise nature of these boundaries. Species within this buffer were assigned to each adjacent element. In addition to the database described above separate map files were created to illustate the distribution of species beyond Haida Gwaii (*e.g.* disjunct distributions). These range maps were reproduced using GIS software but are based on previous published maps and information provided in Schofield and Hong (2002).

BRYOPHYTE DISTRIBUTION

BRYOPHYTES WITHIN A GLOBAL BIOGEOGRAPHIC CONTEXT

The geographic ranges of bryophytes are controlled primarily by climate and historical circumstances. The majority of bryophyte species on Haida Gwaii are non-disjunctive, Holarctic (widespread arctic and boreal) species and are now widespread on terrain that was fully glaciated during the last glacial period. These species likely survived south of the glacial maxima to colonize northern North America post-glacially. The remaining disjunctive or endemic distributions are, for the most part, restricted to specific climatic regions that have likely been interconnected in the distant past and are now markedly disjunct. These distributions are of interest because they offer insight into the vegetation history of the area and highlight species and/or habitats that may be of particular conservation interest.

The physical isolation and geographic history of Haida Gwaii has considerably influenced the structure of the bryoflora. Spores of bryophytes have potential for ready dissemination over wide distances to facilitate colonization. However, it is more likely that the available time for continuous colonization is a major determinant of the flora. The endemic and disjunct species of Haida Gwaii are extremely inefficient in reproduction with very few producing sporophytes or readily dispersible vegetative diaspores (Schofield 1989). These species are also found mainly at or near regions that have escaped the most harsh extremes of the last glaciations (Schofield 1988a).

Unglaciated refugial areas existed but were not large, as emphasized by Sutherland Brown and Nasmith (1962). Although bryophyte fossil evidence is incomplete, evidence of widespread vascular flora extinctions occurs in conjunction with Pleistocene glaciation. It is likely that many

bryophytes were also associated with this vegetation although it is apparent that many bryophytes survived this period in glacial refugia along the Pacific coast with a high number occurring on Haida Gwaii (Schofield 1984, 1988a). Based on the affinities of the bryoflora as well as the presence of highly distinctive endemics, these refugia were sufficient to sustain numerous bryophyte species. It could be argued that these distributions are an artifact of incomplete sampling although sampling on the archipelago (and to a lesser extent the adjacent region) has been extensive over the past 40 years. By comparison, in areas of Europe that have been thoroughly explored, disjunctive patterns have been maintained even as knowledge has increased (Schofield and Crum 1972).

The humid temperate climate of the archipelago is especially conducive to a rich bryophyte cover since air-borne moisture is the main water source for bryophytes. Similar conditions in Northern and Southern Hemispheres produce bryophyte vegetation of similar lushness (Schofield 1989). High numbers of endemic and disjunct species now occupy habitats that would have been available during Pleistocene time and have likely occupied these habitats throughout.

The bryoflora of Haida Gwaii can be segregated (with some overlap) into seven geographic elements, each of which is described below and summarized in Table 4. The subtitles in this section are followed by a number, or numbers, which corresponds to an index number used in Appendices A and B. Appendix A, therefore, contains a column indicating the distribution of taxa according to the geographic elements listed below. Alternativley, Appendix B lists the taxa known to occur within each geographic element. The geographic elements are summarized mainly from Schofield and Hong (2002); other sources used are listed in Appendix A.

Table 4. Summary table noting number of species in each geographic element, as listed in Appendix A. These are "minimum" numbers as not all taxa listed in Appendix A have been evaluated.

Geographic Element	Mosses	Liverworts
Widespread in Northern Hemisphere	172[1]	116[1]
Amphi-pacific	30	18
Western Europe - Western North America	17	5
Western Europe - Western North America (interrupted)	20	16
Tropical - Sub-tropical	7	9
Eastern North America Disjuncts	3	0
Western North America	49	13
Pacific Coast	10	15
Haida Gwaii contains only known Canadian population	13	3
Haida Gwaii endemic	4	1
Not Classified	92	9

1 Schofield and Hong (2002) state that there are 231 mosses and 118 hepatics in this category, but do not list the taxa.

Northern Hemisphere (1)

Species widespread in the Northern Hemisphere form over 60% of the Haida Gwaii bryophyte flora. This includes at least 231 species of mosses and 118 species of liverworts (Schofield and Hong 2002). In Appendix A, we have identified 172 mosses and and 116 liverworts as belonging to this element. However, 92 mosses and 11 liverworts remain to be evaluated and it is likely that most of these belong within this category.

Amphi-Pacific (2)

These species may extend from the Pacific coast of North America via the Aleutian Islands to SE Asia. In a few cases they occur also on the Atlantic coast of North America. There are 30 species of moss and 18 liverworts recognized in this geographic element. Example distributions of eight species are illustrated in Figure 4.

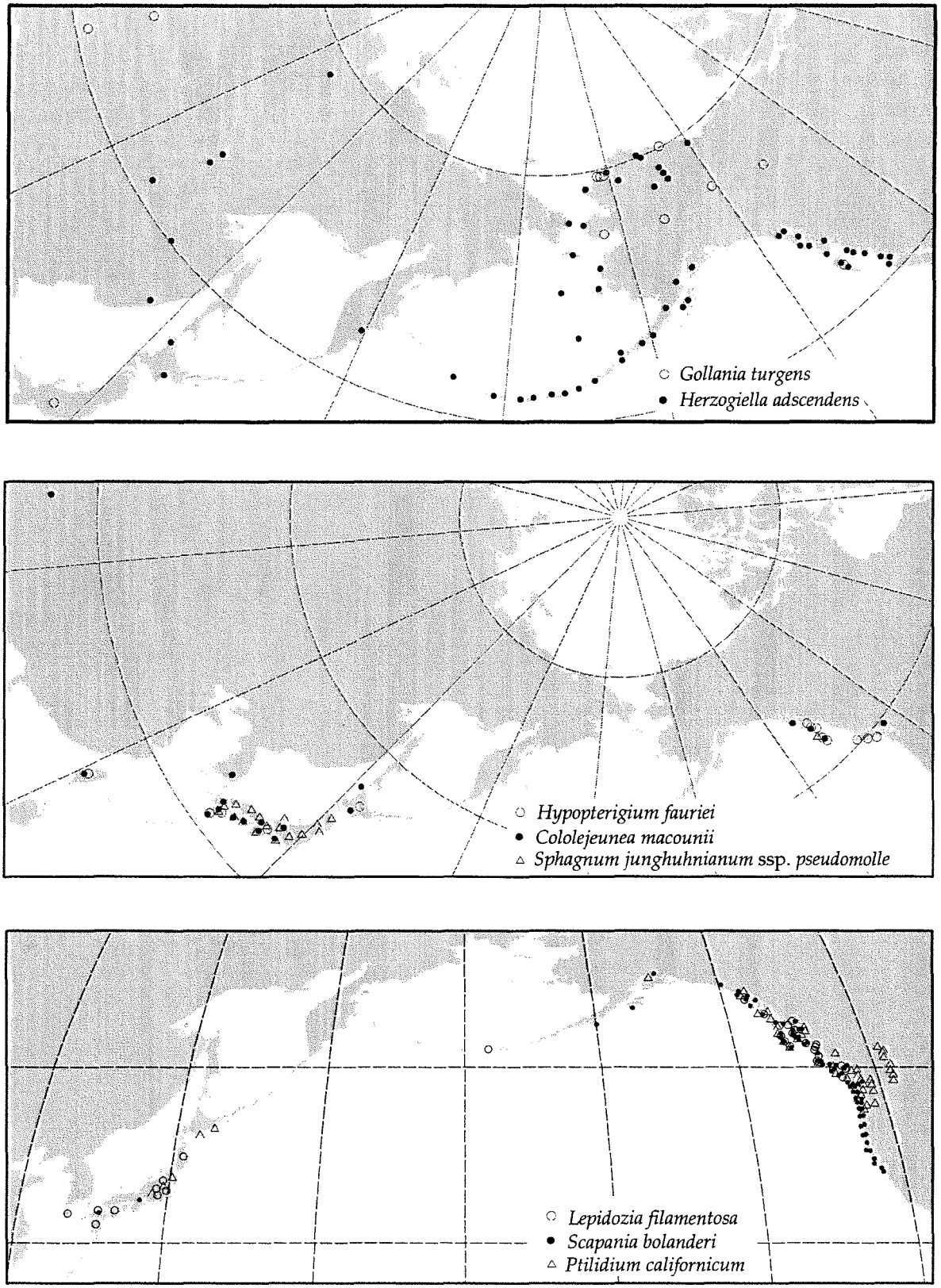


Figure 4. Ranges of selected bryophyte taxa with Amphi-Pacific distribution (Schofield and Hong 2002).

Western European – Western North American (3, 4)

Although the history of these disjunctures is difficult to assess, these species may represent an ancient flora dating back to the late Mesosoic and early Cenozoic. These eras precede the Laurasian continental mass breaking up into the eastern and western hemispheres (Europe and North America) being separated by the Atlantic Ocean. Additional isolating mechanisms may relate to subsequent climatic and geographic changes, in the presence of the inland seas of the Cretaceous or the development of the Cordilleras isolating eastern and western North America (Schofield 1988b). Given these conditions, it has been speculated that the oceanic bryoflora now present in western North American could have once extended across the northern portion of the palaeocontinent of Laurasia connecting northern European and North American ranges (and in some cases, extending east into the mountains of Asia). Then, after continental separation, these taxa were distributed southward along the European Atlantic coast and Pacific North America (Schofield 1988b).

This element reflects disjunct distributions and is well represented in Haida Gwaii. Among these species, a high proportion exists in very high precipitation areas, although a few are mainly found in Mediterranean climates. There are 17 mosses and 5 hepatic species known to occur on Haida Gwaii from this element. An additional 20 moss species and 16 liverworts clearly show wide disjunctions in distribution. These species are usually widespread in Western Europe and Western North America, but show a widely interrupted pattern in the northern hemisphere. Examples of these distributions are illustrated in Figure 5 and 6.

Tropical-Sub-tropical Flora (5)

The following genera are best represented in the tropics. Schofield and Hong (2002) suggest that species of the Haida Gwaii flora (7 mosses and 13 liverworts) are persistent derivatives of an ancient tropical-subtropical flora once widespread on these islands. Although the vascular flora from this element vanished millions of years ago, some bryophytes survived: *Brotherella, Ctenidium, Daltonia, Gollania, Hypopterygium,* and *Wijkia* among the mosses and *Apotreubia, Chandonanthus, Cololejeunea, Herbertus, Mastigophora,* and *Pleurozia* among the liverworts. Most of these are represented by a single species on Haida Gwaii, several of which are endemic.

North America

Species confined to North America include those that are widely distributed in western North America, those endemic to *Haida Gwaii* and a very few species of mosses that are found also in eastern North America.

Eastern North American Disjuncts (6)

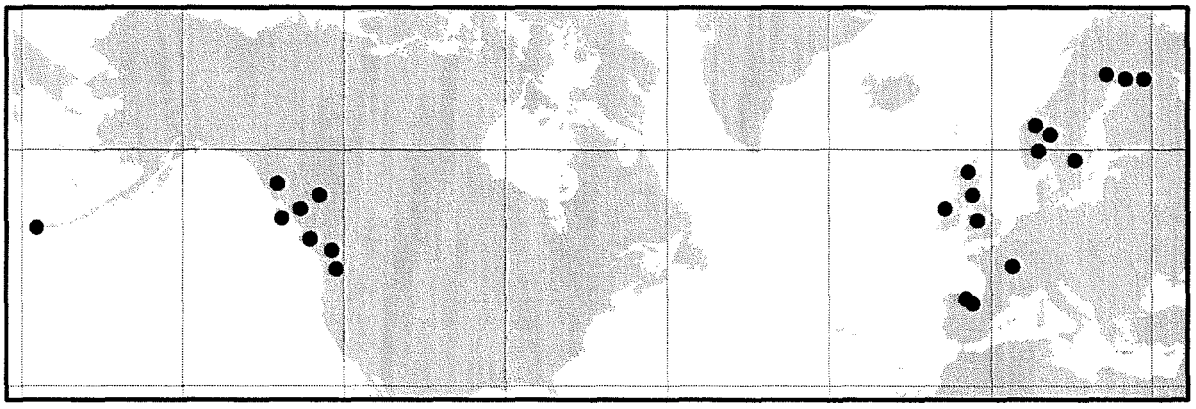
The eastern North American species are: *Bryum miniatum, Heterocladium macounii* and *Trematodon montanus*. The distribution of *Trematodon montanus* is described by Belland and Brassard (1983) as being restricted to Van Inlet on Haida Gwaii and the "Big Level" area of Newfoundland (Figure 7). The British Columbia distributions of all three species and their disjunct nature are described in Schofield (1992).

Western North America (7)

The Western North America wide endemic pattern presents an impressive proportion of this element as represented in North America. Most of these species are widely distributed in Pacific North America and many are frequent components of the vegetation. This element is represented by 50 mosses and 13 liverwort species. Examples of these distributions are illustrated in Figure 8. Anomalous

Andreaea megistopora

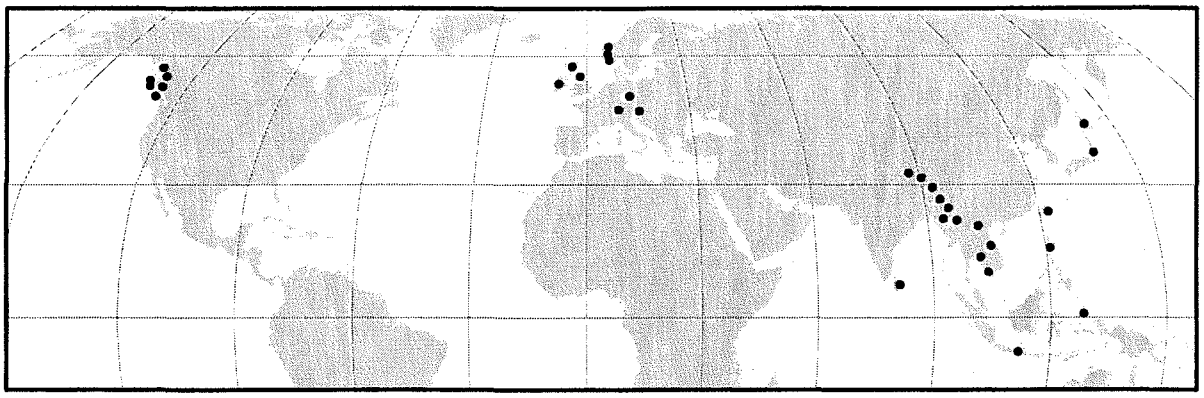
Crumia latifolia



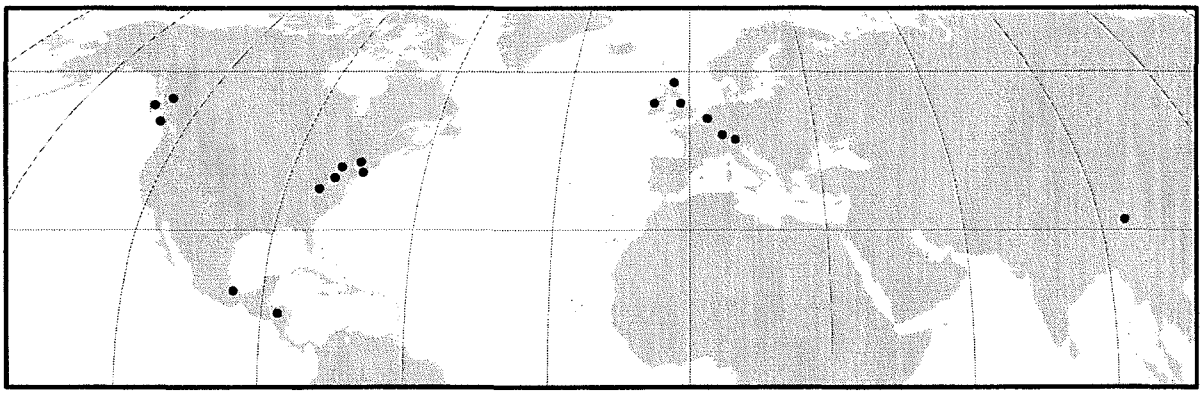
Ditrichum zonatum

Figure 5. Ranges of selected bryophyte taxa with western European - western North American disjunction and showing a highly interrupted pattern in the Northern Hemisphere (Schofield and Hong 2002).

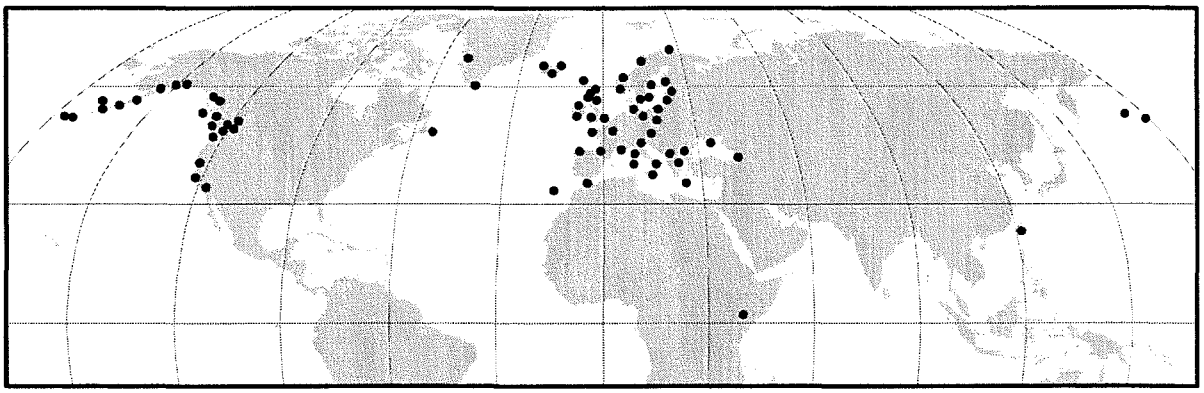
distribution patterns can be noted for *Claopodium bolanderi* and *Rhytidiopsis robusta,* two of the species illustrated in Figure 8. These interior distributions reflect the wet belt (Interior Cedar-Hemlock biogeoclimatic zone) found in Southeastern British Columbia.



Dicranodontium uncinatum



Schofieldiella micans



Antitrichia curtipendula

Figure 6. Ranges of selected bryophyte taxa with Western European - Western North American disjunction and showing a highly interrupted pattern in the Northern Hemisphere (Schofield and Hong 2002).

Pacific Coast (8)

There are 10 mosses and 15 liverworts restricted, in North America, mainly to Haida Gwaii with occasional outlying populations in coastal British Columbia or Alaska. This group includes groups "9" and "10" listed below. Those species that show a wide global distribution are confined primarily to very oceanic climates, or to wet mountain climates.

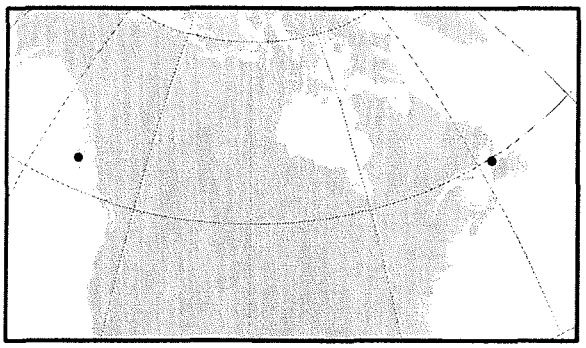


Figure 7. The two locations in Canada from which *Trematodon montanus* has been reported (Belland and Brassard 1983).

Canadian populations restricted to Haida Gwaii (9)

Those species for which Haida Gwaii has the only known Canadian population are listed in Table 5. This includes five Haida Gwaii endemics (see next section), eight from the Pacific Coast element, one from the Amphi-pacific element, and two from the Western North America element.

Table 5. Species of bryophytes for which Haida Gwaii has the only known Canadian population. Bryophyte species considered endemic to Haida Gwaii are shown in bold. Specific epithets shown in quotations indicate that the name is provisional pending formal publication.

Mosses
Andreaea mutabilis
Brotherella "haidensis"
Campylopus japonicus
Claopodium pellucinerve
Daltonia splachnoides
Heterophyllium "haidensis"
Paraleptodontium recurvifolium
Seligeria careyana
Sphagnum junghuhnianum var. *pseudomolle*
Sphagnum kenaiense
Sphagnum wilfii
Wijkia carlottae
Zygodon gracilis
Liverworts
Dendrobazzania griffithianum
Herbertus "haidensis"
Radula auriculata

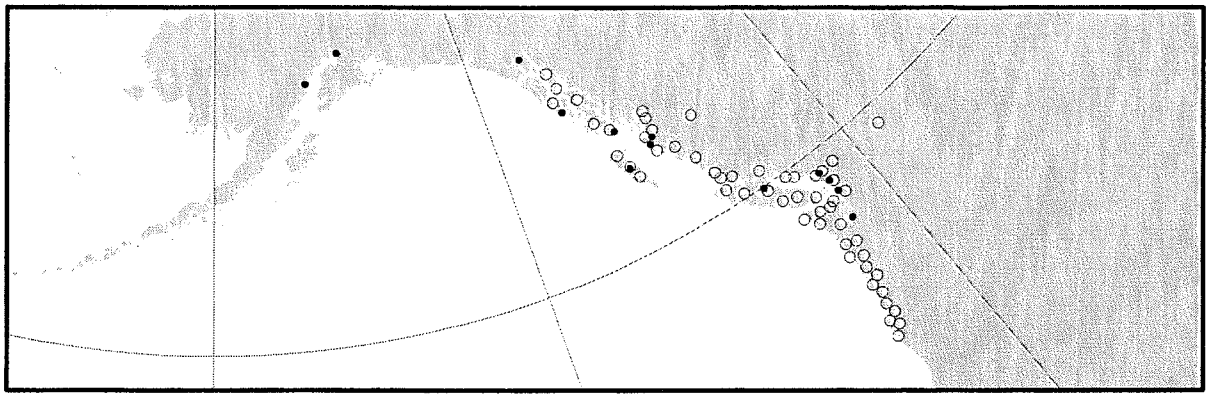
Haida Gwaii (10)

Bryophyte species endemic to Haida Gwaii are all either terrestrial or epilithic in non-forested habitats with the exception of *Seligeria careyana* which is confined to humid limestone cliffs (Vitt and Schofield 1976; Schofield 1989). The five species considered endemic to Haida Gwaii (as far as is known) are listed in Table 5 in bold print. A number are provided with provisional names because they have not been formally published.

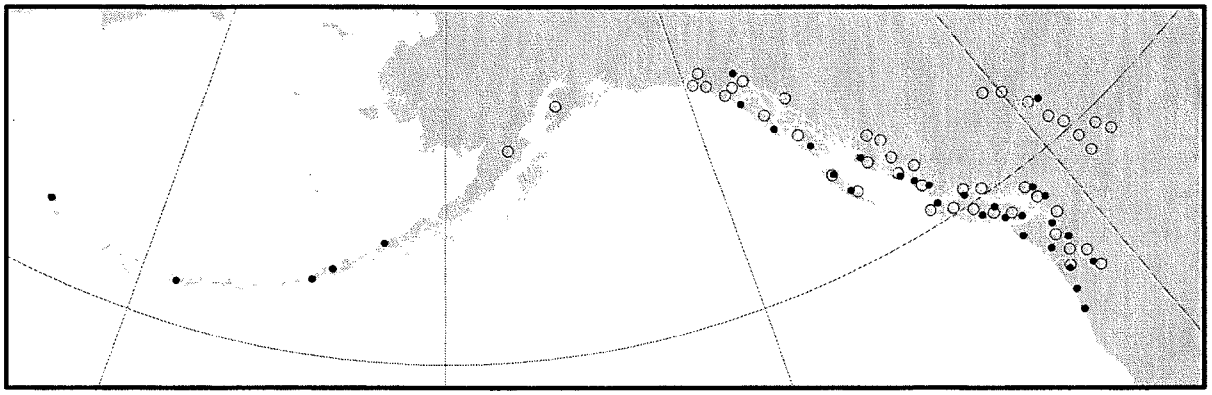
BRYOPHYTES WITHIN THE PHYSIOGRAPHIC ELEMENTS OF HAIDA GWAII

Within the archipelago, general bryophyte distribution patterns follow physiographic ecosection units (figure 2), but are strongly controlled by differences in precipitation. For the puposes of this discussion, the Skidegate Plateau has been subdivided into the eastern plateau, which exhibits a relatively drier climate, and the upper plateau, which is more similar to the Queen Charlotte Ranges in terms of precipitation and overall climate.

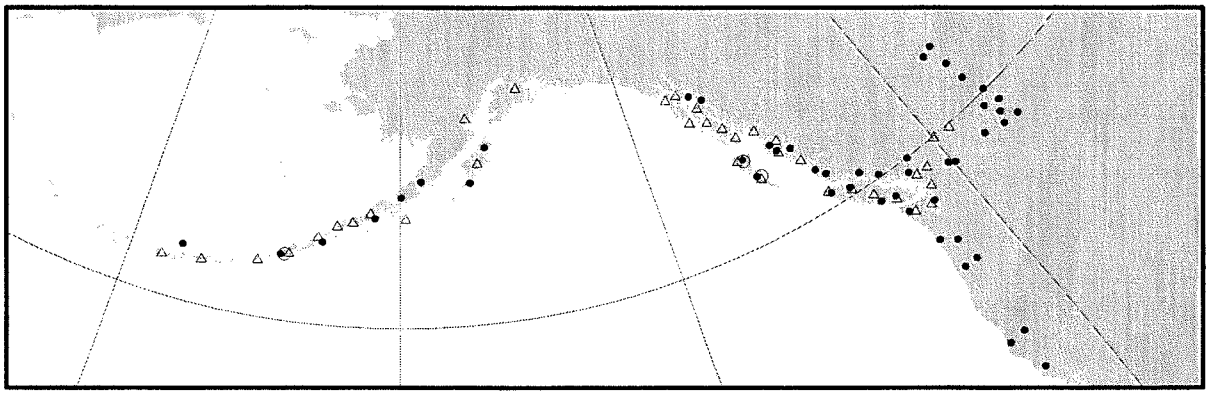
The submontane forests exhibit extraordinary floristic richness. Abundant epiphytes are common on many tree species and shrubs and the forest floor is often carpeted with thick continuous mats. Liverworts commonly flourish as epiphytes and also on dead and decaying wood (Schofield 1988a; Peck et al. 1995; Glime and Hong 2002). At the highest elevations, bryophytes are an important component of the alpine plant communities, in habitats often unsuitable for many vascular plants, playing an important role in soil genesis and community succession (Schofield 1988a). Bryophytes are frequently found on rocky outcrops and seepage areas but are also known to occur in heath or herb dominated communities. Many species extend to lower elevations into subalpine mountain hemlock forests and forest openings. Within the subalpine forests,



Schofieldia monticola (•), *Porella navicularis* (○).



Gyrothyra underwoodiana (•), *Rhytidiopsis robusta* (○).



Claopodium bolanderi (•), *Pseudoleskea baileyi* (Δ), *Ctenidium schofieldii* (○).

Figure 8. Ranges of selected bryophyte taxa with western North America-wide endemic distribution (Schofield and Hong 2002).

bryophytes can form considerable cover. In all zones, there is a strong oceanic influence with mild temperatures and high moisture resulting in a rich and diverse bryoflora. Each physiographic region is described below. A summary of species distributions across physiographic regions is presented in Table 6.

Queen Charlotte Lowlands

The Queen Charlotte Lowlands region is located on northeastern Graham Island (Figure 2) and is underlain by marine sediments (sands and gravels) through much of its extent. The vegetation is represented by the most extensive peatland on the islands, as well as coniferous forest.

Table 6. Summary of species diversity across the three physiographic regions found on Haida Gwaii. These numbers should be considered representative rather than exact as they are dependent on the locational accuracy of bryophyte collections sites and physiographic region boundaries.

Ecosection	Mosses	Liverworts
Queen Charlotte Lowlands	190	86
Skidegate Plateau	320	135
Windward Queen Charlotte Ranges	323	154

Table 7. Mosses known to occur predominantly in the Skidegate lowland bog woodlands. Liverworts are not listed as all liverworts are found in this habitat type.

Aulacomnium androgynum
Buxbaumia piperi
Discelium nudum
Drepanocladus aduncus
Fissidens limbatus
Funaria hygrometrica
Pohlia columbica
Pohlia longibracteata
Schistostega pennata
Tayloria serrata
Tortula ruralis

There are also many lakes and ponds. In total, 190 species of moss and 86 liverworts have been observed in the lowlands. The mosses are found primarily in the extensive peatlands, thus *Sphagnum* is the predominant genus represented by 15 species. In addition to these are 11 moss species known to occur in wet forests and associated habitats (Table 7). Figure 9 illustrates 3 examples of species which are more or less restricted to the lowland region. Although present, none of the liverworts are considered unique to this region.

Eastern Skidegate Plateau

The Skidegate Plateau is transitional between the lowlands and the mountainous Queen Charlotte Ranges (Figure 2). The southern portions of the Plateau, especially around the eastern portion of Skidegate Inlet, and extending in a band along the east coast southward toward (but excluding) Kunghit Island possesses a drier climate, a rain-shadow effect of the windward mountains. It is in this southern portion of the plateau that several bryophytes reach their near northern distribution limit in Pacific North America (Table 8). Most species in this group are frequently

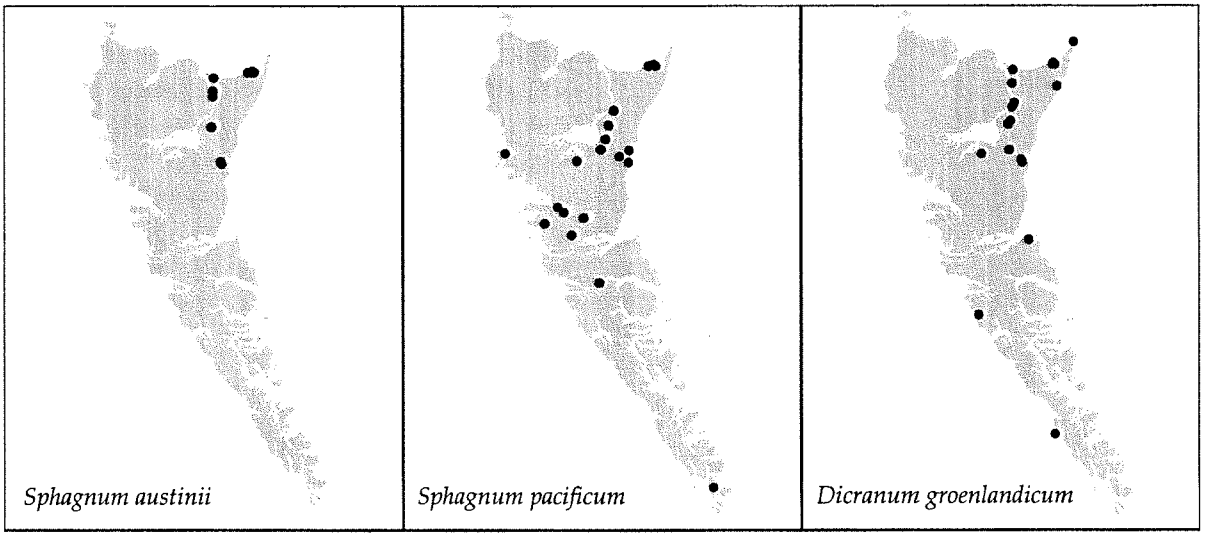


Figure 9. Distributions of three selected bryophyte species known to occur mainly in the Queen Charlotte Lowlands of Haida Gwaii (Schofield and Hong 2002).

Table 8. Bryophyte species known to be at or near their northern distribution limit in Pacific North America.

Mosses
Amphidium californicum
Anacolia menziesii
Barbula unguiculata
Bryolawtonia vancouverensis
Claopodium whippleanum
Crumia latifolia
Dicranoweisia cirrata
Hedwigia stellata
Orthotrichum lyellii
Timmiella crassinervis
Tortula muralis
Tortula princeps
Weissia controversa
Liverworts
Frullania franciscana

encountered in the "Mediterranean" climate zone of southwestern coastal British Columbia and extend southward to southern California.

Upper Skidegate Plateau and Queen Charlotte Ranges

The bryoflora of Haida Gwaii has its richest representation in the upper plateau and mountain terrain where diversity of habitats and a highly humid climate favour bryophyte luxuriance. Table 9 represents a partial species list concentrating on the more remarkable species that are so well represented on the islands but are less frequent (or absent) in the remainder of North America. Figure 10 illustrates examples of species which appear to be restricted to this ecoregion. The Queen Charlotte Ranges are topographically complex and logistically difficult to access. It is likely to expect these areas to yield further taxa new to the islands as well as taxa unique to North America.

BRYOPHYTES WITHIN THE COMMON HABITATS OF HAIDA GWAII

Habitat information for bryophytes is limited. However, there are some species for which sufficient information exists to provide general habitat relationships. As more information becomes available, these descriptions could include more species and be more focussed (Schofield 1976). It is useful to assess the bryoflora on the basis of the vascular plant communities or general habitats with which it is associated. Table 10 lists the 16 habitat or vegetation types described with an enumeration of species for each. Each habitat subtitle is followed by a number, which indicates the habitat element index number found in the species list (Appendix A). A complete list of taxa, sorted by habitat element, is also presented in Appendix C. These habitats are very broadly interpreted. A narrower interpretation would probably reveal distinctive patterns embedded within these broadly interpreted boundaries. Each of the habitat types is followed by a reference number cited in Appendix A.

Forests

Bryophytes within the forest often form dense carpets over the humus, on logs, standing trees, rock outcrops and stones. In any given location, the diversity tends to be low even though coverage is high. In the coastal rainforests, several species of moss predominate the landscape such as *Eurhynchium oreganum, Rhytidiadelphus loreus, Buckiella undulatum* and *Polytrichastrum alpinum.* Dominant hepatic species include: *Rhizomnium glabrescens, Herbertus aduncus, Plagiochila porelloides, Scapania bolanderi,* and *Conocephalum conicum.*

Although forests occupy a high proportion of Haida Gwaii, and contribute substantially to the biomass of bryophytes on the islands, they show relatively low bryophyte diversity on the forest floor. In comparison, undisturbed forests contain the

Table 9. Bryophyte species of interest (Schofield and Hong 2002) occurring on the Skidegate plateau and windward Queen Charlotte ranges physiographic regions.

Mosses	Liverworts
Andreaea mutabilis	*Anastrepta orcadensis*
Andreaa sinuosa	*Anastrophyllum assimile*
Bartramiopsis lescurii	*Anastrophyllum donianum*
Brotherella "canadensis"	*Apotreubia hortonae*
Brotherella "haidensis"	*Bazzania pearsonii*
Camphylopus schwarzii	*Calycularia crispula*
Claopodium pellucinerve	*Chandonanthus hirtellus*
Ctenidium schofieldii	*Cololejeunea macounii*
Daltonia splachnoides	*Dendrobazzania griffithiana*
Dicranodontium asperulum	*Diplophyllum imbricatum*
Dicranodontium subporodictyon	*Diplophyllum plicatum*
Dicranodontium uncinatum	*Douinia ovata*
Didymodon nigrescens	*Eremonotus myriocarpus*
Ditrichum zonatum var. *scabrifolium*	*Gymnomitrion pacificum*
Fissidens aphelotaxifolius	*Haplomitrium hookeri*
Geheebia gigantea	*Herbertus "haidensis"*
Gollania turgens	*Herbertus sakuraii*
Herzogiella adscendens	*Herbertus sendtneri*
Heterophyllium "haidensis"	*Jungermannia evansii*
Paraleptodontium recurvifolium	*Kurzia trichoclados*
Seligeria careyana	*Lepidozia filamentosa* ssp. *subtransversa*
Sphagnum junghuhnianum var. *pseudomolle*	*Marsupella boeckii*
Sphagnum schofieldii	*Marsupella commutata*
Sphagnum wilfii	*Mastigophora woodsii*
Takakia lepidozioides	*Metzgeria leptoneura*
Trematodon montanus	*Plagiochila schofieldiana*
Wijkia carlottae	*Plagiochila semidecurrens*
Zygodon gracilis	*Radula auriculata*
	Radula obtusiloba ssp. *polyclada*
	Scapania ornithopodioides
	Schofieldia monticola
	Sphenolobopsis pearsonii

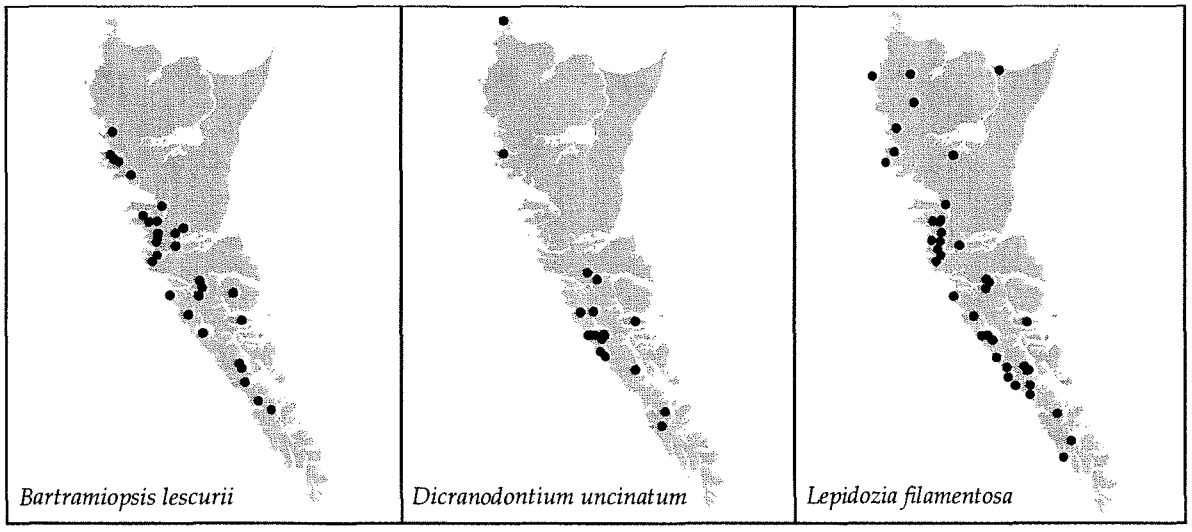


Figure 10. Distributions of three selected bryophyte species known to occur in the Skidegate Plateau and Windward Queen Charlotte Ranges of Haida Gwaii (Schofield and Hong 2002).

Table 10. Summary of species diversity across habitat types found on Haida Gwaii. A more complete listing can be found in Appendix B.

Habitat Type	Mosses	Liverworts
Forest floor	14	8
Large woody debris	7	19
Epiphytes	43	35
Open forest of fen slopes	19	14
Swamp forests	17	6
Peatland bogs	27	14
Peatland fens	26	10
Seaside outcrops	6	2
Sand dunes	18	4
Blowdown (rootmass)	8	7
Disturbed soil	24	6
Aquatic habitats	17	12
Water body margins	45	15
Calcareous rock	43	11
Siliceous rock	59	35
High elevation	35	27
Not classified	124	48

growth if adjacent areas are left for recolonization. Unfortunately opening up the forest floor as well as the disturbance that logging contributes, results in the destruction of the resident bryophytes. Replacement of the forest itself re-creates an environment where the bryophytes can return, but the time period for reaching floristic stability exceeds a century and the diversity of bryophytes is considerably reduced from the original flora (Schofield and Hong 2002). The research needed to document this trend is very long-term, exceeding several human lifetimes. For the purposes of this report, the forest habitats have been subdivided into: 1. Forest floor; 2. Large woody debris (fallen logs); 3. Epiphytic (on other plants) and Epilithic (on rock) habits; and, 4. wet forests and bog woodlands.

Forest Floor Bryophytes (1)

Bryophytes on the floor below a closed forest canopy can form almost continuous carpets. This is a landscape that is recognized commonly throughout Haida Gwaii and may be enhanced in its extent due to the effects of browsing by introduced Sitka black tailed deer. Deer are known to have significantly reduced the herbaceous and shrubby understory in many plant communities on Haida Gwaii (Gaston et al. 2004; Stockton 2004). Fourteen species of moss and 8 species of liverwort are typical or representative of this habitat (Appendix C).

Large Woody Debris (2)

Old growth forests of Haida Gwaii have a high percentage of ground cover as decaying logs and stumps. When these logs and stumps are well decomposed, a number of bryophyte species thrive, including 7 moss species and 18 liverworts (Appendix C). One of these moss species, *Buxbaumia piperi* is considered extremely rare on the islands.

Epiphytic Bryophytes (3)

Bryophyte diversity in the forests increases considerably with addition of the epiphytes on trees and shrubs. Although lichens tend to dominate many ephiphytic communities elsewhere in North America, bryophytes clearly dominate these communities on Haida Gwaii (Glime and Hong 2002). Studies by Peck et al (1995) and Glime and Hong (1997; 2002) presented data on epiphytic bryophytes specifically on conifer species on Haida Gwaii. Glime and Hong (2002) found that three species of hepatic and three mosses dominated the epiphytic cover with liverworts exceeding mosses by a factor of 2.4. The most common observed species, in order of dominance were: *Bazzania denudata, Scapania bolanderi, Frullania tamarisci* ssp. *nisquallensis, Dicranum scoparium, Isothecium myosuroides,* and *Rhytidiadelphus loreus*. These occur most luxuriantly on the lower portion of the tree

trunks, but also on branches and twigs. Cover and diversity tend to decrease upward and is most luxuriant on the lowest meter of the tree bole with terrestrial species dropping out with height (Glime and Hong 2002).

Most species are found on a wide variety of trees but some are species-specific. Also, several species that are normally found elsewhere can be epiphytic in the coastal rainforest (Schofield 1976). Forty-two moss species and 35 liverworts are known to be epiphytic (Appendix C). Of these, one moss, *Daltonia splachnoides*, is particularly rare and red-listed for British Columbia (British Columbia Conservation Data Centre 2003). Two mosses and one hepatic species are known to be folicolous epiphytes (growing on leaves) including *Orthotrichum consimile, O. lyellii and Porella cordaeana* (Vitt et al. 1973) and 30 species (21 mosses and 9 liverworts) are generally epilithic but also known as forest epiphytes.

Wet Forests and Woodlands (4, 5)

In wet fen forest slopes, augmented by seepage, the forest floor bryoflora becomes richer. On these sites, 19 mosses and 14 liverworts are known to occur including 6 species of *Sphagnum*. Swampy depressions, where water persists well into summer, have additional species including 17 mosses and 6 liverworts (Appendix C). In comparison with open bogs and peatlands, swampy habitats show a greater diversity in substrate due to fluctuation in water levels (Schofield 1976).

Open Bogs and Fens (6, 7)

Peatland in the form of extensive bogs are widespread in the Skidegate Lowlands and found intermittently in the other physiographic regions although in much smaller patch sizes. These bogs have their own bryoflora of 27 mosses and 14 liverworts (Appendix C). *Sphagnum* mosses dominate the bogs with *S. austinii* (forming hard rusty hummocks) being dominant in most of the bogs of eastern Graham Island. An additional 14 *Sphagnum* species occur in the bogs with 4 of these also being represented in the wet forest and woodland habitats. Often, other genera that occur are epiphytic or grow on *Sphagnum* peats. Aquatic species can also occur in open peatland pools including *Sphagnum lindbergii* and *S. mendocinum* (Schofield 1976). While the *Sphagnum* diversity may be high in peatlands, overall floristic diversity in is not remarkably high, reflecting the relative uniformity and extreme conditions of this habitat.

Peatland fens are best represented on terraced outcrops, and can occur at all elevations and are often found on steep slopes in the windward Queen Charlotte Ranges and to a lesser extent in the Skidegate Plateau. Twenty-six mosses, including 16 *Sphagnum* species, and 10 liverworts have been identified on these fens (Appendix C).

Shoreline Sites

Seaside Outcrops and Headlands (8)

A few bryophytes are found mainly on seaside outcrops or are restricted to such sites. Some are tolerant of salt spray, while most exploit the sunny sites avoided by other plants. Six mosses and 2 liverworts are known on these habitats (Appendix C). Figure 11 illustrates three examples of bryophytes mainly restricted to seaside habitats.

Sand Dunes(9)

In sand dunes, exemplified by those near the mouth of Tlell River, the stabilized dune slacks (flat-bottomed low areas, close to water table) and the logs embedded in them, bryophytes are important components of the vegetation. In slacks however, a number of mosses can form extensive stands. The bryophytes contribute to the stabilization once they are established by trapping blowing sand while still growing enough to shed it and then

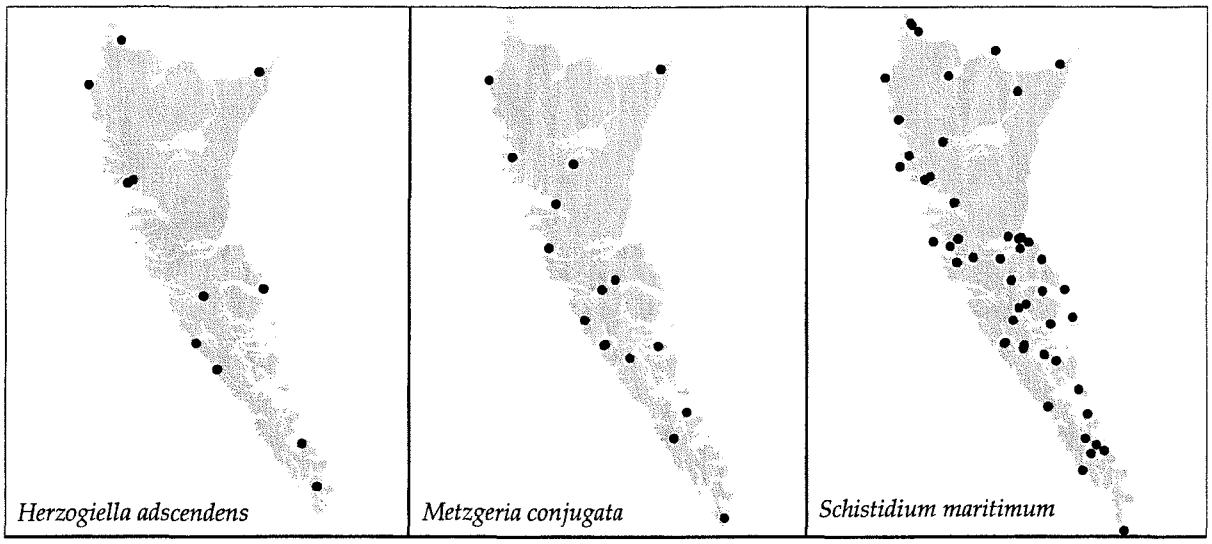


Figure 11. Distributions of three selected bryophyte species known to occur mainly on seaside outcrops (Schofield and Hong 2002).

consolidate the sand. Where spruce trees have become established, the moss cover on the sandy soil can be continuous, dominated by *Eurhynchium oreganum, Rhytidiadelphus loreus, R. squarrosus* and *R. triquetrus*. These habitats are vulnerable to traffic of wheeled vehicles as well as to human walkers. Trampling breaks up the mats and the fragments are blown away, exposing sand to wind erosion. Twelve moss species are known to occur on the active sand dune slacks with an additional 6 species of moss and 4 hepatic species occurring on the more stable sand dune – log complexes (Appendix C). Figure 12 illustrates three examples of bryophytes mainly restricted to stabilized sand dune habitats.

Disturbed Sites

Blowdown (10)

One of the main disturbance regimes in old growth temperate rain forests is windfall. When trees are blown over, the root masses carry earth with it and this forms a habitat for various bryophytes. Eight species of moss and 7 hepatic species are known from this habitat (Appendix C). As the organic and inorganic soil falls from the root mass, the succession of species changes, ultimately leaving a skeletal root system.

Disturbed soil (11)

Disturbed soil is most frequently associated with natural disturbance phenomena such as landslides, avalanches and change in watercourses. In sites exploited for human activities: around habitations, along roadsides, open-pit mines and logging sites the extent of disturbed or open soil can be abundant. Whether natural or human caused, these sites are transitory although the time scale for succession can be considerable. Such sites provide exposed mineral soil available for bryophyte colonization. Twenty-four moss species and 6 liverworts are found frequently on such sites; some are considered rare (Appendix C, D and E).

Aquatic Habitats (12, 13)

Lakes, ponds and watercourses provide habitat for 17 species of moss and 12 species of liverworts of which 5 are from the genus *Scapania* (Appendix C). The wet margins of water bodies, especially those with boulders on lakeshores, and along stream edges and

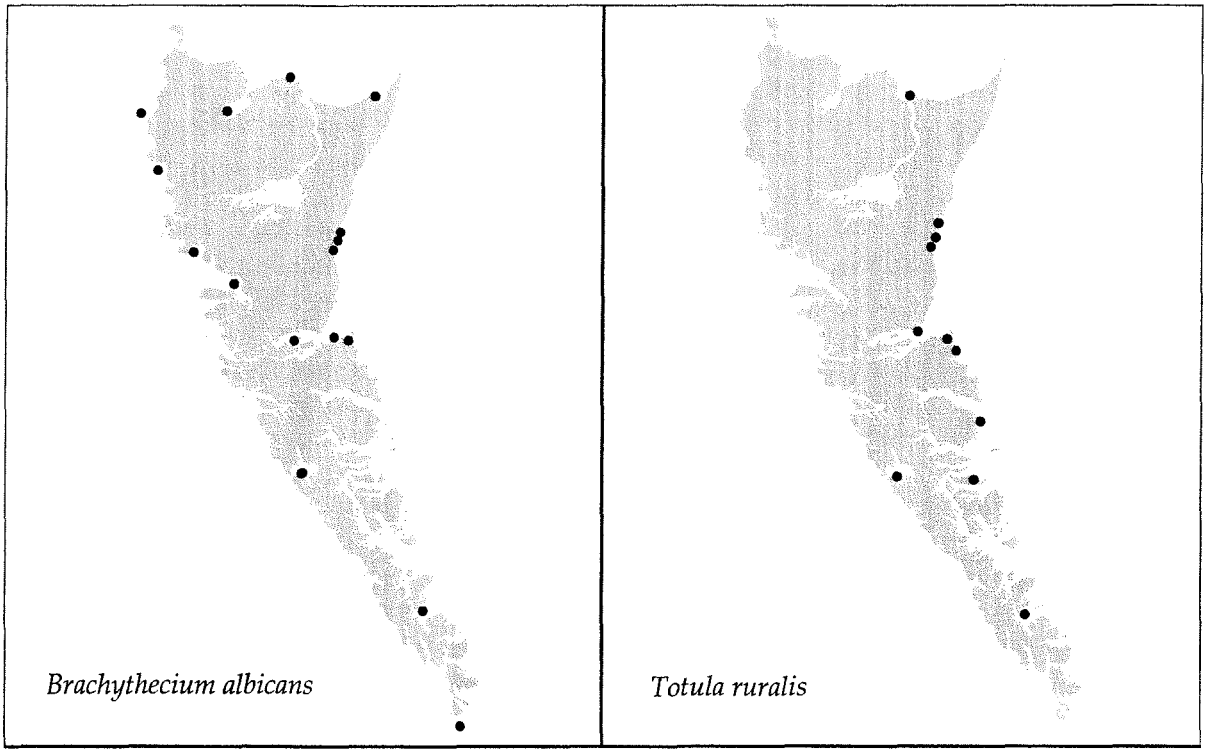


Figure 12. Distributions of two bryophyte species known to occur mainly on stabilized sand dunes (Schofield and Hong 2002).

other watercourses provide likely the richest bryophyte flora (Schofield 1976). An additional 45 mosses and 15 liverworts can occur in these habitats. Emmergent aquatic species of *Sphagnum* are also described above.

Epilithic Bryophytes and Rocky Habitats

Calcareous rock (14)

Calcareous rock (limestone) occurs mainly in the form of outcrops, but is sometimes found as talus. These rock types occur intermittently throughout Haida Gwaii and are important microsites known for high floral diversity. They provide high nutrient levels in a relatively nutrient poor environment. A number of bryophytes are restricted mainly to this habitat type including 42 mosses and 11 liverworts (Appendix C).

Siliceous rock (15)

Siliceous cliffs and boulders or outcrops have a large bryoflora. Many grow directly on the rock, while others are found on the thin soil of rock shelves. Fifty-eight moss species and 35 liverworts are found on these substrates (Appendix C).

High Elevation Habitats (16)

Although alpine and subalpine habitats are limited in Gwaii Haanas, they are more abundant on northern Moresby Island and southern Graham Island. These sites are "oceanic alpine" (Banner et al. 1983) characterized by moderated maritime temperatures, high precipitation (seasonal deep long lasting snowfall, fog and rain) and high winds. These habitats may be at considerable at risk due to a warming global climate which will likely result in a reduction of these characteristics which maintain the habitat and the encroachment of treeline from lower elevations (Pellatt

and Mathewes 1997). At subalpine or alpine sites, usually at or above treeline, a number of bryophytes are characteristic. It should be noted that a few of these bryophytes are found at lower elevations in exposed habitats, particularly near the west coast. Many endemic taxa are restricted in their distribution to localized alpine or west coast areas that may be glacial refugia. Thirty-five mosses and 27 liverworts are known to be present in these habitats (Appendix C). Three examples of these species are mapped in Figure 13.

RESOURCE EVALUATION

TAXONOMIC CHANGES AND SPECIES STATUS

The current database contains information on more than 14,000 specimens from 373 locations. These numbers will likely increase as more collections become automated and existing collection databases are completed. For example, the UBC database may exceed 18,000 Haida Gwaii specimens when fully enumerated (Schofield and Hong 2002). Not reflected in the UBC data are several hundred unidentified specimens. These are mainly of taxonomically perplexing genera that need expert attention. Thus, although many specimens have been collected, further species (and genera) will likely be discovered (Schofield and Hong 2002).

Since the last review of bryoflora on Haida Gwaii (Schofield1989) a number of discoveries and taxonomic changes that have altered concepts of the Haida Gwaii bryoflora. The taxa then assumed to be known in the Western Hemisphere only from Haida Gwaii have been reduced: *Dicranodontium subporodictyon* is now known from northwest Vancouver Island, *Paraleptodontium recurvifolium* (as *Leptodontium* in Schofield (1989)) is known also from Alaska. Among the presumed endemics, *Ctenidium schofieldii* is known also from Adak Island, Alaska, *Sphagnum schofieldii* is known from the Prince Rupert area, B.C. and *Sphagnum wilfii* from SE Alaska and Vancouver Island.

A taxonomic discovery of significance is that *Takakia* is a moss, not an hepatic (Smith and Davison 1993). This was treated as a "hepatic" in Schofield (1989). The undescribed species of *Mastopoma* is treated here as *Heterophyllium "haidensis"*. This remains undescribed and its generic placement remains unresolved. Several

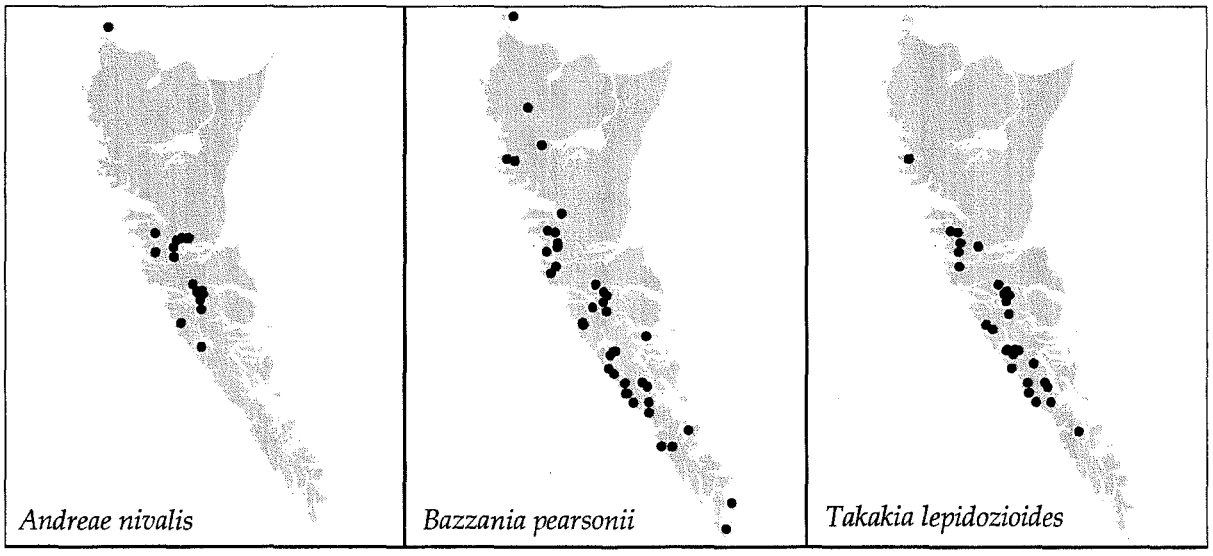


Figure 13. Distributions of three selected bryophyte species known to occur mainly at higher elevations (Schofield and Hong 2002).

other undescribed species of bryophytes are also treated here: *Brotherella "canadensis"*, *Brotherella "haidensis* and *Herbertus "haidensis"*. While *B. "canadensis"* has a wide distribution along the Pacific coast from Alaska to northern Washington State, and *Heterophyllium "haidensis"* is found also on the Brooks Peninsula of Vancouver Island. The endemics to the Archipelago are now five species (Table 5), three differing from those noted in Schofield (1989).

Note that the affinities of these undescribed endemics are all with palaeotropical East Asia. Considered with the disjunctive species known only from Haida Gwaii in North America, plus the many others that are more widespread on the humid portions of the Pacific coast, they assume considerable significance in understanding the genesis of Haida Gwaii bryoflora. Of the endemics, only *Seligeria careyana* produces sporophytes. In consequence, it is difficult to argue that these taxa could have reached the islands relatively recently by long distance dispersal, but rather they are likely remnants of a pre-glacial flora of great age. Regrettably, fossil evidence of bryophytes in pre-glacial sedimentary rock deposits is lacking for Haida Gwaii. For vascular plants, however, Martin and Rouse (1966) have shown a well-developed vascular flora of late Miocene to early Pliocene age (7 million years before present), in which bryophytes were probably present, although not represented in the record. Wolfe (1969) places the flora in a wider geographic context, from Southeast Alaska to California. Using the vascular flora as an indicator, it suggests a warm-temperate climate in which the bryophyte endemics of Haida Gwaii, or their progenitors, would be reasonable components. The same is true also for the disjunctive species.

SPECIES DISTRIBUTIONS OF SPECIAL SIGNIFICANCE

Species Uncommon on Haida Gwaii

Species can be considered rare or uncommon for a number of reasons that may lead to conservation concerns. Ryan (1996) has identified characteristics of rare and endangered bryophyte species for British Columbia that apply to Haida Gwaii which are summarized as:

1. Several bryophyte species infrequently produce spores or asexual gemmae and are, therefore, restricted in their ability to successfully invade new habitats. A lack of spore production may also lead to reduced genetic variability which limits the adaptive capacity of a species in response to changing environmental conditions.

2. A rarity of specific habitat requirements may lead to a limited and disjunct distribution of certain species that are habitat specialists. In many cases, the habitat relationships for bryophytes are not well understood across their ranges.

3. A number of rare species that occur in this region are found at the extreme limits of their range and are likely limited by sub-optimal microclimatic or habitat (substrate) conditions. These conditions may exacerbate the effects of 1 and 2 above. Species range limits and range extensions are important from a conservation perspective even if the species are considered abundant elsewhere as the local populations may be composed of rare genotypes important to the longevity of the species overall or perhaps to the creation of new species over time.

4. Many species may not be truly rare due to inadequate survey effort. This can be exacerbated due to the small size and cryptic nature of many species. In addition, taxonomic description is often

difficult and specimens may not include all the appropriate structures (capsules or spores) necessary for accurate identification.

Twenty-nine moss species and 10 liverworts are represented by a single collection from the archipelago and are therefore considered uncommon (Table 11). Whether these are truly rare in the islands can be determined only after considerable concentrated fieldwork.

Table 11. Bryophyte species considered uncommon on Haida Gwaii.

Mosses
Abietinella abietina
Anacolia menziesii
Andreaea blyttii
Andreaea mutabilis
Andreaea sinuosa
Buxbaumia piperi
Campylopus japonicus
Crumia latifolia
Desmatodon heimii
Didymodon subandreaeoides
Discelium nudum
Distichium inclinatum
Ditrichum ambiguum
Encalypta alpina
Pohlia sphagnicola
Pseudocalliergon trifarium
Rhodobryum roseum
Schistidium "vancouverense"
Scorpidium scorpioides
Schofieldiella micans
Sphagnum junghuhnianum var. *pseudomolle*
Sphagnum schofieldii
Timmiella crassinervis
Tortula amplexa
Tortula muralis
Tortula norvegica
Trematodon montanus
Weissia controversa
Zygodon gracilis
Liverworts
Asterella gracilis
Bazzania trilobata
Cololejeunea macounii
Eremonotus myriocarpus
Gymnomitrion corallioides
Jungermannia evansii
Jungermannia schusterana
Jungermannia subelliptica
Kurzia trichoclados
Schofieldia monticola

Species at Risk on Haida Gwaii

A preliminary list of rare and endangered bryophytes for British Columbia was first compiled in 1996 (Ryan 1996) and it included 40 species from Haida Gwaii. Since 2000, the British Columbia Conservation Data Centre (CDC) has compiled and ranked moss species with a conservation concern for British Columbia. The 2003 list includes 15 endangered or threatened species (red list) (Table 12), 70 vulnerable species (blue list), and 100 species of conservation concern (yellow list) known to occur on Haida Gwaii (British Columbia Conservation Data Centre 2003). A full listing of the CDC-ranked moss species is provided in Appendix D. When red-listed species are mapped in conjunction with physiographic ecosections, most locations are concentrated in the western Skidegate Plateau and the Queen

Table 12. Haida Gwaii mosses that have been red-listed (endangered or threatened) by the British Columbia Conservation Data Centre. An explanation of the codes used can be found in Appendix D.

Taxa	Global Rank	Subnational Rank
Andreaea sinuosa	G2	S1
Campylopus japonicus	G3	S1
Daltonia splachnoides	G1G2	S1
Didymodon rigidulus var. *rigidulus*	G5	S2
Discelium nudum	G3G4	S1
Gollania turgens	G2	S1
Paraleptodontium recurvifolium	G2G3	S2
Seligeria careyana	G1	S1
Sphagnum majus	G5?T?	S1
Sphagnum schofieldii	G1Q	S1
Sphagnum wilfii	G1G2	S1
Trematodon montanus	G1	S1
Wijkia carlottae	G2	S2
Zygodon gracilis	G2	S1

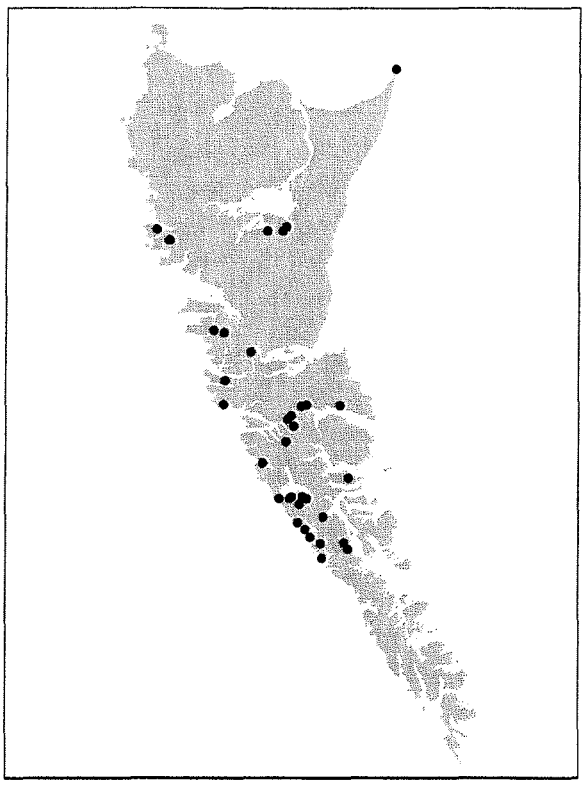


Figure 14. The location of red listed (endangered or threatened) bryophyte species recognized by the Conservation Data Centre. For species listings, see Appendix D.

Charlotte Ranges (Figure 14), suggesting that these areas may pose a greater conservation risk with respect to mosses.

The British Columbia CDC has also compiled a preliminary list of liverworts that may have some level of conservation risk, but these have not yet been ranked (Jenifer Penny, personal communication, April 2003). We considered only those liverworts on the list known to occur in Haida Gwaii and then removed species considered to be common in British Columbia (W.B. Schofield Personal Communication 2003d). The 64 liverworts thus considered are listed in Appendix E. This list must be considered a "work in progress" with additions and further deletions to be expected.

Interestingly, only nine mosses (and no liverworts) have a national "risk" category designated by the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC 2003), none of which occur in Haida Gwaii. This difference between the Provincial and Federal listings highlights a shortcoming of the federal program. Unfortunately, this shortcoming will not be addressed soon. The first step towards a COSEWIC designation is inclusion in COSEWIC's "Prioritized Candidate List". Only 2 mosses and no liverworts are among the more than 600 species presently on this list, neither of which occurs on Haida Gwaii. Moreover, as noted on the COSEWIC web site (www.cosewic.gc.ca/eng/sct6/sct6_3_e.cfm):

"Although recently COSEWIC has been adding species to its list at the rate of ten to twenty species per year, this does not reflect the rate at which species are becoming at risk. Rather, it reflects the rate at which the Committee is able to examine species."

Species Relatively Frequent in Haida Gwaii

Some species are encountered relatively frequently on Haida Gwaii, especially on the west coast. Table 13 lists 28 mosses and 12 liverworts considered widespread. This listing excludes those widespread in Pacific North America. However, it includes species infrequent elsewhere, except along the Pacific coast from northwestern Vancouver Island extending northward and westward along the Alexander Archipelago to the Aleutian Islands of Alaska.

Species to be expected on Haida Gwaii

Based on their distribution in the same climatic regime in adjacent parts of the coast, a number of species can be expected to occur on Haida Gwaii including 18 mosses and 4 liverworts (Table 14). It is impossible to predict the discovery of further disjunctive species or endemics.

Table 13. Bryophyte species considered relatively frequent in Haida Gwaii.

Mosses
Bartramiopsis lescurii
Brotherella "canadensis"
Campylopus fragilis
Dicranella pacifica
Dicranodontium subporodictyon
Dicranodontium uncinatum
Ditrichum zonatum var. *scabrifolium*
Geheebia gigantea
Herzogiella adscendens
Heterophyllium "haidensis"
Hookeria acutifolia
Hypopterygium fauriei
Iwatsukiela leucotricha
Loeskypnum wickesiae
Oxystegus tenuirostris
Paraleucobryum enerve
Racomitrium fasciculare
Racomitrium lawtonae
Sphagnum alaskense
Sphagnum austinii
Sphagnum lindbergii
Sphagnum subobesum
Splachnum sphaericum
Takakia lepidozioides
Thuidium assimile
Ulota drummondii
Wijkia carlottae
Zygodon reinwardtii
Liverworts
Anastrophyllum donianum
Apotreubia hortonae
Bazzania pearsonii
Herbertus sakuraii
Lepidozia filamentosa ssp. *subtransversa*
Mastigophora woodsii
Metzgeria leptoneura
Odontoschisma denudatum
Plagiochila schofieldiana
Plagiochila semidecurrens
Pleurozia purpurea
Scapania ornithopodioides

However, efforts should be concentrated on the mountainous areas where surveys have been limited to date. It is unlikely that these taxa will be discovered by casual collectors but require experienced bryologists.

Table 14. Bryophyte species not yet detected, but likely occurring on Haida Gwaii.

Mosses
Bryhnia hultenii
Bryum weigelii
Cinclidium stygium
Cynodontium alpestre
Helodium blandowii
Meesia uliginosa
Meesia triquetra
Myurella tenerrima
Orthothecium strictum
Orthotrichum pellucidum
Paraleucobryum longifolium
Pohlia proligera
Seligeria campylopoda
Tomentypnum nitens
Trematodon ambiguus
Liverworts
Acrobolbus ciliatus
Cephaloziella subdentata
Lepidozia sandvicensis

ANTHROPOGENIC ACTIVITIES AND BRYOPHYTES

Potential Threats

Ryan (1996) identified six major threats to rare and endangered bryophytes in British Columbia. These have been contextualized for Haida Gwaii as follows:

1. **Forest Harvesting:** Although many of the species of interest on Haida Gwaii are restricted to non-forested habitats, there are also many that occur in forested sites. Forest development in the past 40-60 years has disproportionately removed lower elevation forests and particularly riparian and coastal forests. It is possible that some rare species may have already been lost from these habitats. The removal of forest cover can induce significant changes to the microhabitat conditions including hydrology, temperature, light intensity and humidity. On a local scale, bryophyte cover is essentially removed during logging but tends to return in

older second-growth stands. However, if short rotation forestry is considered, appropriate conditions may not be returned for bryophyte recovery and a fragmented landscape may result in small isolated patches of intact forest conditions. Ryan (1996) has suggested that the bryoflora does not reach its greatest development until the forest reaches an age of at least 440 years. Therefore, if there are "old growth dependent" species, they would not likely be present in a landscape of short rotation forests. Similarly, if variable retention (selective logging) systems are utilized, the resulting forest structure may not sustain adequate microhabitat requirements for some species.

2. **Agricultural Activities:** Agricultural development is limited on Haida Gwaii although any land conversion may have at least a limited effect on bryoflora abundance and diversity.

3. **Air Pollution:** Although Haida Gwaii does not suffer from excessive local sources of air- or water-borne pollution, long range transport of pollutants may affect local ecosystems. Most bryophytes exchange gasses and absorb water over their entire surface. This can include pollutants. These plants are useful indicators of pollution as they often show the first signs of pollution related stress or mortality (Ryan 1996).

4. **Residential Development:** Similarly, residential development has not been excessive on Haida Gwaii. However, assessment of new developments should take into consideration the loss of critical habitat for rare or endangered flora and fauna. Some of the effects of urban development may lead to increased abundance of introduced species or hyper-abundant coverage of some native species due to the changes in habitat present. Other forms of human residence such as seasonal or permanent camps for resource extraction or recreational activities should also be assessed with respect to alienation of critical or sensitive habitats.

5. **Climate Change and Global Warming:** The distribution of many bryophyte species is limited by a narrow climatic tolerance to parameters such as moisture and temperature, although these tolerances may be reflected at the microclimate scale. As such, they may act as useful indicators of climate change as climate driven habitats (and the associated species) change across the landscape. Climate can be monitored by observing changes in growth characteristics and form (often observed well before species disappear), effects on individual species presence/absence and finally, distribution and effects on community assemblages (Gignac 2001). Selection will be driven by individual species whose distribution is clearly restricted by mesoclimate and species assemblages that are indicative of climatically sensitive habitats or ecosystems (Gignac 2001).

6. Locally, the bryophytes which are most likely at high risk from climate change are those found in alpine and sub-alpine habitats. Many of the species of interest on Haida Gwaii fall into this category. Pellatt and Mathewes (1997) suggest that much of the alpine habitat may be lost in a warming climate as treeline is extended upward in elevation. This problem is particularly important on Haida Gwaii where existing alpine and subalpine parkland habitats are spatially limited. Changes to precipitation patterns and subsequent moisture regimes could also have a significant effect on the distribution and abundance of bryophyte species. Gignac (2001) suggests that a selection of species in *Sphagnum* bogs would be useful indicators of change in water table or seasonal water levels. In this

instance, bryophytes would supersede vascular plants in sensitivity due to their lack of rooting structures and subsequent sensitivity to changes in moisture regime.

7. **Human Ignorance:** Likely the greatest threat to any rare or sensitive species is ignorance. This is particularly true with more cryptic or less well-known organisms like the bryophytes. The Pacific Northwest region has been rather well surveyed in relation to many other areas although it is by no means complete. Organizations such as the COSEWIC or the CDC have historically focussed on other groups such as the vascular plants and vertebrates. Although the interest is growing, the assessment of the bryophytes, like the invertebrates and other "lower" groups is in its infancy. Taxonomic complexity is also a problem with these groups as there are a diminishing number of experts who are able to properly identify and distinguish species. Those with the expertise are often over-committed and under-resourced for such tasks. Although most groups of bryophytes are taxonomically stable, there are some taxa that are controversial and are assigned different names by different researchers. This can result in a false sense of species diversity and also a false sense of rarity. Beyond the taxonomic level, ecological or habitat relationships are often poorly understood. There remains much more work to be done in these areas.

Introduced Species

There are 665 vascular plant species on Haida Gwaii of which 153 have been introduced (Calder and Taylor 1968; Talyor 1989; Lomer and Douglas 1999). Some have extended their range after intentional introduction to gardens. Others have entered as weeds to gardens and have expanded their range to disturbed sites, and were unintentionally introduced. Others were intentionally or unintentionally introduced to pastureland or lawns.

For the bryophytes, it is difficult to determine introductions, but some species are unquestionably favoured by disturbed habitats created by human activity although it is mainly indigenous species that invade anthropogenic habitats. Table 15 lists 16 mosses and 3 liverworts that are abundant in human derived habitats although not restricted to them. Six of these species are rare on Haida Gwaii outside of such disturbance.

In some species, abundance is directly enhanced by disturbance. *Tortula muralis* in particular is restricted to concrete surfaces. Logging activities and, in some past instances, mining, have considerably increased the area occupied by these species. In contrast, there are numerous

Table 15. Bryophyte species known in natural habitats but greatly increased in human-derived habitats (Schofield and Hong 2002). Species marked (*) are known to prefer human-derived habitats and are otherwise rare.

Mosses
**Barbula unguiculata*
**Bryum argenteum*
**Ceratodon purpureus*
Dicranella heteromalla
Eurhynchium oreganum
**Funaria hygrometrica*
**Leptobryum pyriforme*
Oligotrichum aligerum
Pogonatum contortum
Pogonatum urnigerum
Pohlia nutans
Polytrichum commune
Polytrichum juniperinum
Pseudotaxiphyllum elegans
Racomitrium elongatum
**Tortula muralis*
Liverworts
Gyrothyra underwoodiana
Jungermannia rubra
Pellia neesiana

bryophytes whose range has been considerably contracted through human activity, both through mining and clear-cut logging. The large number of species that are naturally rare on the islands are especially vulnerable.

CONCLUSION

Bryophytes are well known in general by many but in detail by few. Most visitors know them due to their abundance and diversity across many landscapes and habitats. Their lushness on Haida Gwaii is well known and characteristic of the archipelago. The diversity of bryophytes rivals that of the vascular plants. Although survey efforts to date have been extensive, not all landscapes have been censused and additional taxa are likely to be found. Taxonomic complexity in this group also presents a challenge and additional work may result in the discovery of additional species.

Bryophytes are valued in terms of biodiversity but they are also indicators of ecosystem health and integtrity as well as evolution on local and global scales. The history and phytogeography of mosses and liverworts provides enlightenment with respect to the evolution of ecosystems across North America and elsewhere. Although this information is often lost in the complexities of scientific jargon and taxonomic puzzles, there is great potential for interpretation and expansion of these ideas for communitcation to the general public and those interested in the natural world.

The top issues identified in this report, with respect to bryoflora and in the context of Gwaii Haanas and Haida Gwaii, are the need for the following:

- More extensive surveys in remote habitats such as the alpine outcrops and wet hypermaritime bogs of the west coast.
- Clarification of taxonomy and preparation of conservation status reports on the more rare or interesting species that may be endemic forms or may be important elements in the story of vegetative evolution across the pacific coast of North America and north Asia.
- Better understanding of bryophytes in the context of ecological integrity and changing vegetation landscapes: the effects of human induced disturbances such as introduced browsers, climate change, and industrial forest operations.

RECOMMENDED RESEARCH MONITORING AND MANAGEMENT

Although this is not a complete floristic inventory, it is adequate for ecological studies. A more detailed assessment of the bryoflora would be of considerable value. Within the National Park area it is possible to carry out detailed analyses essential to protecting the integrity of that vegetation. Such baseline research, besides being invaluable for the maintenance of the natural vegetation of the Park, is of vital significance to understanding the vegetation of Haida Gwaii and the entire humid Pacific coast. It provides documentation for a reference area protected from human exploitation.

Further floristic documentation should be encouraged. The complexity of the terrain and its inaccessibility greatly enhance the probability that more taxa will be discovered. This is a long-term project requiring experienced bryologists and students under their supervision. Issues requiring attention range from detailed research and monitoring to species status assessments and records management.

As more information is gathered and the knowledge with respect to bryoflora is expanded, there are additional opportunities for awareness and education

for the general public. The cryptic nature, biogeography, interesting life histories and characteristics of many species along with the sheer abundance and diversity of the local bryoflora offer the potential for interesting educational opportunities.

RESEARCH AND MONITORING

The following questions could guide decisions as funding and expertise become available. Often, bryophytes are not given appropriate consideration in inventory or monitoring programs. Their inclusion could provide a better understanding of issues as outlined below:

- Are there specific areas of Haida Gwaii that harbor phytogeographically significant species? If so, what are the factors that produced this concentration and favour its persistence?
- Alpine areas are poorly inventoried and have a high likelihood of additional rare taxa. Additional inventory efforts should focus on these areas.
- What influence do the effects of deer browsing (removal of vascular flora) have on bryophyte community diversity and abundance?
- What are the potential effects of climate change on bryoflora of Haida Gwaii. Because many of the rare or endemic forms are alpine in nature, these habitats may be lost.
- What is the long-term distribution of critical habitat loss related to logging, urban development, natural succession, climate change (alpine).
- In bryophyte community structure, what are the controls of that structure? Why do particular taxa dominate the bryophyte vegetation of some sites, while in others many taxa are equally abundant?
- In forests, what is the role of the bryophytes in nutrient cycling, soil genesis and in maintaining the vascular plant vegetation?
- What is the significance of heavy epiphytic bryophyte cover to forest health?
- In peatlands, how does the bryophyte cover affect the vascular plant vegetation?
- In peatlands, what are the main criteria that influence vegetational structure and dynamics?
- How do the various *Sphagnum* species of peatland differ in their ecology and how do they interact to produce extensive bogs?
- Is it possible to protect phytogeographically significant bryophytes without affecting the natural succession of a site?

MANAGEMENT

1. COSEWIC currently lists nine mosses and no liverworts as being at risk, none of which occur on Haida Gwaii. For those species where a conservation concern exists, a formal listing process should be pursued with the creation of species status reports. We anticipate that, for many species of concern, there will be a need for better understanding of presence, absence and rarity. This initiative is of particular concern now that the Canadian Species at Risk Act has been passed.
2. This review has examined all of the major bryophyte collections known for Haida Gwaii. Although W.B. Schofield undertook extensive review of many voucher specimens, the taxonomic accuracy of many remains in question.

There may be additional sources of information located at herbaria outside the scope of this work although, it is unlikely that any other major collection exists that will add appreciably to the data base. As opportunities arise, these sources could be checked for applicable records although similar concerns remain with respect to taxonomic and locational accuracy.

3. In addition to this synthesis report, the true value of this initiative is in the consolidated spatial database. It is imperative that the database be maintained so as to include information from new studies as they become available. And, as museum and University herbaria complete the digitization of their collections, some existing records will need to be updated and new historical records added. This database is largely compatible with existing frameworks used by the Provincial Government, the CDC and relevant herbaria. We must ensure that compatibility is maintained in the future in order to facilitate data sharing.

This report provides a basis of communications products for the public. The bryophytes are a large part of the flora in this region and, in general, the level of public knowledge of these plants is limted. Topics such as phytogeography, basic plant physiology and the ecological roles and habitats of bryophytes of interest may be interesting themes to pursue.

LITERATURE CITED

Abercrombie, M., M. Hickman, M.L. Johnson and M. Thain. 1992. Dictionary of biology. Penguin Books, Toronto. 600 p.

Anderson, L.E. 1990. A checklist of *Sphagnum* in North America north of Mexico. Bryologist 93: 500-501.

Anderson, L.E., H..A. Crum and W.R. Buck 1990. List of the mosses of North America north of Mexico. Bryologist 93: 448-499.

Banner A., J. Pojar and R. Trowbridge. 1983. Ecosystem Classification of the Coastal Western Hemlock Zone, Hypermaritime Subzone (CWHhm) Prince Rupert Forest Region. Ministry of Forests, Province of British Columbia. 255 p.

Belland, R.J. and R. Brassard. 1983. *Trematodon montanus*, sp.nov., from Newfoundland and British Columbia, Canada. Lindbergia 9: 1-4

Blom, H. 1995. A revision of the *Schistidium apocarpum* complex in Norway and Sweden. Bryophytorum Bibliotheca 20: 1-320.

Brassard, G. R. 1999. Timmiaceae. In "Bryophyte flora of North America, Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

British Columbia Conservation Data Centre 2003. [http://srmwww.gov.bc.ca/cdc/index.htm]

Buck, W.R. 1997. *Schofieldiella* (Hylocomiaceae), a new genus for an old species. Journal of the Hattori Botanical Laboratory. 82: 39-46.

Byun, S.A., B. Koop and T.E. Reimchen 1999. Coastal refugia and postglacial recolonization routes: a reply to Demboske, Stone, and Cook. Evolution 53: 2013-2015.

Calder, J.A. and R.L. Taylor. 1968. Flora of the Queen Charlotte Islands Part 1. xiii+ 599 pp. Research Branch, Canada Department of Agriculture Monograph No. 4.

Cannings, R. 1975. Interpretation assessment of Naikoon Provincial Park - Part 1. Interpretation Assessment Report 17, 236 p.

Clague, 1989. Quaternary geology of the Queen Charlotte Islands. p. 65-74. In: Scudder, G.G.E. and N. Gessler (eds.). The Outer Shores. Queen Charlotte Island Museum, B.C.

COSEWIC, 2003. Summary of COSEWIC Assessment Results as of November 2003. Committee on the Status of Endangered Wildlife in Canada. 2 p.

Crum, H.A. 2001. Conardia. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Crum, H.A. 2002. Dicranella. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Davison, P.G. and D.K. Smith. 1992. *Calycularia crispula* (Hepaticae) in the Aleutian Islands and Pacific Northwest of North America. Bryologist 95: 266-269.

Dawson, G.M. 1880. Report on the Queen Charlotte Islands, 1878. Geological Survey of Canada, Report of Progress for 1878-79, 189 p.

Demarchi, D. 1996. An Introduction to the Ecoregions of British Columbia. Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, British Columbia. [http://srmwww.gov.bc.ca/rib/wis/eco/bcecode1.html#coast]

Dickie, G. 1968. Notes on mosses and Hepaticae, collected by Robert Brown, esq., on the Northwest coast of America. Transactions of the Botanical Society of Edinburgh 9: 355-358.

Eckel, P.M. 2003. Eucladium. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Environment Canada. 1998. Canadian Climate Normals. Minister of Environment, Ottawa. [http://www.msc-smc.ec.gc.ca/climate/climate_normals/]

Fedje, D.W. 1993. Sea-levels and prehistory in Gwaii Haanas. Unpublished Msc. Thesis, Department of Archaeology, University of Calgary, AB. 160 p.

Flatberg, K.I. 1989. *Sphagnum (Cuspidata) pacificum*, sp. nov. Bryologist 92: 116-119.

Flatberg, K.I. 1993. *Sphagnum rubiginosum* (Sect. Acutifolia), sp. nov. Lindbergia 18: 59-70.

Frahm, J.-P. 1993. *Campylopus japonicus* new to North America north of Mexico. Bryologist 96: 142-144.

Frahm, J.-P. 2002. Campylopus. In "Bryophyte flora of North America, Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Frisvoll, A. 1985. Lectotypifications including nomenclatural and taxonomical notes on *Ditrichum flexicaule* sensu lato. Bryologist 88: 31-40.

Frisvoll, A.A. 1988. A taxonomic revision of the *Racomitrium heterostichum* group (Bryophyta, Grimmiales) in N. and C. America, N. Africa, Europe and Asia. Gunneria 59: 1-289.

Gaston, A.J., S. Stockton, T. Golumbia, J.L. Martin and S. Sharpe. 2004. Vegetation changes on Reef and SGang Gwaay islands following a reduction in deer numbers in Gaston A.J., Golumbia T.E., Martin J.L. and Sharpe S.T. (eds.). 2004. Lessons from the islands: introduced species and what they tell us about how ecosystems work. Proceedings from

the Research Group on Introduced Species 2002 Conference, Queen Charlotte City, British Columbia. Canadian Wildlife Service Occasional Papers (in press).

Gignac, D. 2001. Bryophytes as indicators of climatic change. Bryologist 104: 410-420.

Glime, J.M. and W.S. Hong. 2002. Bole epiphytes on three conifer species from Queen Charlotte Islands, Canada. Bryologist 105: 451-464.

Glime, J.M. and W.S. Hong. 1997. Relationships of geothermal bryophyte communities to soil characteristics at thermal meadow, Hotsprings Island, Queen Charlotte Islands, Canada. Journal of Bryology 19: 435-448.

Godfrey, J.D. 1977. New and interesting hepatics from British Columbia, Canada, and northern Washington State, U.S.A. I. Bryologist 80: 539-543.

Godfrey, J.D. and G.A. Godfrey. 1979. *Jungermannia schusterana,* a new hepatic from British Columbia. Journal of the Hattori Botanical Laboratory 48: 321-327.

Godfrey J.D. and W.B. Schofield. 1979. New and interesting hepatics from British Columbia, Canada, and northern Washington State, U.S.A. II. Bryologist 82: 162-170.

Green, R.H. and K. Klinka. 1994. A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region. British Columbia Ministry of Forests Research Branch, Victoria, BC. 285 p.

Griffin, D. III. 2003a. Conostomum. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Griffin, D. III. 2003b. Philonotis. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Griffin, D. III. 2003c. Plagiopus. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000a. Campyliadelphus. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000b. Campylium. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000c. Campylophyllum. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000d. Drepanocladus. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000e. Hamatocaulis. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000f. Loeskypnum. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000g. Palustriella. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000h. Sanionia. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000i. Scorpidium. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. 2000j. Warnstorfia. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Hedenäs, L. and N. Miller 2000. Pseudocalliergon. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/ V2/ Vol2.htm]

Heusser, C.J. 1989. North Pacific coastal refugia - the Queen Charlotte Islands in perspective. *In:* G.G.E. Scudder and N. Gessler (eds.). The Outer Shores. Based on the proceedings of the Queen Charlotte Islands First International Scientific Symposium, August 1994, University of British Columbia. pp. 131-142.

Hong, W.S. 1980a. The genus *Scapania* in western North America II, Taxonomic treatment. Bryologist 83: 40-59.

Hong, W.S. 1980b. A study of the distribution of *Diplophyllum* in western North America. Bryologist 83: 497-504.

Hong, W.S. 1982. The genus *Marsupella* in western North America. Lindbergia 8: 166-176.

Hong, W.S. 1983a. The genus *Gymnomitrion* in North America, west of the hundredth meridian. Lindbergia 9: 169-177.

Hong, W.S. 1983b. The genus *Porella* in North America west of the hundredth meridian. Bryologist 86: 143-155.

Hong, W.S. 1986. The family Cephaloziellaceae in North America west of the hundredth meridian. Bryologist 89: 155-162.

Hong, W.S. 1987. The distribution of western North American Hepaticae. Endemic taxa and taxa with a north Pacific arc distribution. Bryologist 90: 344-361.

Hong, W.S. 1988a. The family Cephaloziaceae in North America west of the hundredth meridian. Lindbergia 14: 79-88.

Hong, W.S. 1988b. The family Lepidoziaceae in North America west of the hundredth meridian. Bryologist 91: 326-333.

Hong, W.S. 1989. The genus *Frullania* in North America west of the hundredth meridian. Bryologist 92: 363-367.

Hong, W.S. 1990. The family Calypogeiaceae in North America west of the hundredth meridian. Bryologist 92: 363-367.

Hong, W.S. 1992. *Plagiochila* in western North America. Bryologist 95: 142-147.

Hong, W.S. 1993. The family Geocalycaceae (Hepaticae) in North America, west of the hundredth meridian. Bryologist 96: 592-597.

Hong, W.S. 1995. Final Report- A study of the bryophytes and lichens of floor of Thermal Meadow, Hotspring Island and Ramsay Island. Unpublished report submitted to Gwaii Haanas. 51 p.

Hong, W.S. 1996. *Anastrophyllum* in western North America. Bryologist 99: 85-90.

Hong, W.S. 1999. Hepatics of the Vladimir J. Krajina Ecological Reserve, Queen Charlotte Islands, Canada. Haussknechtia. Beiheft 9 (Riclef-Grolle-Festschrift): 183-192.

Hong, W.S. 2002a. Comparison of hepatic flora and floristic affinities among four neighboring islands, Queen Charlotte Islands, British Columbia. Northwest Science 76: 286-292.

Hong, W.S. 2002b. The distribution of Lophozia in North America west of the hundredth meridian. Lindbergia 27: 49-62.

Hong, W.S., B. Deffingbaugh and B. Sparrow. 1993. The genus *Herbertus* in western North America. Lindbergia 18: 41-45.

Hong, W.S ,D. Trexler and K. Flanders. 1990. The family Radulaceae in North America west of the hundredth meridian. Lindbergia 16: 37-43.

Hong, W.S. and J. Vana. 2000. The distribution of *Nardia* in western North America. Lindbergia 25: 9-14.

Ireland, R.R. 2000. Dicranodontium. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Ireland, R.R. 2001. *Buckiella*, a new genus in the Hypnaceae (Musci). Novon 11: 55-62.

Ireland, R.R. 2002a. Dicranum. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Ireland, R.R. 2002b. Paraleucobryum. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Ireland, R.R. 2002c. Trichodon. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Ireland, R.R. 2003a. Herzogiella. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Ireland, R.R. 2003b. Plagiotheciaceae. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Josenhans, H., D.W. Fedje, K.W. Conway and J.V. Barrie. 1995. Postglacial Sea Levels on the Western Canadian Continental Shelf: Evidence for Rapid Change, Extensive Subaerial Exposure, and Early Human Habitation. Marine Geology 125: 73-94.

Josenhans, H., D.W. Fedje, R. Pientiz and J. Southon. 1997. Early Humans and Rapidly Changing Sea Levels in the Queen Charlotte Islands-Hecate Strait, British Columbia, Canada. Science 277: 71-74.

Krajina, K. 1965. Biogeoclimatic zones in British Columbia. Ecol. Western North America 1: 1-17.

Lewis, T. 1982. Ecosystems of Tree-Farm Licence 24, Queen Charlotte Islands, B.C. Unpublished Report Prepared For Western Forest Products Ltd., 194 p.

Lomer, F. and G.W. Douglas. 1999. Additions to the vascular plant flora of the Queen Charlotte Islands, British Columbia. Canadian Field-Naturalist 113: 235-240.

Martin, H. and G.E. Rouse. 1966. Palynology of Late Tertiary sediments from Queen Charlotte Islands, British Columbia. Canadian Journal of Botany 44: 171-208+12 plates.

Mathewes, R.W. 1989. Paleobotany of the Queen Charlotte Islands. p. 75-90. p. 121-125. In: Scudder, G.G.E. and N. Gessler (eds.). The Outer Shores. Queen Charlotte Island Museum, Skidegate,B.C.

McQueen, C.B. and R.S. Andrus 2003. Sphagnaceae. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Merrill, G.L.S. 1992. Notes on North American Polytrichaceae: *Polytrichastrum* Bryologist 95: 270-273.

Norris D.A. and J. Enroth. 1990. Description of *Bryolawtonia* Norris and Enroth (Thamnobryaceae) with observations on the genus *Bestia*. Bryologist 93: 328-331.

Oikos Ecological Services Ltd. 1998. Ecosystem inventory, Hotspring Island, Gwaii Haanas National Park Reserve. Unpublished report prepared for Gwaii Haanas by Oikos Ecological Services, Smithers, BC. 25 p.

Osgood, Wilfred H. 1901. Natural history of the Queen Charlotte Islands, British Columbia: Natural History of the Cook Inlet region, Alaska US. Government Printing Office, Washington, DC North American Fauna. U.S. Dept. of Agriculture, Div. of Biological Survey.

Peck, J.E., W.S. Hong and B. McCune. 1995. Diversity of Epiphytic Bryophytes on Three Host Tree Species, Thermal Meadow, Hotsprings Island, Queen Charlotte Islands. The Bryologist 98: 123-128.

Pellatt M.G. and Mathewes R.W. 1997. Holocene tree line and climate change on the QCI. Canada. Quarternary Research 48: 88-99.

Persson, H. 1958. The Genus Takakia Found in North America. Bryologist 61: 359-361.

Penny, Jenifer. 2003. Personal communication to Todd Golumbia April, 2003; botanist, BC Conservation Data Centre.

Pojar, J., K. Klinka, and D.V. Meidinger. 1987. Biogeoclimatic ecosystem classification in British Columbia. Forest Ecology and Management 22: 119-154.

Qian, H. and K. Klinka. 1998. Plants of British Columbia: Scientific and Common Names of Vascular Plants, Bryophytes and Lichens. UBC Press, Vancouver. 534 p.

Rohrer, J.R. 1999a. Hylocomiaceae. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Rohrer, J.R. 1999b. Rhytidiaceae. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Ryan, M.W. 1996. Bryophytes of British Columbia: rare species and priorities for inventory. Prepared for B.C. Ministry of Forests Research Branch, Victoria, BC and B.C. Ministry of Environment, Lands and Parks, Victoria, BC. Working Paper 12, vii, 100 p.

Schofield, W.B. 1965. Correlations between the moss floras of Japan and British Columbia, Canada. Journal of the Hattori Botanical Laboratory 28: 17-42.

Schofield, W.B. 1972. Disjunctions in bryophytes. Annals of the Missouri Botanical Garden 59: 174-202.

Schofield, W.B. 1976. Bryophytes of British Columbia III: habitat and distributional information for selected mosses. Syesis 9: 317-354.

Schofield, W.B. 1984. Bryogeography of the Pacific coast of North America. Journal of the Hattori Botanical Laboratory 55: 35-43.

Schofield, W.B. 1988a. Bryogeography and the bryophytic characterization of biogeoclimatic zones of British Columbia. Canada Canadian Journal of Botany 6: 2673-2686.

Schofield, W.B. 1988b. Bryophyte disjunctions in the northern hemisphere: Europe and North America. Botanical Journal of the Linnean Society 98: 211-224.

Schofield, W.B. 1989. Structure and affinities of the bryoflora of the Queen Charlotte Islands. p. 109-119. In: Scudder, G.G.E. and N. Gessler (eds.). The Outer Shores. Queen Charlotte Island Museum, Skidegate, B.C.

Schofield, W.B. 1992. Some common mosses of British Columbia. Royal British Columbia Museum Handbook. Victoria British Columbia.

Schofield, W.B. 2003a. Dicranoweisia. In "Bryophyte flora of North America, Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Schofield, W.B. 2003b. Disceliaceae. In "Bryophyte flora of North America, Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Schofield, W.B. 2003c. Diphysiaceae. In "Bryophyte flora of North America, Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Schofield, W.B. 2003d. Personal communication to Todd Golumbia November, 2003; University of British Columbia Herbarium.

Schofield, W.B. and H.A. Crum. 1972. Disjunctions in bryophytes. Annals of the Missouri Botanical Garden 59: 174-202.

Schofield, W.B. and W.S. Hong 2002. An assessment of the bryophytes of Haida Gwaii. Unpublished report prepared for Gwaii Haanas National Park Reserve and Haida Heritage Site, Queen Charlotte, BC., 79 p.

Schuster, R.M. and N. Konstantinova. 1995. Studies on Treubiales, I On *Apotreubia* Hatt. *et al.* and *A. hortonae* Schust. and Konstantinova n.sp. Journal of the Hattori Botanical Laboratory 78: 41-61.

Schuster, R.M. and W.B. Schofield. 1982. on *Dendrobazzania*, a new genus of Lepidoziaceae (Jungermanniales) Bryologist 85: 231-238.

Smith, D.K. and P.G. Davison. 1993. Antheridia and sporophytes in *Takakia ceratophylla* (Mitt.) Grolle: Evidence from reclassification among the mosses. Journal of the Hattori Botanical Laboratory 73: 263-271.

Stockton, S. 2004. The effects of deer on plant diversity in Gaston A.J., Golumbia T.E., Martin J.L. and Sharpe S.T. (eds.). Lessons from the islands: introduced species and what they tell us about how ecosystems work. Proceedings from the Research Group on Introduced Species 2002 Conference, Queen Charlotte City, British Columbia. Canadian Wildlife Service Occasional Papers (in press).

Stotler. R. and B. Crandall-Stotler. 1977. A checklist of the liverworts of North America. Bryologist 80: 405-428.

Sutherland Brown, A. and A. Nasmith. 1962. The glaciation of the Queen Charlotte Islands. Canadian Field-Naturalist 76: 209-219.

Taylor, R.L. 1989. Vascular plants of the Queen Charlote Islands. p. 121-125. In: Scudder, G.G.E. and N. Gessler (eds.). The Outer Shores. Queen Charlotte Island Museum, Skidegate, B.C.

Touw, A. 2001. A taxonomic revision of the Thuidiaceae (Musci) of Tropical Asia, the western Pacific and Hawaii. Journal of the Hattori Botanical Laboratory 91: 1-136.

Vana, J and W.S. Hong. 1999. The genus *Jungermannia* in western North America. Lindbergia 24: 133-144.

Vitt, D. 2003a. Amphidium. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Vitt, D. 2003b. Orthotrichum. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Vitt, D. 2003c. Ulota. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Vitt, D. 2003d. Zygodon. In "Bryophyte flora of North America Volume 2 Acrocarpous Mosses, Part 2, and Pleurocarpous Mosses" (=Flora of North America Vol. 28) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V2/Vol2.htm]

Vitt, D. and W.B. Schofield. 1976. Seligeria careyana, a new species from the Queen Charlotte Islands, Western Canada. Bryologist 79: 231-234.

Vitt, D.H., Ostafichuk, M. and Brodo, I.M. 1973. Folicolous bryophytes and lichens of Thuja plicata in western British Columbia. Canadian Journal of Botany 51: 571-580.

Warner, B.G., J.J. Clague and R.W. Mathewes. 1984. Geology and Paleoecology of a mid-Wisconsin Peat from the Queen Charlotte Islands, British Columbia, Canada. Quarterly Research 21: 337-350.

Wolfe, J.A. 1969. Neogene floristic and vegetational history of the Pacific Northwest. Madrono 20: 83-110.

Zander, R.H. 1999. Barbula. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Zander, R.H. 2000. Bryoerythrophyllum. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Zander, R.H. 2002. Didymodon. In "Bryophyte flora of North America Volume 1 Introduction, Acrocarpous Mosses, Part 1" (=Flora of North America Vol. 27) R. H. Zander, Lead editor. [http://ridgwaydb.mobot.org/bfna/V1/Vol1.htm]

Appendix A. Bryophyte taxa recorded from Haida Gwaii

Taxa are sorted alphabetically by Family and Scientific name within the moss and hepatic groups.

Taxa in bold are red-listed (endangered / threatened) and blue-listed (vulnerable) by the British Columbia Conservation Data Centre, Victoria, B.C.

Distribution Codes

1 Widespread in Northern hemisphere
2 Amphipacific
3 Western European – Western North American
4 Western European – Western North American showing a widely interrupted pattern in the northern hemsiphere
5 Tropical – subtropical affinity
6 Eastern North America disjuncts
7 Western North America
8 Pacific Coast
9 Species in which Haida Gwaii contains the only known Canadian population (includes Haida Gwaii endemics)
10 Haida Gwaii endemics

Habitat codes

1 Forest floor
2 Large woody debris
3 Epiphytes
4 Open forest of fen slopes
5 Swamp forests
6 Peatland bogs
7 Peatland fens
8 Seaside outcrops
9 Sand dunes
10 Blowdown (rootmass)
11 Disturbed soil
12 Aquatic habitats
13 Water body margins
14 Calcareous rock
15 Siliceous rock
16 High elevations

Herbaria at which specimens are held

UBC – University of British Columbia Herbarium, Vancouver, British Columbia
RBC – Royal British Columbia Museum Plant Collection, Victoria, British Columbia
H - Dr. W.S. Hong Collection at Gwaii Haanas and Montana
NYB - New York Botanical Garden, New York City, New York
SM - Sweden Museum of Natural History, Stockholm, Sweden
UW - University of Washington Herbarium, Seattle Washington

Note: Distribution and habitat codes are summarized mainly from Schofield and Hong (2002). Additional information on distribution was obtained from Brassard (1999); Crum (2001, 2002); Eckel (2003); Frahm (2002); Griffin (2003a, 2003b, 2003c); Hedenäs (2000a, 2000b, 2000c, 2000d, 2000e, 2000f, 2000g, 2000h, 2000i, 2000j); Hedenäs and Miller (2000); Hong (1980a, 1980b, 1982, 1983a, 1983b, 1986, 1987, 1988a, 1988b, 1989, 1990, 1992, 1993, 1996, 1999); Hong et al. (1993); Hong et al. (1990); Hong and Vana (2000); Ireland (2000, 2002a, 2002b, 2002c, 2003a, 2003b); McQueen and Andrus (2003); Rohrer, (1999a, 1999b); Schofield (2003a, 2003b, 2003c); Vana and Hong (1999); Vitt (2003a, 2003b, 2003c, 2003d); and Zander (1999, 2000, 2002).

Taxon	Distribution	Habitat	Herbarium
Mosses			
Amblystegiaceae			
Amblystegium serpens (Hedw.) Schimp	1	3	UBC
Calliergon cordifolium (Hedw.) Kindb.	1	5	NYB,UBC
Calliergon giganteum (Schimp.) Kindb.	1	7	UBC
Calliergon stramineum (Brid.) Kindb.	1	6	UBC
Calliergonella cuspidata (Hedw.) Loeske	1		NYB,UBC
Campyliadelphus chrysophyllus (Brid.) Kanda	1		UBC
Campylium stellatum (Hedw.) C. Jens.	1	4,16	UBC
Campylophyllum halleri (Hedw.) Fleisch.	1	13	UBC
Conardia compacta (C. Müll.) Robins.	1		SM,UBC
Cratoneuron filicinum (Hedw.) Spruce	1	5	NYB,UBC
Drepanocladus aduncus (Hedw.) Warnst.	1		UBC
Drepanocladus polycarpus (Voit.) Warnst.			UBC
Hamatocaulis vernicosus (Mitt.) Hedenäs	1	7	
Hygrohypnum bestii (Ren. & Bryhn) Broth.			UBC
Hygrohypnum dilatatum (Wils.) Loeske			UBC
Hygrohypnum luridum (Hedw.) Jenn.		13	UBC
Hygrohypnum molle (Hedw.) Loeske		12	
Hygrohypnum ochraceum (Turn. ex Wils.) Loeske	1	12,15	UBC
Hygrohypnum smithii (Sw.) Broth.		12	NYB,UBC
Leptodictyum riparium (Hedw.) Warnst.	1	5,12	UBC
Limprichtia revolvens (Sw.) Loeske		7	
Loeskypnum badium (Hartm.) Paul	1	7	
Loeskypnum wickesiae (Grout) Tuom.	2	7	SM,UBC
Palustriella falcata (Brid.) Hedenäs	1		NYB,SM,UBC
Pseudocalliergon trifarium (Web. & Mohr) Loeske	1		NYB,UBC
Sanionia symmetrica (Ren. & Card.) Wheldon	7		UBC
Sanionia uncinata (Hedw.) Loeske	1	4,14,15	NYB,UBC
Sarmenthypnum sarmentosum (Wahlenb.) Tuom. & T. Kop.		7	
Scorpidium revolvens (Sw. ex Anonymo) Rubers	1		NYB,UBC
Scorpidium scorpioides (Hedw.) Limpr.	1	7,12	NYB,UBC
Warnstorfia exannulata (Schimp.) Loeske	1	4,12	NYB,SM,UBC
Warnstorfia fluitans (Hedw.) Loeske	1	5,12	UBC
Warnstorfia sarmentosa (Wahlenb.) Hedenäs	1		NYB,UBC
Andreaeaceae			
Andreaea alpestris (Thed.) Schimp.		16	NYB,UBC
Andreaea blyttii Schimp.		16	UBC
Andreaea megistospora B. Murr. var. *megistospora*	3		UBC
Andreaea megistospora* var. *epapillosa (B. Murr.) Crum & Anderson			UBC
Andreaea mutabilis Hook. f & Wils.	8,9	16	UBC
Andreaea nivalis Hook.	4	16	UBC,UW
Andreaea rupestris Hedw.	1	14	UBC
Andreaea sinuosa B. Murr.	3	16	UBC
Aulacomniaceae			
Aulacomnium androgynum (Hedw.) Schwaegr.	1	10	UBC
Aulacomnium palustre (Hedw.) Schwaegr.	1	4,6	H,NYB,UBC

Taxon	Distribution	Habitat	Herbarium
Bartramiaceae			
Anacolia menziesii (Turn.) Par.	7	14	UBC
Bartramia ithyphylla Brid.	1	16	UBC
Bartramia pomiformis Hedw.	1	3,14	UBC
Conostomum tetragonum (Hedw.) Lindb.	1	16	UBC
Philonotis capillaris Lindb.	1		UBC
Philonotis fontana (Hedw.) Brid.	1	5,14,15	UBC
Plagiopus oederiana (Sw.) Crum & Anderson	1	13	NYB,UBC
Brachytheciaceae			
Brachythecium albicans (Hedw.) Schimp.		9	NYB,UBC
Brachythecium frigidum (C. Müll.) Besch.	7	5,14,15	NYB,UBC
Brachythecium leibergii Grout	7		UBC
Brachythecium plumosum (Hedw.) Schimp.	1	14,15	NYB,UBC
Brachythecium reflexum (Starke in Web. & Mohr) Schimp. in B.S.G.		3	UBC
Brachythecium rivulare Schimp.	1	5,15	NYB,UBC
Brachythecium velutinum (Hedw.) Schimp.			UBC
Cirriphyllum cirrosum (Schwaegr.) Grout	1	13	UBC
Eurhynchium oreganum (Sull.) Jaeg.	7	1,3,15	H,NYB,RBC,UBC
Eurhynchium praelongum (Hedw.) Schimp.	1	1,3,15	H,NYB,UBC,UW
Eurhynchium pulchellum (Hedw.) Jenn. var. *pulchellum*	1	3	UBC
Eurhynchium pulchellum Jenn. **var. *barnesii*** (Ren. & Card.) Grout	7	13	UBC
Homalothecium aeneum (Mitt.) Lawt.	7		
Homalothecium fulgescens (Mitt. ex C. Müll.) Lawt.	7	3	NYB,UBC
Homalothecium nuttallii (Wils.) Jaeg.	7	3	UBC
Isothecium cardotii Kindb. in Macoun & Kindb.	7	3,14	UBC
Isothecium myosuroides Brid.	7	3,9,14	H,NYB,RBC,UBC
Scleropodium cespitans (C. Müll.) L. Koch	3		NYB,UBC
Scleropodium obtusifolium (Jaeg.) Kindb.	7	15	NYB,UBC
Bruchiaceae			
Trematodon montanus Belland & Brassard	6,7	16	UBC
Bryaceae			
Anomobryum filiforme (Dicks.) Solms		14	UBC
Bryum amblyodon C. Müll.			UBC
Bryum argenteum Hedw.	1	11	UBC
Bryum caespiticium Hedw.	1		
Bryum capillare Hedw.	1	11	UBC
Bryum dichotomum Hedw.			UBC
Bryum gemmiparum De Not.			UBC
Bryum meesioides Kindb.			NYB,UBC
Bryum miniatum Lesq.	6	14	UBC
Bryum pallens (Brid.) Sw.			UBC
Bryum pseudotriquetrum (Hedw.) Gaertn. et al.	1	5	UBC
Epipterygium tozeri (Grev.) Lindb.	4	11	UBC
Leptobryum pyriforme (Hedw.) Wils.	1		UBC
Plagiobryum zieri (Hedw.) Lindb.			UBC

Taxon	Distribution	Habitat	Herbarium
Pohlia annotina (Hedw.) Lindb.	1	11	UBC
Pohlia camptotrachela (Ren. & Card.) Broth.		11	UBC
Pohlia cardotii (Ren.) Broth.	7	16	
Pohlia columbica (Kindb.) Andrews	7	11	UBC
Pohlia cruda (Hedw.) Lindb.	1	10,14	UBC
Pohlia drummondii (C. Müll.) Andrews			UBC
Pohlia elongata Hedw.			UBC
Pohlia filum (Schimp.) Mårt.			SM
Pohlia lescuriana (Sull.) Grout			UBC
Pohlia longibracteata Broth.	7		NYB,UBC
Pohlia nutans (Hedw.) Lindb.	1	9,10,11	H,NYB,UBC
Pohlia pacifica Shaw	7	16	UBC
Pohlia sphagnicola (Bruch & Schimp.) Lindb. & Arnell		6	
Pohlia wahlenbergii (Web. & Mohr) Andrews	1	15	NYB,UBC
Rhodobryum roseum (Hedw.) Limpr.	4		UBC
Roellia roellii (Broth.) Andr. ex Crum	7	16	UBC
Buxbaumiaceae			
Buxbaumia piperi Best	7	2	UBC
Diphyscium foliosum (Hedw.) Mohr	1	16	UBC
Climaciaceae			
Climacium dendroides (Hedw.) Web. & Mohr	1	15	H,UBC
Daltoniaceae			
Daltonia splachnoides (Sm.) Hook. & Tayl.	5,8,9	3	UBC
Dicranaceae			
Arctoa fulvella (Dicks.) Bruch & Schimp.		16	UBC
Campylopus atrovirens De Not.	4	6	NYB,UBC
Campylopus atrovirens ssp. *gracilis* Dixon	1		NYB,UBC
Campylopus flexuosus (Hedw.) Brid.	1		NYB,UBC
Campylopus fragilis (Brid.) Bruch & Schimp.	4	8	H,NYB,UBC
Campylopus japonicus Broth.	2,8,9	6	NYB
Campylopus schimperi Milde	1	16	UBC
Campylopus schwarzii Schimp.	4,8	16	NYB,UBC
Cynodontium jenneri (Schimp.) Stirt.		14	UBC
Dichodontium pellucidum (Hedw.) Schimp.	1	4,5,12,15	H,NYB,UBC
Dicranella heteromalla (Hedw.) Schimp.	1	10,11	NYB,UBC,UW
Dicranella pacifica Schof.	7	5	UBC
Dicranella palustris (Dicks.) Crundw. ex Warb.	1	4,5,12,15	NYB,UBC
Dicranella rufescens (With.) Schimp.	1	11	UBC
Dicranella schreberiana (Hedw.) Hilf. ex Crum & Anderson	1	11	UBC
Dicranella subulata (Hedw.) Schimp.	1	11	UBC
Dicranella varia (Hedw.) Schimp.	1		NYB,UBC
Dicranodontium asperulum (Mitt.) Broth.	4		UBC
Dicranodontium denudatum (Brid.) Britt.	1	6	UBC
Dicranodontium subporodictyon Broth.	4,8	14	NYB,UBC,UW
Dicranodontium uncinatum (Harv.) Jaeg.	4	14	NYB,UBC
Dicranoweisia cirrata (Hedw.) Lindb. ex Milde	4	9	
Dicranoweisia crispula (Hedw.) Lindb. ex Milde	1	16	UBC

Taxon	Distribution	Habitat	Herbarium
Dicranum angustum Lindb.	1	16	
Dicranum elongatum Schleich. ex Schwaegr.	1		SM
Dicranum fuscescens Turn.	1	2,3,9	H,SM,UBC,UW
Dicranum groenlandicum Brid.	1	6	SM,UBC
Dicranum howellii Ren. & Card.	7		SM
Dicranum majus Sm.	1	1,5,15	H,SM,UBC
Dicranum muehlenbeckii Bruch & Schimp.	1		UBC
Dicranum pallidisetum (Bail.) Irel.	7	16	UBC
Dicranum scoparium Hedw.	1	1,3,9,15	H,NYB,RBC,SM,UBC,UW
Dicranum tauricum Sapeh.	4	3	UBC
Dicranum undulatum Brid.	1	6	H,SM,UBC
Kiaeria blyttii (Schimp.) Broth.		16	UBC
Kiaeria falcata (Hedw.) Hag.		16	NYB,UBC
Kiaeria starkei (Web. & Mohr) Hag.	1	14	UBC
Oncophorus virens (Hedw.) Brid.		16	
Oncophorus wahlenbergii Brid.	1	16	NYB,UBC
Paraleucobryum enerve (Thed.) Loeske	1		NYB,UBC
Rhabdoweisia crispata (With.) Lindb.	4	14	
Disceliaceae			
Discelium nudum (Dicks.) Brid.	1	11	NYB,UBC
Ditrichaceae			
Ceratodon purpureus (Hedw.) Brid.	1	9,11	UBC
Distichium capillaceum (Hedw.) Bruch & Schimp.	1	13	NYB,UBC
Distichium inclinatum (Hedw.) Bruch & Schimp.		13	UBC
Ditrichum ambiguum Best	7	11	UBC
Ditrichum flexicaule (Schwaegr.) Hampe	1	13	UBC
Ditrichum heteromallum (Hedw.) Britt.	3	11	NYB,UBC
Ditrichum zonatum (Brid.) Kindb. **var. *scabrifolium*** Dix.	3	14	UBC
Trichodon cylindricus (Hedw.) Schimp.	1	11	NYB,UBC
Encalyptaceae			
Encalypta alpina Sm.		13	UBC
Encalypta ciliata Hedw.	1	14	NYB,UBC
Encalypta procera Bruch	1	13	UBC
Encalypta rhaptocarpa Schwaegr.	1		UBC
Entodontaceae			
Entodon concinnus (De Not.) Par.		13	NYB,UBC
Fissidentaceae			
Fissidens adianthoides Hedw.	1	14	NYB,UBC
Fissidens aphelotaxifolius Purs.			UBC
Fissidens bryoides Hedw.		15,16	NYB,UBC
Fissidens grandifrons Brid.		12,13	NYB,UBC
Fissidens limbatus Sull.	7	11	UBC
Fissidens osmundioides Hedw.	1		NYB,UBC
Fontinalaceae			
Dichelyma uncinatum Mitt.		12	UBC
Fontinalis antipyretica Hedw. var. *antipyretica*	1	12	NYB,UBC
Fontinalis antipyretica var. *oregonensis* Ren. & Card.		5	NYB,UBC
Fontinalis neomexicana Sull. & Lesq.	7	12	NYB,UBC

Taxon	Distribution	Habitat	Herbarium
Funariaceae			
Funaria hygrometrica Hedw.	1	11	UBC
Grimmiaceae			
Dryptodon patens (Hedw.) Brid.		14	NYB,UBC
Grimmia donniana Sm.		14	
Grimmia elatior Bruch ex Bals. & De Not.		14	UBC
Grimmia torquata Hornsch.		14	UBC
Grimmia trichophylla Grev.		14	
Racomitrium aciculare (Hedw.) Brid.	1	14,15	NYB,UBC
Racomitrium affine (Schleich. ex Web. & Mohr) Lindb.			
Racomitrium aquaticum (Brid. ex Schrad.) Brid.		14,15	NYB,UBC
Racomitrium canescens (Hedw.) Brid.	1		
Racomitrium elongatum Ehrh. ex Frisv.		11,15	UBC
Racomitrium ericoides (Web. ex Brid.) Brid.		9	UBC
Racomitrium fasciculare (Hedw.) Brid.		14	NYB,UBC
Racomitrium heterostichum (Hedw.) Brid.	1	14,15	UBC
Racomitrium lanuginosum (Hedw.) Brid.	1	6	H,NYB,RBC,SM,UBC
Racomitrium lawtonae Irel.	7	14	H,NYB,UBC
Racomitrium macounii Kindb.		16	NYB,UBC
Racomitrium microcarpon (Hedw.) Brid.			UBC
Racomitrium muticum (Kindb.) Frisv.	2	16	NYB,UBC
Racomitrium occidentale (Ren. & Card.) Ren. & Card.	7	14	UBC
Racomitrium sudeticum (Funck) Bruch & Schimp.	1	16	UBC
Racomitrium varium (Mitt.) Jaeg.	7	14,15	NYB,UBC
Schistidium agassizii Sull. & Lesq.	1		UBC
Schistidium apocarpum (Hedw.) Bruch & Schimp.	1		SM,UBC
Schistidium crassipilum Blom.		13	UBC
Schistidium maritimum (Turn.) Bruch & Schimp.		8	NYB,UBC
Schistidium papillosum Culm. in Amann			UBC
Schistidium rivulare (Brid.) Podp.		15	UBC
Schistidium trichodon (Brid.) Poelt	4	13	UBC
Schistidium vancouverense Blom. in sched.	7		UBC
Hedwigiaceae			
Hedwigia stellata Hedenas	3	14	
Hookeriaceae			
Hookeria acutifolia Hook. & Grev.		15	NYB,UBC
Hookeria lucens (Hedw.) Sm.	3	5,15	H,NYB,RBC,UBC
Hylocomiaceae			
Hylocomiastrum pyrenaicum (Spruce) Fleisch.	1		UBC
Hylocomiastrum umbratum (Hedw.) Fleisch.	1		NYB,UBC
Hylocomium splendens (Hedw.) Schimp.	1	1,15	H,NYB,RBC,UBC
Pleurozium schreberi (Brid.) Mitt.	1	4	H,NYB,UBC
Rhytidiadelphus loreus (Hedw.) Warnst.	1	1,3,15	H,NYB,RBC,UBC
Rhytidiadelphus squarrosus (Hedw.) Warnst.	1	4,16,15	UBC
Rhytidiadelphus subpinnatus (Lindb.) T. Kop.	1		NYB,H
Rhytidiadelphus triquetrus (Hedw.) Warnst.	1	1,3,15	H,NYB,RBC,UBC
Rhytidiopsis robusta (Hook.) Broth.	7	16	NYB,UBC
Schofieldiella micans (Mitt.) Buck	4		UBC

Taxon	Distribution	Habitat	Herbarium
Hypnaceae			
Buckiella undulata (Hedw.) Irel.	3	1,2,3	NYB,UBC
Ctenidium schofieldii Nish.	5,7		NYB,UBC
Gollania turgens (C. Müll.) Ando	2,5	13	UBC
Herzogiella adscendens (Lindb.) Iwats. & Schof.	2	8	UBC
Herzogiella striatella (Brid.) Iwats.	1	16	NYB,UBC
Hypnum callichroum Funck ex Brid.		3	NYB,UBC,UW
Hypnum circinale Hook.	7	3,9	H,NYB,UBC
Hypnum cupressiforme Hedw.	1	8	H,NYB,UBC
Hypnum dieckii Ren. & Card.	2	4,15	NYB,UBC
Hypnum lindbergii Mitt.	1		NYB,UBC
Hypnum pallescens (Hedw.) P. Beauv.	1	3	
Hypnum plicatulum (Lindb.) Jaeg.	2		NYB,UBC
Hypnum recurvatum (Lindb. & Arnell) Kindb.	1	13	
Hypnum revolutum (Mitt.) Lindb.	1		
Hypnum subimponens Lesq.	2	3,9,14	NYB,UBC
Hypnum vaucheri Lesq.	1		UBC
Isopterygiopsis pulchella (Hedw.) Iwats.	1	14	NYB,UBC
Orthothecium chryseum (Schwaegr.) Schimp.		13	UBC
Platydictya jungermannioides (Brid.) Crum	1	13	UBC
Pseudotaxiphyllum elegans (Brid.) Iwats.	1	3,10,14,15	NYB,UBC
Ptilium crista-castrensis (Hedw.) De Not.	1	4	UBC
Hypopterygiaceae			
Hypopterygium fauriei Besch.	2,5,8	13	UBC
Leskeaceae			
Claopodium bolanderi Best	7	14	UBC
Claopodium crispifolium (Hook.) Ren. & Card.	2	3,14	H,NYB,UBC
Claopodium pellucinerve (Mitt.) Best	2,9	13	NYB,UBC
Claopodium whippleanum (Sull.) Ren. & Card.	3		NYB,UBC
Lescuraea saxicola (Schimp.) Milde			UBC
Pseudoleskea atricha (Kindb.) Kindb.			UBC
Pseudoleskea baileyi Best & Grout	7	16	NYB,UBC
Pseudoleskea incurvata (Hedw.) Loeske			UBC
Pseudoleskea patens (Lindb.) Kindb.		14	UBC
Pseudoleskea stenophylla Ren. & Card.	2	3	UBC
Leucodontaceae			
Antitrichia californica Sull.	3		
Antitrichia curtipendula (Hedw.) Brid.	4	3,6,9	H,NYB,RBC,UBC
Meesiaceae			
Paludella squarrosa (Hedw.) Brid.	1		
Mniaceae			
Leucolepis acanthoneuron (Schwaegr.) Lindb.	7	1,5,15	H,RBC,UBC
Mnium ambiguum H. Müll.		13	UBC
Mnium blyttii Bruch & Schimp			UBC
Mnium marginatum (With.) Brid. ex P. Beauv.		13	NYB,UBC
Mnium spinulosum Bruch & Schimp	1		H,UBC
Mnium thomsonii Schimp.			UBC

Taxon	Distribution	Habitat	Herbarium
Plagiomnium insigne (Mitt.) T. Kop.	7	1,15	H,UBC
Plagiomnium rostratum (Schrad.) T. Kop.		13	UBC
Plagiomnium venustum (Mitt.) T. Kop.	7	14	UBC
Rhizomnium glabrescens (Kindb.) T. Kop.	7	1,2,3,15	H,RBC,UBC
Rhizomnium magnifolium (Horik.) T. Kop.	1	5,7,15	NYB,UBC
Rhizomnium nudum (Britt. & Williams) T. Kop.	2	16	UBC
Rhizomnium pseudopunctatum (Bruch & Schimp.) T. Kop.			UBC
Neckeraceae			
Metaneckera menziesii (Hook.) Steere	3	3	NYB,UBC
Neckera douglasii Hook.	7	3	NYB,UBC
Oedipodiaceae			
Oedipodium griffithianum (Dicks.) Schwaegr.	4	13	NYB,UBC
Orthotrichaceae			
Amphidium californicum (Hampe ex C. Müll.) Broth.	7	13	NYB,UBC
Amphidium lapponicum (Hedw.) Schimp.	1	14	NYB,UBC
Amphidium mougeotii (Bruch & Schimp.) Schimp.	1	14	NYB,SM,UBC
Orthotrichum consimile Mitt.	4	3	UBC
Orthotrichum lyellii Hook. & Tayl.	3	3	NYB,UBC
Orthotrichum pulchellum Brunt.	7		UBC
Ulota drummondii (Hook. & Grev.) Brid.	4	3	UBC
Ulota megalospora Vent.	7	3	UBC
Ulota obtusiuscula C. Müll. & Kindb.	7	3	H,NYB,RBC,UBC,UW
Ulota phyllantha Brid.	1	3,8,9	H,NYB,UBC
***Zygodon gracilis* Wils.**	3,8,9	13	UBC
Zygodon reinwardtii (Hornsch. in Reinw. & Hornsch.) A.Br. in Bruch. & Schi	1	3	NYB,UBC
Zygodon viridissimus (Dicks.) Brid. var. *rupestris* Lindb. ex Hartm.	1	13	NYB,UBC
Plagiotheciaceae			
Plagiothecium cavifolium (Brid.) Iwats.	1	3,14	NYB,UBC
Plagiothecium denticulatum (Hedw.) Schimp.	1	3,14	UBC
Plagiothecium laetum Schimp.	1	2,14	UBC
Plagiothecium piliferum (Sw. ex Hartm.) Schimp.	1	3,14	UBC
Pleuroziopsidaceae			
Pleuroziopsis ruthenica (Weinm.) Kindb. ex Britt.	2	15	UBC
Polytrichaceae			
Atrichum selwynii Aust.	7	15	UBC
Atrichum undulatum (Hedw.) P. Beauv.			UBC
Bartramiopsis lescurii (James) Kindb.	2	14	UBC
Meiotrichum lyallii Merrill	7	16	
Oligotrichum aligerum Mitt.	2	11,15	NYB,UBC
Oligotrichum hercynicum (Hedw.) Lam. & DC.	4	16	UBC
Oligotrichum parallelum (Mitt.) Kindb.	2	15	NYB,UBC
Pogonatum contortum (Brid.) Lesq.	2	10,11,15	UBC
Pogonatum dentatum (Brid.) Brid.			UBC
Pogonatum urnigerum (Hedw.) P. Beauv.	1		UBC
Polytrichastrum alpinum (Hedw.) G.L. Sm.	1	1,10,14,15	H,NYB,UBC,UW
Polytrichum commune Hedw.	1	15	H,NYB,UBC
Polytrichum formosum Hedw.		5,15	H,NYB,RBC,UBC,UW
Polytrichum juniperinum Hedw.	1	9,15	UBC

Taxon	Distribution	Habitat	Herbarium
Polytrichum longisetum Brid.			
Polytrichum piliferum Hedw.	1		UBC
Polytrichum sexangulare Brid.		16	UBC
Polytrichum strictum Brid.	1	6	NYB,UBC
Pottiaceae			
Anoectangium aestivum (Hedw.) Mitt.		14	UBC
Barbula unguiculata Hedw.	1	11	UBC
Bryoerythrophyllum recurvirostrum (Hedw.) Chen	1		NYB,UBC
Crumia latifolia (Kindb.) Schof.	3	13	
Desmatodon heimii (Hedw.) Mitt.		8	
Didymodon fallax Hedw. var. *reflexus* (Brid.) Zand.	1		NYB,UBC
Didymodon nigrescens (Mitt.) Saito	2	13	UBC
Didymodon rigidulus Hedw. **var. *rigidulus***	1		UBC
Didymodon rigidulus var. *gracilis* (Schleich. ex Hook. & Grev.) Zand.	1		UBC
Didymodon subandreaeoides (Kindb.) Zand.	2	13	UBC
Didymodon tophaceus (Brid.) Lisa	1	13	
Didymodon vinealis (Brid.) Zand. var. *flaccidus* (Bruch & Schimp.) Zand.	2		UBC
Eucladium verticillatum (Brid.) Bruch & Schimp.	1		UBC
Geheebia gigantea (Funck) Boul.	4	13	NYB,UBC
Gymnostomum aeruginosum Sm.		13	NYB,UBC
Hymenostylium insigne (Dix.) Podp.	3	13	UBC
Hymenostylium recurvirostre (Hedw.) Dix.			UBC
Oxystegus tenuirostris (Hook. & Tayl.) A. J. E. Sm.			UBC
Paraleptodontium recurvifolium (Tayl.) Long	3,8,9		NYB,UBC
Timmiella crassinervis (Hampe) L. Koch	7	11	UBC
Tortella fragilis (Hook. & Wils.) Limpr.		13	UBC
Tortella tortuosa (Hedw.) Limpr.	1	3,13	NYB,UBC
Tortula amplexa (Lesq.) Steere	3	11	UBC
Tortula muralis Hedw.	1		
Tortula norvegica (Web.) Wahlenb. ex Lindb.		16	UBC
Tortula princeps De Not.	1	14	NYB,UBC
Tortula ruralis (Hedw.) Gaertn. et al.	1	9,14	UBC
Weissia controversa Hedw.			UBC
Pterigynandraceae			
Heterocladium dimorphum (Brid.) Schimp.			UBC
Heterocladium macounii Best	6	3,14	H,NYB,UBC
Heterocladium procurrens (Mitt.) Jaeg.	2	3	NYB,UBC
Iwatsukiella leucotricha (Mitt.) Buck & Crum	2		NYB,UBC
Myurella julacea (Schwaegr.) Schimp		13	UBC
Pterigynandrum filiforme Hedw.		3	UBC
Rhytidiaceae			
Rhytidium rugosum (Hedw.) Kindb.	1		UBC
Schistostegaceae			
Schistostega pennata (Hedw.) Web. & Mohr.	1	10	UBC
Scouleriaceae			
Scouleria aquatica Hook.	2	12,15	NYB,UBC

Taxon	Distribution	Habitat	Herbarium
Seligeriaceae			
Blindia acuta (Hedw.) Bruch & Schimp.	1	14	NYB,UBC
Seligeria careyana Vitt & Schof.	9,10	13	UBC
Seligeria donniana (Sm.) C. Müll.		13	UBC
Seligeria tristichoides Kindb.		13	UBC
Sematophyllaceae			
Brotherella "canadensis" Schof. in Sched.	5,7	3,4,7	NYB,UBC
Brotherella "haidensis" Schof. in Sched.	5,9,10	14	
Heterophyllium "haidensis" Schof. in Sched.	9,10	4,7	UBC
Wijkia carlottae (Schof.) Crum	5,9,10	14	NYB,UBC,UW
Sphagnaceae			
Sphagnum "sjorsianum" Andrus in sched.			UBC
Sphagnum alaskense Andrus & Janssen	7	6,7	UBC
Sphagnum angustifolium (C. Jens. ex Russ.) C. Jens.	1	6	NYB,UBC
Sphagnum austinii Sull.	1	6	NYB,UBC
Sphagnum balticum (Russ.) C. Jens.	1		UBC
Sphagnum californicum Andrus in Sched.	1		UBC
Sphagnum capillifolium (Ehrh.) Hedw.	1	6	NYB,UBC,UW
Sphagnum compactum DC.	1	7	NYB,UBC
Sphagnum contortum Schultz	1	7	
Sphagnum fimbriatum Wils.	1	4,7	NYB,UBC
Sphagnum fuscum (Schimp.) Klinggr.	1	6	NYB,UBC
Sphagnum girgensohnii Russ.	1	1,15	H,NYB,SM,UBC,UW
Sphagnum henryense Warnst.	1	6	UBC
Sphagnum junghuhnianum Dozy & Molk. **var. *pseudomolle*** (Warnst.)	2,8,9		UBC
Sphagnum kenaiense Andrus	7,9		UBC
Sphagnum lindbergii Schimp.	1	6,7,12	NYB,SM,UBC,UW
Sphagnum magellanicum Brid.	1	6	NYB,UBC
Sphagnum majus (Russ.) C. Jens.	1	6	
Sphagnum mendocinum Sull. & Lesq.	7	4,6,7,12	NYB,UBC
Sphagnum orientale Sav.-Ljub.	2		UBC
Sphagnum pacificum Flatb.	7	6,7,12	SM,UBC
Sphagnum palustre L.	1	7	NYB,UBC
Sphagnum papillosum Lindb.	1	4,6,7	NYB,UBC,UW
Sphagnum platyphyllum (Lindb. ex Braithw.) Sull. ex Warnst.	1		UBC
Sphagnum quinquefarium (Lindb. ex Braithw.) Warnst.	1		UBC
Sphagnum rubellum Wils.	1		UBC
Sphagnum rubiginosum Flatberg	1	4	SM,UBC
Sphagnum russowii Warnst.	1	4,6,7	NYB,UBC,UW
Sphagnum schofieldii Crum	7,8		
Sphagnum squarrosum Crome	1	1,15	NYB,SM,UBC,UW
Sphagnum subnitens Russ. & Warnst.	1	7	H,NYB,UBC
Sphagnum subobesum Warnst.	2	7	UBC
Sphagnum subsecundum Nees	1	7	NYB,UBC
Sphagnum tenellum (Brid.) Bory	1	7	UBC
Sphagnum teres (Schimp.) Ångstr.	1	7	NYB,UBC
Sphagnum warnstorfii Russ.	1	7	UBC
Sphagnum wilfii Crum	7,9		NYB,UBC

Taxon	Distribution	Habitat	Herbarium
Splachnaceae			
Splachnum ampullaceum Hedw.		6	UBC,UW
Splachnum sphaericum Hedw.		4,6	NYB,UBC
Tayloria serrata (Hedw.) Bruch & Schimp.			UBC
Tetraplodon mnioides (Hedw.) Bruch & Schimp	1	4,6	UBC
Takakiaceae			
Takakia lepidozioides Hatt. & H. Inoue	2	14,16	NYB,UBC
Tetraphidaceae			
Tetraphis geniculata Girg. ex Milde	2	2	UBC
Tetraphis pellucida Hedw.	1	2	NYB,UBC
Tetrodontium brownianum (Dicks.) Schwaegr.	4	14	UBC
Thamnobryaceae			
Bryolawtonia vancouverensis (Kindb. in Mac.) Norris & Enroth	7	13	NYB,UBC,UW
Porotrichum bigelovii (Sull.) Kindb.	7	13	NYB,UBC
Thamnobryum neckeroides (Hook.) Lawt.	2		NYB,UBC
Thuidiaceae			
Abietinella abietina (Hedw.) Fleisch.	1	13	UBC
Thuidium assimile (Mitt.) Jaeg.		14	UBC
Timmiaceae			
Timmia austriaca Hedw.	1		UBC
Hepatics			
Adelanthaceae			
Odontoschisma denudatum (Nees ex Mart.) Dum.	1	3	UBC
Odontoschisma elongatum (Lindb.) Evans	1	6	UBC
Aneuraceae			
Aneura pinguis (L.) Dum.	1	6	H,UBC
Riccardia chamedryfolia (With.) Grolle	1	5	UBC
Riccardia latifrons Lindb.	1	2	H,RBC,UBC
Riccardia multifida (L.) S. Gray	1	5,14	H,RBC,UBC,UW
Riccardia palmata (Hedw.) Carruth.	1	2	H,RBC,UBC
Antheliaceae			
Anthelia julacea (L.) Dum.	1	4,14	NYB,RBC,UBC
Anthelia juratzkana (Limpr.) Trev.	1	16	NYB,RBC,UBC
Aytoniaceae			
Asterella gracilis (Web.) Underw.	1	16	UBC
Reboulia hemisphaerica (L.) Raddi	1	13	
Blasiaceae			
Blasia pusilla L.	1	11	UBC
Calypogeiacaceae			
Calypogeia azurea Stotler & Crotz.	1	1,2,10	H,UBC
Calypogeia fissa (L.) Raddi	1	2	UBC
Calypogeia integristipula Steph.	1	14	UBC
Calypogeia muelleriana (Schiffn.) K. Müll.	1	1,2,10	H,RBC,UBC
Calypogeia sphagnicola (H. Arnell & J. Perss.) Warnst. & Loeske	1	6	H,RBC,UBC
Calypogeia suecica (H. Arnell & J. Perss.) K. Müll.	1	5,14	H,RBC,UBC

Taxon	Distribution	Habitat	Herbarium
Cephaloziaceae			
Cephalozia bicuspidata (L.) Dum.	1	1,2	H,RBC,UBC
Cephalozia bicuspidata ssp. *ambigua* (Mass.) Schust.			
Cephalozia connivens (Dicks.) Lindb.	1		UBC
Cephalozia leucantha Spruce	1		H,RBC,UBC
Cephalozia lunulifolia (Dum.) Dum.	1	2	H,RBC,UBC
Cephalozia macounii (Aust.) Aust.	1		H,RBC
Cephalozia media Lindb.			UBC
Cephalozia pleniceps (Aust.) Lindb.	1	5,6	UBC
Cladopodiella fluitans (Nees) Joerg.	1	6,12	RBC,UBC
Hygrobiella laxifolia (Hook.) Spruce	1	13,15	UBC
Pleurocladula albescens (Hook.) Grolle	1	16	UBC
Schofieldia monticola Godfr.	7	16	UBC
Cephaloziellaceae			
Cephaloziella divaricata (Sm.) Schiffn.	1	9	H,UBC
Cephaloziella divaricata var. *scabra* M.A. Howe	1		UBC
Cephaloziella rubella (Nees) Warnst.	1		UBC
Codoniaceae			
Fossombronia dumortieri (Hub. & Genth.) Lindb.			UBC
Fossombronia foveolata Lindb.		11,15	
Conocephalaceae			
Conocephalum conicum (L.) Lindb.	1	5,14,15	H,NYB,RBC,UBC
Geocalycaceae			
Geocalyx graveolens (Schrad.) Nees	1	2	H,RBC,UBC
Harpanthus flotovianus (Nees) Nees	1	7	UBC
Gymnomitriaceae			
Eremonotus myriocarpus (Carr.) Lindb. & Kaal. ex Pears.	4		UBC
Gymnomitrion concinnatum (Lightf.) Corda	1	16	UBC
Gymnomitrion corallioides Nees	1	16	UBC
Gymnomitrion obtusum (Lindb.) Pears.	1	14,16	UBC
Gymnomitrion pacificum Grolle	2,8	16	UBC
Marsupella alpina (Mass. & Carest.) H. Bern.	4	14,16	UBC
Marsupella aquatica (Lindenb.) Schiffn.	1		UBC
Marsupella boeckii (Aust.) Kaal.	1	14	UBC
Marsupella boeckii var. *stableri* (Spruce) Schust.	3		UBC
Marsupella commutata (Limpr.) H. Bern.	4		UBC
Marsupella emarginata (Ehrh.) Dum.	1	15	H,RBC,UBC
Marsupella sparsifolia (Lindb.) Dum.	1	16	UBC
Marsupella sphacelata (Gieseke) Dum.	1	16	UBC
Gyrothyraceae			
Gyrothyra underwoodiana M.A. Howe	7	11,15	H,RBC,UBC
Haplomitriaceae			
Haplomitrium hookeri (Sm.) Nees	3	16	UBC
Herbertaceae			
Herbertus "haidensis" Schof. in sched.	5,9,10	3	
Herbertus aduncus (Dicks.) S. Gray	4,5	3,6,7,14,15	H,NYB,RBC,UBC,UW
Herbertus sakuraii (Warnst.)	2,5	4,7,14	H,RBC,SM,UBC

Taxon	Distribution	Habitat	Herbarium
Herbertus sendtneri (Nees) Evans	4,5,8	16	UBC
Jubulaceae			
Frullania californica (Aust.) Evans	7	3	H,UBC
Frullania franciscana M.A. Howe	7	3	H,RBC,UBC
Frullania tamarisci (L.) Dum. ssp. *nisquallensis* (Sull.) Hatt.	2	3,8,9,14	H,RBC,UBC
Jungermanniaceae			
Anastrepta orcadensis (Hook) Schiffn.	4,8		UBC
Anastrophyllum assimile (Mitt.) Steph.	2,4	16	UBC
Anastrophyllum donianum (Hook.) Steph.	4,8	4,7	UBC
Anastrophyllum minutum (Schreb.) Schust.	1	3,6,14	UBC
Anastrophyllum minutum var. *grandis* (Gott. ex Lindb.) Schust.	1		
Barbilophozia attenuata (Mart.) Loeske	1		
Barbilophozia barbata (Schmid. ex Schreb.) Loeske	1	14	UBC
Barbilophozia floerkei (Web. & Mohr) Loeske	1	16	SM,UBC
Barbilophozia hatcheri (Evans) Loeske	1	14	UBC
Barbilophozia kunzeana (Hub.) Gams.	1	16	
Barbilophozia lycopodioides (Wallr.) Loeske	1	14	SM,UBC
Barbilophozia quadriloba (Lindb.) Loeske	1	13,16	UBC
Chandonanthus hirtellus (Web.) Mitt.	2,5,8		RBC,UBC
Gymnocolea inflata (Huds.) Dum.	1	6,12	NYB,RBC,SM,UBC
Jamesoniella autumnalis (DC.) Steph.	1		NYB,RBC,UBC,UW
Jungermannia atrovirens Dum.	1	13	SM,UBC
Jungermannia evansii Vana			UBC
Jungermannia exsertifolia Steph.	1	16	SM,UBC
Jungermannia exsertifolia ssp. *cordifolia* (Dum.) Vana		12	SM,UBC
Jungermannia hyalina Lyell	1		SM,UBC
Jungermannia leiantha Grolle	1		SM,UBC
Jungermannia obovata Nees	1		SM,UBC
Jungermannia pumila With.	1	14	SM,UBC
Jungermannia rubra Gott. ex Underw.	7	11	NYB,SM,UBC
Jungermannia schusterana Godfrey & Godfrey	7,8	12	UBC
Jungermannia sphaerocarpa Hook.	1		
Jungermannia subelliptica (Lindb. ex Kaal.) Lev.	1		UBC
Lophozia alpestris (Schleich. ex Web.) Evans			UBC,UW
Lophozia badensis (Gott. ex Rabenh.) Schiffn.	1		NYB,SM,UW
Lophozia bantriensis (Hook.) Steph.	1	13	H,SM,UBC
Lophozia collaris (Nees) Dum.	1		UBC
Lophozia heterocolpos (Thed.) M.A. Howe	1	13	UBC
Lophozia incisa (Schrad.) Dum.	1	2,3,10	H,RBC,SM,UBC
Lophozia laxa (Lindb.) Grolle	1		UBC
Lophozia longiflora (Nees) Schiffn.	1	2	
Lophozia obtusa (Lindb.) Evans	1		UBC
Lophozia opacifolia Culm.	1	16	SM,UBC
Lophozia sudetica (Nees) Grolle	1		
Lophozia ventricosa (Dicks.) Dum.	1	2	H,SM,UBC
Lophozia ventricosa var. *longiflora* (Nees) Macoun			
Lophozia wenzelii (Nees) Steph.	1		SM,UBC
Mylia anomala (Hook.) S. Gray	1	6	UBC
Mylia taylorii (Hook.) S. Gray	1	3,6,12	H,RBC,SM,UBC

Taxon	Distribution	Habitat	Herbarium
Nardia compressa (Hook.) S. Gray	1	16	UBC
Nardia geoscyphus (DeNot.) Lindb.	1	16	UBC
Nardia insecta Lindb.	4		UBC
Nardia japonica Steph.	2	16	UBC
Nardia scalaris S. Gray	1	14	H,UBC
Sphenolobopsis pearsonii (Spruce) Schust.	4	14	SM,UBC
Tetralophozia pusilla (Steph.) Urmi			UBC
Tetralophozia setiformis (Ehrh.) Schljak.	1		UBC
Tritomaria exsecta (Schrad.) Loeske	1	2,3	UBC
Tritomaria polita (Nees) Joerg.	1	13,16	
Tritomaria quinquedentata (Huds.) Buch	1	16	UBC
Lejeuneaceae			
Cololejeunea macounii (Spruce ex Underw.) Evans	2,5,8	3	UBC
Lepidoziaceae			
Bazzania ambigua (Lindenb.) Trev.	7		NYB,UW
Bazzania denudata (Torr. ex Gott. & al.) Trev.	2	2,3,10	H,RBC,UBC,UW
Bazzania pearsonii Steph.	4,8	4,7,16	H,NYB,RBC,UBC
Bazzania tricrenata (Wahlenb.) Lindb.	1	4,7,14,15	H,NYB,RBC,UBC
Bazzania trilobata (L.) S. Gray	4	6,7	UBC
Dendrobazzania griffithiana (Steph.) Schust. & Schof.	2,8,9		NYB,UBC
Kurzia pauciflora (Dicks.) Grolle	1	4	UBC
Kurzia sylvatica (Evans) Grolle	1	3,6	H,NYB,RBC
Kurzia trichoclados (Hong, 1986)	3,8		UBC
Lepidozia filamentosa ssp. *subtransversa* (Steph.) Hatt.	2	4,7,15	RBC,UBC
Lepidozia reptans (L.) Dum.	1	1,2,3,10	H,RBC,UBC
Lophocoleaceae			
Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dum.	1		UBC
Chiloscyphus polyanthos (L.) Corda	1	5,12,15	H,UBC
Chiloscyphus polyanthos ssp. *fragilis* (A. Roth) K. Muell.			UBC
Lophocolea bidentata (L.) Dum.	1	2,3	H,UBC
Lophocolea heterophylla (Schrad.) Dum.	1	3	UBC
Marchantiaceae			
Marchantia polymorpha L.	1	11,15	UBC
Preissia quadrata (Scop.) Nees	1	13	UBC
Mastigophoraceae			
Mastigophora woodsii (Hook.) Nees	4,5,8		NYB,UBC
Metzgeriaceae			
Apometzgeria pubescens (Schrank) Kuwah.	1	3,13	UBC
Metzgeria conjugata Lindb.	1	3,8,14	H,RBC,UBC
Metzgeria leptoneura Spruce	4		NYB,RBC,UBC
Metzgeria temperata Kuwah.	1	3	UBC
Pallaviciniaceae			
Moerckia blyttii (Moerck) Brockm.	1	16	H,NYB,UBC
Moerckia hibernica (Hook.) Gott.	1	13	UBC
Pelliaceae			
Calycularia crispula Mitt.	2,8		UBC
Pellia endiviifolia (Dicks.) Dum.	1	13	RBC,UBC

Taxon	Distribution	Habitat	Herbarium
Pellia epiphylla (L.) Corda	1		H,RBC
Pellia neesiana (Gott.) Limpr.	1	4,11,14,15	RBC,UBC
Plagiochilaceae			
Plagiochila asplenioides (L.) Dum.	1		H,NYB,UW
Plagiochila porelloides (Torr. ex Nees) Lindenb.	1	1,2,3,14,15	H,RBC,UBC
Plagiochila schofieldiana H. Inoue	7	3,14,15	NYB,RBC,UBC,UW
Plagiochila semidecurrens Lehm. et Lindenb. var. *semidecurrens*	2	3,14	H,NYB,RBC,UBC
Plagiochila semidecurrens var. *alaskana* (Evans) H. Inoue	2		NYB,UBC
Pleuroziaceae			
Pleurozia purpurea Lindb.	4,5	4,6,7	H,NYB,RBC,UBC
Porellaceae			
Porella cordaeana (Hub.) Moore	3	3,14	H,SM,UBC
Porella navicularis (Lehm. & Lindenb.) Lindb.	7	3	H,NYB,RBC,UBC
Porella roellii Steph.	7	3,14	NYB,UBC
Pseudolepicoleaceae			
Blepharostoma trichophyllum (L.) Dum.	1	2,3	H,RBC,UBC
Ptilidiaceae			
Ptilidium californicum (Aust.) Underw.	2	3	UBC
Ptilidium ciliare (L.) Hampe	1	12	NYB,UBC
Ptilidium pulcherrimum (G. Web.) Hampe	1		RBC,UBC
Radulaceae			
Radula auriculata Steph.	2,8,9	3	NYB,RBC,UBC
Radula bolanderi Gott.	7	3	H,RBC,UBC
Radula complanata (L.) Dum.	1	3,14	UBC
Radula obtusiloba Steph. ssp. *polyclada* (Evans) Hatt.	2	3,14	H,NYB,RBC,UBC,UW
Scapaniaceae			
Diplophyllum albicans (L.) Dum.	1	1,3,10,14,15	H,RBC,UBC
Diplophyllum imbricatum (M.A. Howe) K. Müll.	7	16	UBC
Diplophyllum plicatum Lindb.	2	1,3,14	H,RBC,UBC
Diplophyllum taxifolium (Wahlenb.) Dum.	1	14	RBC,UBC
Douinia ovata (Dicks.) Buch	3	3,14	H,RBC,UBC
Scapania americana K. Müll.	7	4,14	H,NYB,RBC,UBC
Scapania bolanderi Aust.	2	1,2,3,9,10	H,NYB,RBC,UBC,UW
Scapania gymnostomophila Kaal.	1		UBC
Scapania irrigua (Nees) Gott. & al.	1	12	
Scapania ornithopodioides (Schofield & Crum, 1972)	4,8	4,7	UBC
Scapania paludicola Loeske & K. Müll.	1	12	UBC,UW
Scapania paludosa (K. Müll.) K. Müll.	1	4,6,12	NYB,UBC
Scapania scandica (H. Arnell & Buch) Macv.	1	14	
Scapania subalpina (Nees) Dum.	1	15	UBC
Scapania uliginosa (Sw. ex Lindenb.) Dum.	1	4,12,14	H,NYB,RBC,UBC
Scapania umbrosa (Schrad.) Dum.	1	2,9	H,RBC,UBC
Scapania undulata (L.) Dum. var. *undulata*	1	12	H,NYB,RBC,UBC
Scapania undulata var. *oakesii* (Aust.) Buch			H,NYB,UBC
Treubiaceae			
Apotreubia hortonae Schuster & Konstantiniva	5,7,8	4	UBC

Appendix B. Taxa Listed by Geographical Elements

1 Widesread in Northern hemisphere

Mosses, Hepatics

Many, see appendix A

2 Amphipacific

Mosses

Bartramiopsis lescurii
Campylopus japonicus
Claopodium crispifolium
Claopodium pellucinerve
Didymodon nigrescens
Didymodon subandreaeoides
Didymodon vinealis var. *flaccidus*
Gollania turgens
Herzogiella adscendens
Heterocladium procurrens
Hypnum dieckii
Hypnum plicatulum
Hypnum subimponens
Hypopterygium fauriei
Iwatsukiella leucotricha
Loeskhypnum wickesiae
Oligotrichum aligerum
Oligotrichum parallelum
Pleuroziopsis ruthenica
Pogonatum contortum
Pseudoleskea stenophylla
Racomitrium muticum
Rhizomnium nudum
Scouleria aquatica
Sphagnum junghuhnianum var. *pseudomolle*
Sphagnum orientale
Sphagnum subobesum
Takakia lepidozioides
Tetraphis geniculata
Thamnobryum neckeroides

Hepatics

Anastrophyllum assimile
Bazzania denudata
Calycularia crispula
Chandonanthus hirtellus
Cololejeunea macounii
Dendrobazzania griffithiana
Diplophyllum plicatum
Frullania tamarisci ssp. *nisquallensis*
Gymnomitrion pacificum
Herbertus sakuraii
Lepidozia filamentosa ssp. *subtransversa*
Nardia japonica
Plagiochila semidecurrens var. *alaskana*
Plagiochila semidecurrens var. *semidecurrens*
Ptilidium californicum
Radula auriculata
Radula obtusiloba ssp. *polyclada*
Scapania bolanderi

3 Western European – Western North American

Mosses

Andreaea megistospora
Andreaea sinuosa
Antitrichia californica
Buckiella undulata
Claopodium whippleanum
Crumia latifolia
Ditrichum heteromallum
Ditrichum zonatum var. *scabrifolium*
Hedwigia stellata
Hookeria lucens
Hymenostylium insigne
Metaneckera menziesii
Orthotrichum lyellii
Paraleptodontium recurvifolium
Scleropodium cespitans
Tortula amplexa
Zygodon gracilis

Hepatics

Douinia ovata
Haplomitrium hookeri
Kurzia trichoclados
Marsupella boeckii var. *stableri*
Porella cordaeana

4 Western European – Western North American showing a widely interrupted pattern in the Northern Hemisphere

Mosses

Andreaea nivalis
Antitrichia curtipendula
Campylopus atrovirens
Campylopus fragilis
Campylopus schwarzii
Dicranodontium asperulum
Dicranodontium subporodictyon
Dicranodontium uncinatum
Dicranoweisia cirrata
Dicranum tauricum
Epipterygium tozeri
Geheebia gigantea
Oedipodium griffithianum
Oligotrichum hercynium
Orthotrichum consimile
Rhabdoweisia crispata
Rhodobryum roseum
Schistidium trichodon
Schofieldiella micans
Tetrodontium brownianum
Ulota drummondii

Hepatics

Anastrepta orcadensis
Anastrophyllum assimile
Anastrophyllum donianum
Bazzania pearsonii
Bazzania trilobata
Eremonotus myriocarpus
Herbertus aduncus
Herbertus sendtneri
Nardia insecta
Marsupella alpina
Marsupella commutata
Mastigophora woodsii
Metzgeria leptoneura
Pleurozia purpurea
Scapania ornithopodioides
Sphenolobopsis pearsonii

5 Tropical – subtropical affinity

Mosses

Brotherella "canadensis"
Brotherella "haidensis"
Ctenidium schofieldii
Daltonia splachnoides
Gollania turgens
Hypopterygium fauriei
Wijkia carlottae

Hepatics

Apotreubia hortonae
Chandonanthus hirtellus
Cololejeunea macounii
Herbertus "haidensis"
Herbertus aduncus
Herbertus sakuraii
Herbertus sendtneri
Mastigophora woodsii
Pleurozia purpurea

6 Eastern North America disjuncts

Mosses

Bryum miniatum
Heterocladium macounii
Trematodon montanus

Hepatics

none

7 Western North America

Mosses

Amphidium californicum
Anacolia menziesii
Brachythecium frigidum
Brachythecium leibergii
Brotherella "canadensis"
Bryolawtonia vancouverensis
Buxbaumia piperi
Claopodium bolanderi
Ctenidium schofieldii
Dicranella pacifica
Dicranum pallidisetum
Ditrichum ambiguum
Eurhynchium oreganum
Eurhynchium pulchellum var. *barnesii*
Fontinalis neomexicana
Homalothecium aeneum
Homalothecium fulgescens
Homalothecium nuttallii
Hypnum circinale
Isothecium myosuroides
Leucolepis acanthoneuron
Meiotrichum lyallii
Neckera douglasii
Plagiomnium insigne
Plagiomnium venustum
Pohlia cardotii
Pohlia columbica
Pohlia longibracteata
Pohlia pacifica
Porotrichum bigelovii
Pseudoleskea baileyi
Racomitrium lawtonae
Racomitrium occidentale
Racomitrium varium
Rhizomnium glabrescens
Rhytidiopsis robusta
Roellia roellii
Sanionia symmetrica
Schistidium vancouverense
Scleropodium obtusifolium
Sphagnum alaskense
Sphagnum kenaiense
Sphagnum mendocinum
Sphagnum pacificum
Sphagnum schofieldii
Sphagnum wilfii
Timmiella crassinervis
Trematodon montanus
Ulota megalospora
Ulota obtusiuscula

Hepatics

Apotreubia hortonae
Bazzania ambigua
Diplophyllum imbricatum
Frullania californica
Frullania franciscana
Gyrothyra underwoodiana
Jungermannia rubra
Jungermannia schusterana
Plagiochila schofieldiana
Porella navicularis
Porella roellii
Radula bolanderi
Scapania americana
Schofieldia monticola

8 Pacific Coast

Mosses

Andreaea mutabilisDicranodontium subporodicty *on* *Sphagnum schofieldii*
Campylopus japonicus *Hypopterygium fauriei* *Zygodon gracilis*
Campylopus schwarzii *Paraleptodontium recurvifolium*
Daltonia splachnoides *Sphagnum junghuhnianum* var. *pseudomolle*

Hepatics

Anastrepta orcadensis *Chandonanthus hirtellus* *Jungermannia schusterana*
Anastrophyllum donianum *Cololejeunea macounii* *Kurzia trichoclados*
Apotreubia hortonae *Dendrobazzania griffithiana* *Mastigophora woodsii*
Bazzania pearsonii *Gymnomitrion pacificum* *Radula auriculata*
Calycularia crispula *Herbertus sendtneri* *Scapania ornithopodioides*

9 Species in which Haida Gwaii contains the only known Canadian population

Mosses

Andreaea mutabilisHeterophy *llium "haidensis"* *Sphagnum wilfii*
Brotherella "haidensis" *Paraleptodontium recurvifolium* *Wijkia carlottae*
Campylopus japonicus *Seligeria careyana* *Zygodon gracilis*
Claopodium pellucinerve *Sphagnum "kenaiense"*
Daltonia splachnoides *Sphagnum junghuhnianum* var. *pseudomolle*

Hepatics

Dendrobazzania griffithiana *Herbertus "haidensis"* *Radula auriculata*

10 Haida Gwaii endemics

Mosses

Brotherella "haidensis" *Seligeria careyana* *Wijkia carlottae*
Heterophyllium haidensis

Hepatics

Herbertus "haidensis"

Appendix C. Taxa listed by habitat types on Haida Gwaii

1 Forest floor

Mosses

Buckiella undulata
Dicranum majus
Dicranum scoparium
Eurhynchium praelongum
Eurhynchium oreganum
Hylocomium splendens
Leucolepis acanthoneuron
Plagiomnium insigne
Polytrichastrum alpinum
Rhizomnium glabrescens
Rhytidiadelphus loreus
Rhytidiadelphus triquetrus
Sphagnum girgensohnii
Sphagnum squarrosum

Liverworts

Cephalozia bicuspidata
Calypogeia azurea
Calypogeia muelleriana
Diplophyllum albicans
Diplophyllum plicatum
Lepidozia reptans
Plagiochila porelloides
Scapania bolanderi

2 Large woody debris

Mosses

Buckiella undulata
Buxbaumia piperi
Dicranum fuscescens
Plagiothecium laetum
Rhizomnium glabrescens
Tetraphis geniculata
Tetraphis pellucida

Liverworts

Bazzania denudata
Blepharostoma trichophyllum
Calypogeia azurea
Calypogeia fissa
Calypogeia muelleriana
Cephalozia bicuspidata
Cephalozia lunulifolia
Geocalyx graveolens
Lepidozia reptans
Lophocolea bidentata
Lophozia incisa
Lophozia longiflora
Lophozia ventricosa
Plagiochila porelloides
Riccardia latifrons
Riccardia palmata
Scapania bolanderi
Scapania umbrosa
Tritomaria exsecta

3 Epiphytes

Mosses

Amblystegium serpens
Antitrichia curtipendula
Bartramia pomiformis
Brachythecium reflexum
Brotherella "canadensis"
Buckiella undulata
Claopodium crispifolium
Daltonia splachnoides
Dicranum fuscescens
Dicranum scoparium
Dicranum tauricum
Eurhynchium oreganum
Eurhynchium praelongum
Eurhynchium pulchellum
Heterocladium macounii
Heterocladium procurrens
Homalothecium fulgescens
Homalothecium nuttallii
Hypnum callichroum
Hypnum circinale
Hypnum pallescens
Hypnum subimponens
Isothecium cardotii
Isothecium myosuroides
Metaneckera menziesii
Neckera douglasii
Orthotrichum consimile
Orthotrichum lyellii
Plagiothecium cavifolium
Plagiothecium denticulatum
Plagiothecium piliferum
Pseudoleskea stenophylla
Pseudotaxiphyllum elegans
Pterigynandrum filiforme
Rhizomnium glabrescens
Rhytidiadelphus loreus
Rhytidiadelphus triquetrus
Tortella tortuosa
Ulota drummondii
Ulota megalospora
Ulota obtusiuscula
Ulota phyllantha
Zygodon reinwardtii

Liverworts

Anastrophyllum minutum
Apometzgeria pubescens
Bazzania denudata
Blepharostoma trichophyllum
Cololejeunea macounii
Diplophyllum albicans
Diplophyllum plicatum
Douinia ovata
Frullania californica
Frullania franciscana
Frullania tamarisci ssp. *nisquallensis*
Herbertus "haidensis"
Herbertus aduncus
Kurzia sylvatica
Lepidozia reptans
Lophocolea bidentata
Lophocolea heterophylla
Lophozia incisa
Metzgeria conjugata
Metzgeria temperata
Mylia taylorii
Odontoschisma denudatum
Plagiochila porelloides
Plagiochila schofieldiana
Plagiochila semidecurrens var. *semidecurrens*
Porella cordaeana
Porella navicularis
Porella roellii
Ptilidium californicum
Radula auriculata
Radula bolanderi
Radula complanata
Radula obtusiloba ssp. *polyclada*
Scapania bolanderi
Tetralophozia filiformis
Tritomaria exsecta

4 Open forest of fen slopes

Mosses

Aulacomnium palustre
Brotherella "canadensis"
Campylium stellatum
Dichodontium pellucidum
Dicranella palustris
Heterophyllium "haidensis"
Hypnum dieckii
Pleurozium schreberi
Ptilium crista-castrensis
Rhytidiadelphus squarrosus
Sanionia uncinata
Sphagnum fimbriatum
Sphagnum mendocinum
Sphagnum papillosum
Sphagnum rubiginosum
Sphagnum russowii
Splachnum sphaericum
Tetraplodon mnioides
Warnstorfia exannulata

Liverworts

Anastrophyllum donianum
Anthelia julacea
Apotreubia hortonae
Bazzania pearsonii
Bazzania tricrenata
Herbertus sakuraii
Kurzia pauciflora
Lepidozia filamentosa ssp. *subtransversa*
Pellia neesiana
Pleurozia purpurea
Scapania americana
Scapania ornithopodioides
Scapania paludosa
Scapania uliginosa

5 Swamp forests

Mosses

Brachythecium frigidum
Brachythecium rivulare
Bryum pseudotriquetrum
Calliergon cordifolium
Cratoneuron filicinum
Dichodontium pellucidum
Dicranella pacifica
Dicranella palustris
Dicranum majus
Fontinalis antipyretica var. oregonensis
Hookeria lucens
Leptodictyum riparium
Leucolepis acanthoneuron
Philonotis fontana
Polytrichum formosum
Rhizomnium magnifolium
Warnstorfia fluitans

Liverworts

Calypogeia suecica
Cephalozia pleniceps
Chiloscyphus polyanthos
Conocephalum conicum
Riccardia chamedryfolia
Riccardia multifida

6 Peatland bogs

Mosses

Antitrichia curtipendula
Aulacomnium palustre
Calliergon stramineum
Campylopus atrovirens
Campylopus japonicus
Dicranodontium denudatum
Dicranum groenlandicum
Dicranum undulatum
Pohlia sphagnicola
Polytrichum strictum
Racomitrium lanuginosum
Sphagnum alaskense
Sphagnum angustifolium
Sphagnum austinii
Sphagnum capillifolium
Sphagnum fuscum
Sphagnum henryense
Sphagnum lindbergii
Sphagnum magellanicum
Sphagnum majus
Sphagnum mendocinum
Sphagnum pacificum
Sphagnum papillosum
Sphagnum russowii
Splachnum ampullaceum
Splachnum sphaericum
Tetraplodon mnioides

Liverworts

Anastrophyllum minutum
Aneura pinguis
Bazzania trilobata
Calypogeia sphagnicola
Cephalozia pleniceps
Cladopodiella fluitans
Gymnocolea inflata
Herbertus aduncus
Kurzia sylvatica
Mylia anomala
Mylia taylorii
Odontoschisma elongatum
Pleurozia purpurea
Scapania paludosa

7 Peatland fens

Mosses

Brotherella "canadensis"
Calliergon giganteum
Hamatocaulis vernicosus
Heterophyllium "haidensis"
Limprichtia revolvens
Loeskypnum badium
Loeskypnum wickesiae
Rhizomnium magnifolium
Sarmenthypnum sarmentosum
Scorpidium scorpioides
Sphagnum alaskense
Sphagnum compactum
Sphagnum contortum
Sphagnum fimbriatum
Sphagnum lindbergii
Sphagnum mendocinum
Sphagnum pacificum
Sphagnum palustre
Sphagnum papillosum
Sphagnum russowii
Sphagnum subnitens
Sphagnum subobesum
Sphagnum subsecundum
Sphagnum tenellum
Sphagnum teres
Sphagnum warnstorfii

Liverworts

Anastrophyllum donianum
Bazzania pearsonii
Bazzania tricrenata
Bazzania trilobata
Harpanthus flotovianus
Herbertus aduncus
Herbertus sakuraii
Lepidozia filamentosa
Pleurozia purpurea
Scapania ornithopodioides

8 Seaside outcrops

Mosses

Campylopus fragilis
Desmatodon heimii
Herzogiella adscendens
Hypnum cupressiforme
Schistidium maritimum
Ulota phyllantha

Liverworts

Frullania tamarisci ssp. nisquallensis
Metzgeria conjugata

9 Sand dunes

Mosses

Antitrichia curtipendula
Brachythecium albicans
Ceratodon purpureus
Dicranoweisia cirrata
Dicranum fuscescens
Dicranum scoparium
Hypnum circinale
Hypnum subimponens
Isothecium myosuroides
Pohlia nutans
Polytrichum juniperinum
Racomitrium ericoides
Tortula ruralis
Ulota phyllantha

Liverworts

Cephaloziella divaricata
Frullania tamarisci ssp. nisquallensis
Scapania bolanderi
Scapania umbrosa

10 Blowdown (rootmass)

Mosses

Aulacomnium androgynum
Dicranella heteromalla
Pogonatum contortum
Pohlia cruda
Pohlia nutans
Polytrichastrum alpinum
Pseudotaxiphyllum elegans
Schistostega pennata

Liverworts

Bazzania denudata
Calypogeia azurea
Calypogeia muelleriana
Diplophyllum albicans
Lepidozia reptans
Lophozia incisa
Scapania bolanderi

11 Distrubed soil

Mosses

Barbula unguiculata
Bryum argenteum
Bryum capillare
Ceratodon purpureus
Dicranella heteromalla
Dicranella rufescens
Dicranella schreberiana
Dicranella subulata
Discelium nudum
Ditrichum ambiguum
Ditrichum heteromallum
Epipterygium tozeri
Fissidens limbatus
Funaria hygrometrica
Oligotrichum aligerum
Pogonatum contortum
Pohlia annotina
Pohlia camptotrachela
Pohlia columbica
Pohlia nutans
Racomitrium elongatum
Timmiella crassinervis
Tortula amplexa
Trichodon cylindricus

Liverworts

Blasia pusilla
Fossombronia foveolata
Gyrothyra underwoodiana
Jungermannia rubra
Marchantia polymorpha
Pellia neesiana

12 Aquatic habitats

Mosses

Dichelyma uncinatum
Dichodontium pellucidum
Dicranella palustris
Fissidens grandifrons
Fontinalis antipyretica
Fontinalis neomexicana
Hygrohypnum molle
Hygrohypnum ochraceum
Hygrohypnum smithii
Leptodictyum riparium
Scorpidium scorpioides
Scouleria aquatica
Sphagnum lindbergii
Sphagnum mendocinum
Sphagnum pacificum
Warnstorfia exannulata
Warnstorfia fluitans

Liverworts

Chiloscyphus polyanthos
Cladopodiella fluitans
Gymnocolea inflata
Jungermannia exsertifolia ssp. cordifolia
Jungermannia schusterana
Mylia taylorii
Ptilidium ciliare
Scapania irrigua
Scapania paludicola
Scapania paludosa
Scapania uliginosa
Scapania undulata

13 Calcareous rocks

Mosses

Abietinella abietina
Amphidium californicum
Bryolawtonia vancouverensis
Campylophyllum halleri
Cirriphyllum cirrosum
Claopodium pellucinerve
Crumia latifolia
Didymodon nigrescens
Didymodon subandreaeoides
Didymodon tophaceus
Distichium capillaceum
Distichium inclinatum
Ditrichum flexicaule
Encalypta alpina
Encalypta procera
Entodon concinnus
Eurhynchium pulchellum var. barnesii
Fissidens grandifrons
Geheebia gigantea
Gollania turgens
Gymnostomum aeruginosum
Hygrohypnum luridum
Hymenostylium insigne
Hypnum recurvatum
Hypopterygium fauriei
Mnium ambiguum
Mnium marginatum
Myurella julacea
Oedipodium griffithianum
Orthothecium chryseum
Plagiomnium rostratum
Plagiopus oederiana
Platydictya jungermannioides
Porotrichum bigelovii
Schistidium crassipilum
Schistidium trichodon
Seligeria careyana
Seligeria donniana
Seligeria tristichoides
Tortella fragilis
Tortella tortuosa
Zygodon gracilis
Zygodon viridissimus

Liverworts

Apometzgeria pubescens
Barbilophozia quadriloba
Hygrobiella laxifolia
Jungermannia atrovirens
Lophozia bantriensis
Lophozia heterocolpos
Moerckia hibernica
Pellia endiviifolia
Preissia quadrata
Reboulia hemisphaerica
Tritomaria polita

14 Siliceous rocks

Mosses

Amphidium lapponicum
Amphidium mougeotii
Anacolia menziesii
Andreaea rupestris
Anoectangium aestivum
Anomobryum filiforme
Bartramia pomiformis
Bartramiopsis lescurii
Blindia acuta
Brachythecium frigidum
Brachythecium plumosum
Brotherella "haidensis"
Brotherella "wijkioides"
Bryum miniatum
Claopodium bolanderi
Claopodium crispifolium
Cynodontium jenneri
Dicranodontium subporodictyon
Dicranodontium uncinatum
Ditrichum zonatum var. scabrifolium
Dryptodon patens
Encalypta ciliata
Fissidens adianthoides
Grimmia donniana
Grimmia elatior
Grimmia torquata
Grimmia trichophylla
Hedwigia stellata
Heterocladium macounii
Hypnum subimponens
Isopterygiopsis pulchella
Isothecium cardotii
Isothecium myosuroides
Kiaeria starkei
Philonotis fontana
Plagiomnium venustum
Plagiothecium cavifolium
Plagiothecium denticulatum
Plagiothecium laetum
Plagiothecium piliferum
Pohlia cruda
Polytrichastrum alpinum
Pseudoleskea patens
Pseudotaxiphyllum elegans
Racomitrium aciculare
Racomitrium aquaticum
Racomitrium fasciculare
Racomitrium heterostichum
Racomitrium lawtonae
Racomitrium occidentale
Racomitrium varium
Rhabdoweisia crispata
Sanionia uncinata
Takakia lepidozioides
Tetrodontium brownianum
Thuidium assimile
Tortula princeps
Tortula ruralis
Wijkia carlottae

Liverworts

Anastrophyllum minutum
Anthelia julacea
Barbilophozia barbata
Barbilophozia hatcheri
Barbilophozia lycopodioides
Bazzania tricrenata
Calypogeia integristipula
Calypogeia suecica
Conocephalum conicum
Diplophyllum albicans
Diplophyllum plicatum
Diplophyllum taxifolium
Douinia ovata
Frullania tamarisci ssp. nisquallensis
Gymnomitrion obtusum
Herbertus aduncus
Herbertus sakuraii
Jungermannia pumila
Marsupella alpina
Marsupella boeckii
Metzgeria conjugata
Nardia scalaris
Pellia neesiana
Plagiochila porelloides
Plagiochila schofieldiana
Plagiochila semidecurrens var. *semidecurrens*
Porella cordaeana
Porella roellii
Radula complanata
Radula obtusiloba ssp. *polyclada*
Riccardia multifida
Scapania americana
Scapania scandica
Scapania uliginosa
Sphenolobopsis pearsonii

15 Water body margins

Mosses

Atrichum selwynii
Brachythecium frigidum
Brachythecium plumosum
Brachythecium rivulare
Climacium dendroides
Dichodontium pellucidum
Dicranella palustris
Dicranum majus
Dicranum scoparium
Eurhynchium oreganum
Eurhynchium praelongum
Hookeria acutifolia
Hookeria lucens
Hygrohypnum ochraceum
Hylocomium splendens
Hypnum dieckii
Leucolepis acanthoneuron
Oligotrichum aligerum
Oligotrichum parallelum
Philonotis fontana
Plagiomnium insigne
Pleuroziopsis ruthenica
Pogonatum contortum
Pohlia wahlenbergii
Polytrichastrum alpinum
Polytrichum commune
Polytrichum formosum
Polytrichum juniperinum
Pseudotaxiphyllum elegans
Racomitrium aciculare
Racomitrium aquaticum
Racomitrium elongatum
Racomitrium heterostichum
Racomitrium varium
Rhizomnium glabrescens
Rhizomnium magnifolium
Rhytidiadelphus loreus
Rhytidiadelphus squarrosus
Rhytidiadelphus triquetrus
Sanionia uncinata
Schistidium rivulare
Scleropodium obtusifolium
Scouleria aquatica
Sphagnum girgensohnii
Sphagnum squarrosum

Liverworts

Bazzania tricrenata
Chiloscyphus polyanthos
Conocephalum conicum
Diplophyllum albicans
Fossombronia foveolata
Gyrothyra underwoodiana
Herbertus aduncus
Hygrobiella laxifolia
Lepidozia filamentosa
Marchantia polymorpha
Marsupella emarginata
Pellia neesiana
Plagiochila porelloides
Plagiochila schoefieldiana
Scapania subalpina

16 Higher elevations

Mosses

Andreaea alpestris
Andreaea blyttii
Andreaea mutabilis
Andreaea nivalis
Andreaea sinuosa
Arctoa fulvella
Bartramia ithyphylla
Campylium stellatum
Campylopus schimperi
Campylopus schwarzii
Conostomum tetragonum
Dicranoweisia crispula
Dicranum angustum
Dicranum pallidisetum
Diphyscium foliosum
Kiaeria blyttii
Kiaeria falcata
Meiotrichum lyallii
Oligotrichum hercynicum
Oncophorus virens
Oncophorus wahlenbergii
Pohlia cardotii
Pohlia pacifica
Polytrichum sexangulare
Pseudoleskea baileyi
Racomitrium macounii
Racomitrium muticum
Racomitrium sudeticum
Rhizomnium nudum
Rhytidiadelphus squarrosus
Rhytidiopsis robusta
Roellia roellii
Takakia lepidozioides
Tortula norvegica
Trematodon montanus

Liverworts

Anastrophyllum assimile
Anthelia juratzkana
Asterella gracilis
Barbilophozia floerkei
Barbilophozia kunzeana
Barbilophozia quadriloba
Bazzania pearsonii
Diplophyllum imbricatum
Gymnomitrion concinnatum
Gymnomitrion corallioides
Gymnomitrion obtusum
Gymnomitrion pacificum
Haplomitrium hookeri
Herbertus sendtneri
Jungermannia exsertifolia
Lophozia opacifolia
Marsupella alpina
Marsupella sparsifolia
Marsupella sphacelata
Moerckia blyttii
Nardia compressa
Nardia geoscyphus
Nardia japonica
Pleurocladula albescens
Schofieldia monticola
Tritomaria polita
Tritomaria quinquedentata

Appendix D. Haida Gwaii moss taxa in the British Columbia Conservation Data Centre tracking list and explanations of the codes used to represent conservation status in listing.

Explanation of codes used by the Conservation Data Centre, Victoria, B.C.

Code	Meaning	Notes
G	Global	The assigned rank applies to the entire range of the taxon
S	Provincial	The assigned rank applies only within British Columbia.
	Global/Provincial Ranks	
1	Critically Imperiled	Critically imperiled because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000).
2	Imperiled	Imperiled because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000).
3	Vulnerable	Vulnerable either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals
4	Apparently Secure	Uncommon but not rare, and usually widespread. Possibly cause for long term concern. Typically more than 100 occurrences provincially or more than 10,000 individuals.
5	Secure	Common, typically widespread and abundant.
_#_#	Range Rank	A numeric range rank (e.g., S2S3) is used to indicate uncertainty about the exact status of a taxon.
U	Unrankable	Currently not rankable due to lack of available information about status or trends.
?	Unranked	Global/Provincial rank not yet assessed.
	Rank Qualifiers	
?	Inexact numeric rank	Denotes inexact numeric rank.
Q	Questionable taxonomy	Taxonomic status is questionable; rank may change with taxonomy.
	Intraspecific Taxon Ranks	
T	The status of infraspecific taxa (subspecies, variants)	The status of infraspecific taxa are indicated by a "T-rank" following the species' global/provincial rank. Rules for assigning T ranks follow the principles outlined above. For example, the provincial rank of a critically imperiled subspecies of an otherwise widespread and common species is S5T1.
	British Columbia Conservation Status (subnational rank only)	
Red	Considered endangered or threatened	Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. Red-listed taxa include those that have been, or are being, evaluated for these designations.
Blue	Considered vulnerable	Vulnerable taxa are of special concern because of characteristics that make them particularly sensitive to human activities or natural events.
Yellow	Not at risk, but of conservation concern	Of conservation concern because they have a small range or low abundance, because they have shown provincial declines, or because there are perceived long-term threats.

Scientific Name (from CDC)	Global Rank	Provincial Rank	BC Status
Abietinella abietina	G4G5	S3S5	Yellow
Amblystegium serpens var. serpens	G5T5	S3S5	Yellow
Amphidium californicum	G4	S3S5	Yellow
Amphidium lapponicum	G5	S4	Yellow
Amphidium mougeotii	G5	S2S3	Blue
Anacolia menziesii	G4	S3S5	Yellow
Andreaea alpestris	G5?	S3S4	Yellow
Andreaea blyttii	G5	S3S5	Yellow
Andreaea megistospora ssp. epapillosa	G4G5T2T3	S2S3	Blue
Andreaea megistospora ssp. megistospora	G4G5T3T4	S3S4	Yellow
Andreaea mutabilis	G5	S1S3	Blue
Andreaea nivalis	G5	S4	Yellow
Andreaea obovata	G3G5	S3S5	Yellow
Andreaea rothii	G5	S2S3	Blue
Andreaea rupestris var. rupestris	G5T?	S4	Yellow
Andreaea sinuosa	G2	S1	Red
Anoectangium aestivum	G3G5	S3S5	Yellow
Anomobryum filiforme	G4	S3S4	Yellow
Antitrichia californica	G5	S3S5	Yellow
Antitrichia curtipendula	G5	S4	Yellow
Arctoa fulvella	G3G5	S3S5	Yellow
Atrichum selwynii	G4	S4	Yellow
Atrichum undulatum	G5	S3S5	Yellow
Aulacomnium androgynum	G5	S4	Yellow
Aulacomnium palustre	G5	S4	Yellow
Barbula unguiculata	G5	S3S5	Yellow
Bartramia ithyphylla	G4G5	S3S5	Yellow
Bartramia pomiformis	G5	S4	Yellow
Bartramiopsis lescurii	G3G5	S3S4	Yellow
Blindia acuta	G5	S4	Yellow
Brachythecium albicans	G5	S3S5	Yellow
Brachythecium frigidum	G4	S3S5	Yellow
Brachythecium leibergii	G5?	S3S5	Yellow
Brachythecium plumosum	G5	S3S5	Yellow
Brachythecium reflexum var. reflexum	G4G5T?	S3S4	Yellow
Brachythecium rivulare	G5	S3S5	Yellow
Brachythecium velutinum var. velutinum	G5T?	S3S5	Yellow
Bryoerythrophyllum recurvirostre	GGU	S1S3	Blue
Bryum amblyodon	G?	S2S3	Blue
Bryum argenteum	G5	S3S4	Yellow
Bryum caespiticium	G5	S3S5	Yellow
Bryum canariense	G3G5	S2	Red
Bryum capillare var. capillare	G5T5	S3?	Yellow
Bryum dichotomum	G?	S3S4	Yellow
Bryum gemmiparum	G3G5	S1S3	Blue
Bryum meesioides	G3G4	S3S4	Yellow
Bryum miniatum	G3G4	S3S4	Yellow
Bryum pallens	G4G5	S3S4	Yellow
Bryum pseudotriquetrum	G5T?Q	S1S3	Blue
Buckiella undulata	G5	S4	Yellow
Buxbaumia piperi	G4	S3S4	Yellow
Calliergon cordifolium	G5	S3S5	Yellow
Calliergon giganteum	G5	S3S4	Yellow
Calliergon stramineum	G5	S3S4	Yellow

Scientific Name (from CDC)	Global Rank	Provincial Rank	BC Status
Calliergonella cuspidata	G5	S3S5	Yellow
Campylium stellatum var. stellatum	G5T5	S4S5	Yellow
Campylopus atrovirens	G4?	S3S4	Yellow
Campylopus flexuosus	G5?	S2S3	Blue
Campylopus fragilis	G5?	S3S5	Yellow
Campylopus japonicus	G3	S1	Red
Campylopus schimperi	G3G4	S2S3	Blue
Campylopus schwarzii	G4G5	S3S4	Yellow
Ceratodon purpureus var. purpureus	G5T5	S4S5	Yellow
Cirriphyllum cirrosum	G5?	S3S5	Yellow
Claopodium bolanderi	G4	S3S5	Yellow
Claopodium crispifolium	G4	S3S4	Yellow
Claopodium pellucinerve	G3G5	S1S3	Blue
Claopodium whippleanum	G4	S3S5	Yellow
Climacium dendroides	G5	S3S4	Yellow
Conardia compacta	G3G5	S3S4	Yellow
Conostomum tetragonum	G5	S3S5	Yellow
Cratoneuron filicinum	G5	S4	Yellow
Crumia latifolia	G3	S2S3	Blue
Ctenidium schofieldii	G2G3	S2S3	Blue
Cynodontium jenneri	G5	S3S5	Yellow
Daltonia splachnoides	G1G2	S1	Red
Desmatodon heimii	G5	S2S3	Blue
Dichelyma uncinatum	G3G5	S3S4	Yellow
Dichodontium pellucidum	G4G5T?	S3S4	Yellow
Dicranella heteromalla	G5?	S3S4	Yellow
Dicranella pacifica	G4	S3S5	Yellow
Dicranella palustris	G5?	S3S5	Yellow
Dicranella rufescens	G5?	S3S4	Yellow
Dicranella schreberiana var. schreberiana	G5T5	S3S5	Yellow
Dicranella subulata	G5?	S3S5	Yellow
Dicranella varia	G5	S3S5	Yellow
Dicranodontium asperulum	G4G5	S3S4	Yellow
Dicranodontium denudatum	G4G5	S3S5	Yellow
Dicranodontium subporodictyon	G3	S2S3	Blue
Dicranodontium uncinatum	G5?	S3S5	Yellow
Dicranoweisia cirrata	G4	S3S4	Yellow
Dicranoweisia crispula var. crispula	G4G5T?	S3S5	Yellow
Dicranum angustum	G5?	S1S3	Blue
Dicranum elongatum	G5	S3S5	Yellow
Dicranum fuscescens var. fuscescens	G5T?	S4	Yellow
Dicranum groenlandicum	G5?	S3S4	Yellow
Dicranum majus var. majus	G4G5T?	S3S5	Yellow
Dicranum muehlenbeckii	G3G5	S3S5	Yellow
Dicranum pallidisetum	GU	S3S5	Yellow
Dicranum scoparium	G5	S4	Yellow
Dicranum tauricum	G4	S4	Yellow
Dicranum undulatum	G5	S3S5	Yellow
Didymodon fallax var. reflexus	G5T5?	S3S5	Yellow
Didymodon nigrescens	G3G5	S2S3	Blue
Didymodon rigidulus	G5	S2	Red
Didymodon rigidulus var. gracilis	G5T5?	S3S4	Yellow
Didymodon rigidulus var. rigidulus	G5T4?	S2S3	Blue
Didymodon subandreaeoides	GU	S2S3	Blue

Scientific Name (from CDC)	Global Rank	Provincial Rank	BC Status
Didymodon tophaceus	G5	S3S4	Yellow
Didymodon vinealis var. flaccidus	G5T?	S4	Yellow
Diphyscium foliosum	G5	S2S3	Blue
Discelium nudum	G3G4	S1	Red
Distichium capillaceum	G5	S4	Yellow
Distichium inclinatum	G4G5	S3S4	Yellow
Ditrichum ambiguum	G4?	S3S4	Yellow
Ditrichum flexicaule	G5	S4	Yellow
Ditrichum heteromallum	G3G5	S3S4	Yellow
Ditrichum zonatum var. scabrifolium	G3G5T2T3	S2S3	Blue
Drepanocladus aduncus var. aduncus	G5T5	S3S5	Yellow
Dryptodon patens	G4G5	S3S5	Yellow
Encalypta alpina	G5?	S2S3	Blue
Encalypta ciliata	G5	S3S4	Yellow
Encalypta procera	G4G5	S3S5	Yellow
Encalypta rhaptocarpa	G4G5	S3S4	Yellow
Entodon concinnus	G4G5	S1S3	Blue
Epipterygium tozeri	G4?	S2S3	Blue
Eucladium verticillatum	G4	S2S3	Blue
Eurhynchium oreganum	G4	S4	Yellow
Eurhynchium praelongum	G5	S3S4	Yellow
Eurhynchium pulchellum var. barnesii	G5T?	S2S3	Blue
Eurhynchium pulchellum var. pulchellum	G5T?	S4	Yellow
Fissidens adianthoides	G5	S3S4	Yellow
Fissidens bryoides	G5	S3S5	Yellow
Fissidens grandifrons	G3G5	S3S5	Yellow
Fissidens limbatus	G3G5	S3S4	Yellow
Fissidens osmundioides	G5	S3S5	Yellow
Fontinalis antipyretica var. antipyretica	G5T?	S3S5	Yellow
Fontinalis antipyretica var. oregonensis	G5T?	S3S4	Yellow
Fontinalis neomexicana	G3G5	S3S5	Yellow
Funaria hygrometrica	G5	S4	Yellow
Geheebia gigantea	G5?	S2S3	Blue
Gollania turgens	G2	S1	Red
Grimmia elatior	G3G5	S2S3	Blue
Grimmia torquata	G3G5	S3S5	Yellow
Grimmia trichophylla	G5?	S3S5	Yellow
Gymnostomum aeruginosum	G5	S3S5	Yellow
Hamatocaulis vernicosus	G5	S3S5	Yellow
Hedwigia stellata	G4	S3S4	Yellow
Herzogiella adscendens	GU	S3S5	Yellow
Herzogiella striatella	G4G5	S3S4	Yellow
Heterocladium dimorphum	G4G5	S3S4	Yellow
Heterocladium macounii	G3G4	S4	Yellow
Heterocladium procurrens	G2G4	S3S5	Yellow
Heterophyllium haidensis	G3?Q	S2S3	Blue
Homalothecium aeneum	G4	S3S4	Yellow
Homalothecium fulgescens	G4	S3S4	Yellow
Homalothecium nuttallii	G4	S3S4	Yellow
Hookeria acutifolia	G4G5	S3S5	Yellow
Hookeria lucens	G5	S3S4	Yellow
Hygrohypnum bestii	G4	S3S5	Yellow
Hygrohypnum luridum	G5	S3S5	Yellow
Hygrohypnum molle	G4G5	S3S5	Yellow

Scientific Name (from CDC)	Global Rank	Provincial Rank	BC Status
Hygrohypnum ochraceum	G5	S4	Yellow
Hygrohypnum smithii	G3G5	S3S4	Yellow
Hylocomiastrum pyrenaicum	G4G5	S3S5	Yellow
Hylocomiastrum umbratum	G5	S3S4	Yellow
Hylocomium splendens	G5	S4S5	Yellow
Hymenostylium insigne	G3	S2S3	Blue
Hymenostylium recurvirostre	G5	S3S5	Yellow
Hypnum callichroum	G5?	S3S5	Yellow
Hypnum circinale	G4	S4	Yellow
Hypnum cupressiforme var. cupressiforme	G5T5	S3S5	Yellow
Hypnum dieckii	G3G5	S3S5	Yellow
Hypnum lindbergii	G5	S3S5	Yellow
Hypnum pallescens	G5	S3S4	Yellow
Hypnum plicatulum	G5	S2S3	Blue
Hypnum recurvatum	G3G5	S3S4	Yellow
Hypnum revolutum	G5	S3S4	Yellow
Hypnum subimponens	G4	S4	Yellow
Hypnum vaucheri	G3G5	S3S5	Yellow
Hypopterygium fauriei	G3G5	S3S4	Yellow
Isopterygiopsis pulchella	G5	S3S5	Yellow
Isothecium myosuroides	G5	S4S5	Yellow
Iwatsukiella leucotricha	G4	S3S4	Yellow
Kiaeria blyttii	G5	S3S5	Yellow
Kiaeria falcata	G5	S3S5	Yellow
Kiaeria starkei	G5	S3S4	Yellow
Leptobryum pyriforme	G5	S4	Yellow
Leptodictyum riparium	G5	S3S5	Yellow
Lescuraea saxicola	G4G5	S1S3	Blue
Leucolepis acanthoneuron	G4	S4	Yellow
Loeskypnum badium	G4G5	S2S3	Blue
Loeskypnum wickesiae	G3G5	S2S3	Blue
Meesia triquetra	G5	S3S4	Yellow
Meesia uliginosa	G5T?	S3S5	Yellow
Meiotrichum lyellii	GU	S3S5	Yellow
Metaneckera menziesii	G4G5	S4	Yellow
Mnium ambiguum	G5	S3S5	Yellow
Mnium blyttii	G5	S3S4	Yellow
Mnium marginatum	G5	S3S5	Yellow
Mnium spinulosum	G5	S4	Yellow
Mnium thomsonii	G5	S3S5	Yellow
Myurella julacea	G5	S3S5	Yellow
Neckera douglasii	G4	S3S4	Yellow
Oedipodium griffithianum	G5	S1S3	Blue
Oligotrichum aligerum	G5	S3S4	Yellow
Oligotrichum hercynicum	G5	S3S5	Yellow
Oligotrichum parallelum	G5	S3S5	Yellow
Oncophorus virens	G5	S3S5	Yellow
Oncophorus wahlenbergii	G5	S3S4	Yellow
Orthothecium chryseum	G5?	S3S5	Yellow
Orthotrichum consimile	G4	S3S5	Yellow
Orthotrichum lyellii	G4	S3S4	Yellow
Orthotrichum pulchellum	G4	S3S4	Yellow
Oxystegus tenuirostris	G5	S3S5	Yellow
Paludella squarrosa	G3G5	S3S4	Yellow

Scientific Name (from CDC)	Global Rank	Provincial Rank	BC Status
Paraleptodontium recurvifolium	G2G3	S2	Red
Paraleucobryum enerve	G5?	S3S5	Yellow
Philonotis capillaris	G4?	S3S4	Yellow
Philonotis fontana var. fontana	G5T5	S3S5	Yellow
Plagiobryum zieri	G3G4	S3S5	Yellow
Plagiomnium insigne	G4	S3S4	Yellow
Plagiomnium medium	G5	S3S5	Yellow
Plagiomnium rostratum	G5	S3S5	Yellow
Plagiomnium venustum	G4	S3S5	Yellow
Plagiopus oederiana	G5?	S3S4	Yellow
Plagiothecium cavifolium	G5	S3S5	Yellow
Plagiothecium denticulatum	G5	S3S4	Yellow
Plagiothecium laetum	G5	S3S5	Yellow
Plagiothecium piliferum	G5	S3S5	Yellow
Platydictya jungermannioides	G5	S3S5	Yellow
Pleuroziopsis ruthenica	G3	S1S3	Blue
Pleurozium schreberi	G5	S4S5	Yellow
Pogonatum contortum	G4	S3S4	Yellow
Pogonatum dentatum	G3G5	S3S5	Yellow
Pogonatum urnigerum	G5	S3S4	Yellow
Pohlia annotina	G4G5	S3S4	Yellow
Pohlia camptotrachela	G3G5	S1S3	Blue
Pohlia cardotii	GU	S2S3	Blue
Pohlia columbica	G3G5	S1S3	Blue
Pohlia cruda	G5	S4	Yellow
Pohlia drummondii	G3G4	S3S4	Yellow
Pohlia elongata	G4G5	S2S3	Blue
Pohlia filum	G4G5	S2S3	Blue
Pohlia lescuriana	G4?	S1S3	Blue
Pohlia longibracteata	G2G4	S3S5	Yellow
Pohlia nutans	G5	S4	Yellow
Pohlia pacifica	GU	S1S3	Blue
Pohlia sphagnicola	G2G3	S2S3	Blue
Pohlia wahlenbergii	G5	S3S4	Yellow
Polytrichum alpinum var. alpinum	G4G5T?	S3S5	Yellow
Polytrichum commune var. commune	G5T5	S3S4	Yellow
Polytrichum formosum	G5	S3S5	Yellow
Polytrichum juniperinum	G5	S4	Yellow
Polytrichum longisetum	G5	S2S3	Blue
Polytrichum piliferum	G5	S4	Yellow
Polytrichum sexangulare	G4	S3S5	Yellow
Polytrichum strictum	G5	S3S5	Yellow
Porotrichum bigelovii	G4	S3S5	Yellow
Porotrichum vancouveriense	G4	S3S5	Yellow
Pseudoleskea atricha	G5	S3S4	Yellow
Pseudoleskea baileyi	G3G5	S3S5	Yellow
Pseudoleskea patens	G5	S3S5	Yellow
Pseudoleskea stenophylla	G5?	S3S5	Yellow
Pseudotaxiphyllum elegans	G5	S4	Yellow
Pterigynandrum filiforme	G4G5	S3S5	Yellow
Ptilium crista-castrensis	G5	S4	Yellow
Racomitrium aciculare	G5	S4	Yellow
Racomitrium affine	G?T?	S2S3	Blue
Racomitrium aquaticum	G2G4	S3S5	Yellow

Scientific Name (from CDC)	Global Rank	Provincial Rank	BC Status
Racomitrium elongatum	GU	S4S5	Yellow
Racomitrium ericoides	GU	S3S5	Yellow
Racomitrium fasciculare	G5	S3S5	Yellow
Racomitrium heterostichum var. heterostichum	G5T5	S3S5	Yellow
Racomitrium lanuginosum	G5	S3S4	Yellow
Racomitrium lawtonae	G3G4	S3S4	Yellow
Racomitrium macounii	GU	S3S4	Yellow
Racomitrium microcarpon	G?T?	S3S4	Yellow
Racomitrium muticum	GU	S3S5	Yellow
Racomitrium occidentale	GU	S3S5	Yellow
Racomitrium sudeticum	G5?	S3S5	Yellow
Racomitrium varium	GU	S3S5	Yellow
Rhabdoweisia crispata	G5	S2S3	Blue
Rhizomnium glabrescens	G4	S3S4	Yellow
Rhizomnium magnifolium	G4G5	S3S5	Yellow
Rhizomnium nudum	G3G5	S3S5	Yellow
Rhizomnium pseudopunctatum	G5	S3S4	Yellow
Rhodobryum roseum	G5	S1S3	Blue
Rhytidiadelphus loreus	G5	S4	Yellow
Rhytidiadelphus squarrosus	G4G5	S4	Yellow
Rhytidiadelphus subpinnatus	GU	S3S5	Yellow
Rhytidiadelphus triquetrus	G5	S4	Yellow
Rhytidiopsis robusta	G4	S3S4	Yellow
Rhytidium rugosum	G5	S3S4	Yellow
Roellia roellii	G4	S3S4	Yellow
Schistidium agassizii	G3G5	S2S3	Blue
Schistidium apocarpum ssp. apocarpum	G5T?	S4	Yellow
Schistidium crassipilum	G?Q	S3S4	Yellow
Schistidium maritimum	G3G5	S3S5	Yellow
Schistidium rivulare ssp. rivulare	G4G5T4T5	S3S5	Yellow
Schistidium trichodon	G2G4	S3S4	Yellow
Schistidium vancouverense	G?Q	S2S3	Blue
Schistostega pennata	G4	S3S4	Yellow
Scleropodium cespitans var. cespitans	G4T?	S3S5	Yellow
Scleropodium obtusifolium	G4	S3S4	Yellow
Scorpidium scorpioides	G4G5	S3S4	Yellow
Scouleria aquatica	G4	S3S4	Yellow
Seligeria careyana	G1	S1	Red
Seligeria donniana	G4G5	S3S5	Yellow
Seligeria tristichoides	G4	S2S3	Blue
Sphagnum angustifolium	G5	S3S5	Yellow
Sphagnum balticum	G2G4	S2S3	Blue
Sphagnum bartlettianum	G4G5	S2S3	Blue
Sphagnum capillifolium	G5	S4	Yellow
Sphagnum centrale	G5	S3?	Yellow
Sphagnum compactum	G5	S3S5	Yellow
Sphagnum contortum	G5	S2S3	Blue
Sphagnum fimbriatum	G5	S3S4	Yellow
Sphagnum fuscum	G5	S4S5	Yellow
Sphagnum girgensohnii	G5	S4S5	Yellow
Sphagnum henryense	G4?	S3S5	Yellow
Sphagnum junghuhnianum var. pseudomolle	G?T?	S1S3	Blue
Sphagnum lindbergii	G5?	S3S5	Yellow

Scientific Name (from CDC)	Global Rank	Provincial Rank	BC Status
Sphagnum magellanicum	G5	S3S5	Yellow
Sphagnum majus ssp. majus	G5?T?	S1	Red
Sphagnum mendocinum	G4	S3S4	Yellow
Sphagnum orientale	G2G4	S1S3	Blue
Sphagnum pacificum	G3G4	S3S4	Yellow
Sphagnum palustre	G5	S3S4	Yellow
Sphagnum papillosum	G5	S4S5	Yellow
Sphagnum platyphyllum	G5	S1S3	Blue
Sphagnum quinquefarium	G5	S2S3	Blue
Sphagnum rubellum	G5	S3S5	Yellow
Sphagnum rubiginosum	G?	S1S3	Blue
Sphagnum russowii	G5	S3S5	Yellow
Sphagnum schofieldii	G1Q	S1	Red
Sphagnum squarrosum	G5	S3S4	Yellow
Sphagnum subnitens	G5	S3S5	Yellow
Sphagnum subobesum	G3G5	S1S3	Blue
Sphagnum subsecundum var. subsecundum	G5T4	S3S5	Yellow
Sphagnum tenellum	G5	S3S5	Yellow
Sphagnum teres	G5	S3S5	Yellow
Sphagnum warnstorfii	G5	S3S5	Yellow
Sphagnum wilfii	G1G2	S1	Red
Splachnum ampullaceum	G4	S3S5	Yellow
Splachnum sphaericum	G3G5	S3S4	Yellow
Tayloria serrata var. serrata	G5T?	S2S3	Blue
Tetraphis geniculata	G3G5	S3S5	Yellow
Tetraphis pellucida	G5	S4	Yellow
Tetraplodon mnioides	G4	S3S4	Yellow
Tetrodontium brownianum	G3G4	S2S3	Blue
Thamnobryum neckeroides	GU	S3S5	Yellow
Thuidium assimile	G5T5	S3S4	Yellow
Timmia austriaca	G4G5	S4	Yellow
Timmiella crassinervis	G4	S3S5	Yellow
Tortella fragilis	G4G5	S3S5	Yellow
Tortella tortuosa	G5	S4	Yellow
Tortula amplexa	G2G4	S2S3	Blue
Tortula muralis	G5	S3S4	Yellow
Tortula norvegica	G5	S3S5	Yellow
Tortula princeps	G5?	S3S4	Yellow
Tortula ruralis	G5	S3S5	Yellow
Trematodon montanus	G1	S1	Red
Trichodon cylindricus	G4G5	S3S5	Yellow
Ulota drummondii	G3G5	S2S3	Blue
Ulota megalospora	G3G5	S3S5	Yellow
Ulota obtusiuscula	GU	S3S4	Yellow
Ulota phyllantha	G3G5	S3S5	Yellow
Weissia controversa	G5	S3S5	Yellow
Wijkia carlottae	G2	S2	Red
Zygodon gracilis	G2	S1	Red
Zygodon reinwardtii	G5?	S3S4	Yellow
Zygodon viridissimus var. rupestris	G5T5	S3S4	Yellow

Appendix E. Provisional list of liverworts potentially at risk in Haida Gwaii. This list is derived from an unreviewed draft list for all of British Columbia. The list has been refined for Haida Gwaii by W.B. Schofield although ranking has not yet been applied. Data are courtesy of Jennifer Penny, British Columbia Conservation Data Centre, Victoria, B.C.

Anastrepta orcadensis
Anastrophyllum assimile
Anastrophyllum donianum
Apotreubia hortonae
Bazzania pearsonii
Bazzania trilobata
Blaisia pusilla
Calypogeia fissa
Calypogeia integristipula
Calypogeia sphagnicola
Calypogeia suecica
Cephalozia connivens
Cephalozia leucantha
Cephalozia macounii
Cephalozia media
Cephalozia pleniceps
Cephaloziella rubella
Chandonanthus hirtellus
Cladopodiella fluitans
Cololejeunea macounii
Dendrobazzania griffithiana
Eremonotus myriocarpus
Fossombronia dumortieri
Gymnomitrion pacificum
Haplomitrium hookeri
Herbertus sendtneri
Hygrobiella laxifolia
Jungermannia leiantha
Jungermannia obovata
Jungermannia pumila
Jungermannia schusteriana
Jungermannia sphaerocarpa
Kurzia trichoclados
Lophozia badensis
Lophozia bantriensis
Lophozia heterocolpos
Lophozia obtusa
Lophozia sudetica
Marsupella alpina
Marsupella commutata
Mastigophora woodsii
Metzgeria leptoneura
Metzgeria temperata
Moerckia hibernica
Nardia compressa
Nardia geoscyphus
Nardia insecta
Nardia japonica
Pleurozia purpurea
Radula auriculata
Radula bolanderi
Reboulia hemisphaerica
Riccardia chamedryfolia
Scapania gymnostomophila
Scapania irrigua
Scapania ornithopodioides
Scapania paludicola
Scapania scandica
Schofieldia monticola
Sphenolobopsis pearsonii
Takakia lepidozioides
Tritomaria exsecta
Tritomaria polita
Tritomaria quinquedentata