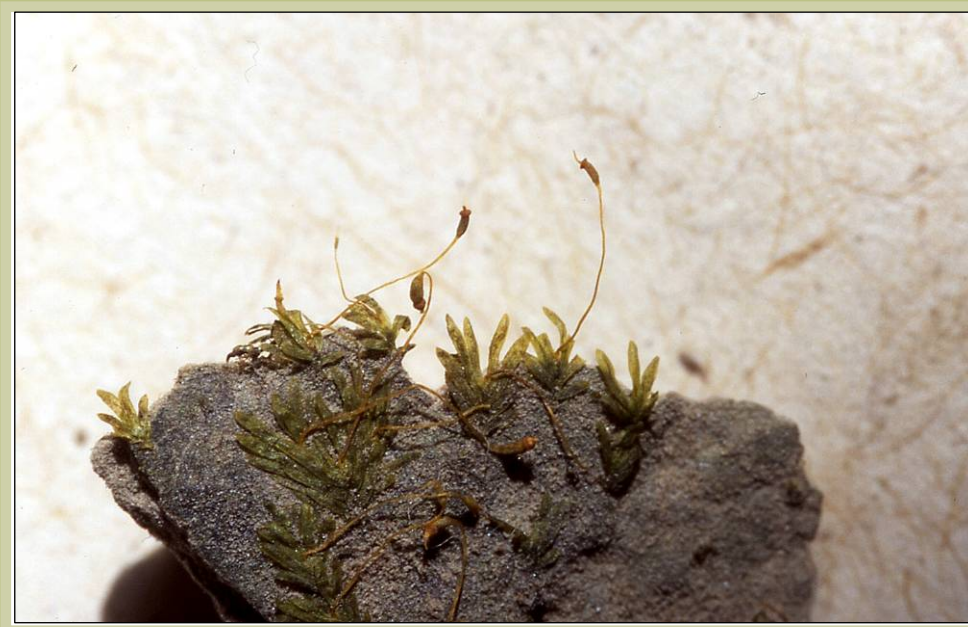


Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus*) in Canada

Poor Pocket Moss



2010



Environment
Canada

Environnement
Canada

Canada

About the *Species at Risk Act* Recovery Strategy Series

What is the *Species at Risk Act* (SARA)?

SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is “*to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity.*”

What is recovery?

In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of the species’ persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

What is a recovery strategy?

A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies — Environment Canada, Parks Canada Agency, and Fisheries and Oceans Canada — under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA (www.sararegistry.gc.ca/approach/act/default_e.cfm) outline both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. A period of three to four years is allowed for those species that were automatically listed when SARA came into force.

What’s next?

In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

The series

This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

RECOVERY STRATEGY FOR THE POOR POCKET MOSS (*Fissidens pauperculus*) IN CANADA

2010

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia (Appendix 2) under Section 44 of the *Species at Risk Act*. Environment Canada has included an addition which completes the SARA requirements for this recovery strategy, and excludes the section on Socio-economic Considerations which is not required by the Act.

This recovery strategy is the recovery strategy of the Minister of the Environment of Canada for this species.

2010

This recovery strategy for the Poor Pocket Moss in Canada consists of the:

- Addition to the Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia; prepared by Environment Canada.
- Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia; prepared by the Poor Pocket Moss Recovery Team for the B.C. Ministry of Environment.

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Additional copies:

Additional copies can be downloaded from the SAR Public Registry (www.sararegistry.gc.ca).

Cover illustration: René Belland

Également disponible en français sous le titre
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**Addition to the Recovery Strategy for the Poor Pocket Moss
(*Fissidens pauperculus* M. Howe) in British Columbia**

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DECLARATION

This recovery strategy has been prepared in cooperation with the jurisdictions responsible for the poor pocket moss. Environment Canada has reviewed and accepts this document (compound of the British Columbia Recovery Strategy [excluding the section on Socio-economic Considerations] and the federal addition) as its recovery strategy for the poor pocket moss, as required under the *Species at Risk Act* (SARA). This recovery strategy also constitutes advice to other jurisdictions and organizations that may be involved in recovering the species.

The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives.

This recovery strategy will be the basis for one or more action plans that will provide details on specific recovery measures to be taken to support conservation and recovery of the species. The Minister of the Environment will report on progress within five years, as requested under SARA.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada or any other jurisdiction alone. In the spirit of the Accord for the Protection of Species at Risk, the Minister of the Environment invites all responsible jurisdictions and Canadians to join Environment Canada in supporting and implementing this strategy for the benefit of the poor pocket moss and Canadian society as a whole.

RESPONSIBLE JURISDICTIONS

Environment Canada
Government of British Columbia

STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts on non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of the poor pocket moss. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: description of the species' habitat and biological needs, ecological role, and limiting factors; effects on other species; and the recommended approaches for recovery.

RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* [Subsection 2(1)].

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SAR Public Registry:

www.sararegistry.gc.ca/sar/recovery/residence_e.cfm.

PREFACE

The poor pocket moss was listed on Schedule 1 of the *Species at Risk Act* (SARA) as Endangered in June 2003.

SARA section 37 requires the competent Minister to prepare a recovery strategy for all listed extirpated, endangered or threatened species. SARA section 44 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for content (subsections 41(1) or (2)).

The British Columbia Ministry of Environment led the development of this recovery strategy for the species in cooperation with Environment Canada, Canadian Wildlife Service – Pacific and Yukon Region. All responsible jurisdictions reviewed and provided support for posting this recovery strategy.

SPECIES STATUS INFORMATION

The species has been assigned a global status rank of G3 - Vulnerable (NatureServe 2009). The species has not been ranked nationally by NatureServe. It is estimated that the percent of the global range of this species in Canada is less than 1%.

SPECIES AT RISK ACT REQUIREMENTS

The following sections address specific requirements of SARA that are either not addressed in the Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia (Appendix 2) or need to be highlighted.

1. Consultation

There is currently one known population of this species, on public land owned by the District of North Vancouver. Officials from this municipality were consulted during the process of preparing the recovery strategy, including this addition. The individuals in Canada who are considered experts on the biology of the species were members of the recovery team or were consulted in the course of preparing this strategy. Additional opportunities for consultation were afforded through posting on the SAR Public Registry.

2. Socio-economic Considerations

The Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia (Appendix 2) contains a short statement on socio-economic considerations. As a socio-economic analysis is not required under Section 41(1) of SARA, the Socio-economic Considerations section of the Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia (Appendix 2) is not considered part of the Minister of Environment's recovery strategy for this species.

3. Recovery feasibility

Recovery of the poor pocket moss is deemed feasible based on the four criteria for assessing feasibility:

Are individuals capable of reproduction currently available to improve the population growth rate or population abundance?

Yes, the plant is present in one location and field observations suggest that recruitment is occurring.

Is sufficient suitable habitat available to support the species or could it be made available through habitat management or restoration?

Yes, there is habitat to support the small population that is now in British Columbia. It seems stable and can be maintained by proper management.

Can significant threats to the species or its habitat be avoided or mitigated through recovery actions?

Yes, the main threats (erosion of the gully where the species is found induced either by infrequent storms or pedestrians using the trail running above the site) can be managed and mitigated.

Do the necessary recovery techniques exist?

Yes, various means exist to protect the species and manage its habitat including use of an exclusion zone.

4. Update regarding populations and distribution information

The Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia (Appendix 2) provides population information current to 2005, as follows: “These latter six patches ranged from about 1–2 cm² (three patches) and 6 cm² (two patches), to about 40 cm² (one patch at the original location reported by W.B. Schofield).”

More recent surveys in 2007 and 2009 (T. McIntosh, pers. comm. 2010) provide the following information:

A small ~10 x 5 cm patch was discovered in 2007, and was still present in 2009 on a more southerly gully adjacent to the better-studied northern gully. The six patches present in the northern gully in 2005 expanded significantly in 2007 and 2009. Apparently, poor pocket moss colonized large areas of the silt face that were exposed during the 2005 rain and erosion event. It is estimated that well over 1000 plants were present in July 2009.

5. Recovery goals

- I. To protect and maintain the extant population of the poor pocket moss.
- II. To investigate additional areas where the poor pocket moss may be found, and if located, to protect and maintain those additional populations.

6. Recovery objectives

- I. To implement additional habitat protection through stewardship activities and other mechanisms for the extant population and corresponding habitat by 2010.
- II. To implement habitat protection for any newly discovered populations as soon as possible, once known.
- III. To determine the level of real and potential threats to this species and its habitat by 2010.

7. Critical Habitat

Section 41(1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, and examples of activities that are likely to result in its destruction. In 2007, the provincial recovery strategy for the poor pocket moss concluded that more work needed to be completed before identifying critical habitat. Since the publication of the provincial recovery strategy, Environment Canada worked with the province of British Columbia, the District of North Vancouver, and Parks Canada Agency to complete additional work needed to identify critical habitat for this species. If additional populations are located in future surveys as identified in the schedule of studies (page 12-13 of Appendix 2), Environment Canada may identify more critical habitat.

Critical habitat for poor pocket moss includes the area of occupancy and both the upslope and down slope catchment area of the two gullies where the species is currently located. Although the catchment area is not wholly occupied by the species, it is considered critical habitat because activities that occur within this area may have negative effects on the occupied site. If the activities result in the alteration of shade or moisture components of the microclimate, or create landslides in and around the area occupied by the species, the species' ability to use the habitat may become compromised. The exact area identified as critical habitat is described in Appendix 1. Appendix 1 has been removed from the public document to protect the species and its habitat.

7.1 Examples of activities likely to result in destruction of critical habitat

Although some activities may not destroy critical habitat initially, their repeated occurrence or occurrence in conjunction with other damaging activities may create a destructive effect on critical habitat over time.

Examples of activities that may result in the destruction of critical habitat of the poor pocket moss include, but are not limited to:

- Compression, inversion, or any other type of disturbance to the soil that may result in the erosion of soil substrates used by the species. Specific examples include indiscriminate disturbances created by hiking, cycling and trail maintenance either proximate to the area of occurrence or upslope from the area of occurrence that may result in small-scale erosion.
- Alterations to the microclimate of the site including annual or seasonal hydrological regimes, soil moisture content and the amount of shade.
- Any activity or action that may result in a landslide anywhere in the proximity of the critical habitat. Specific examples include land clearing and removal of vegetation.

8. Existing and Recommended Approaches to Habitat Protection

Information about approaches for habitat protection is provided in the corresponding section in the Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia (Appendix 2), in which zoning, the park master planning process, trail decommissioning, signage, and stewardship are discussed.

9. Statement on Action Plans

An action plan will be posted by 2011. The Minister of the Environment may adopt an action plan developed by British Columbia.

10. References

Green, R.N. and K. Klinka. 1994. A field guide for site identification and interpretation for the Vancouver forest region. B.C. Min. of For., Res. Br., Victoria, BC.

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Appendix 1

Critical habitat identification and location

Appendix 1 has been removed from the public document to protect the species and its habitat

Appendix 2

Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia

Recovery Strategy for the Poor Pocket Moss (*Fissidens pauperculus* M. Howe) in British Columbia



Prepared by the Poor Pocket Moss Recovery Team



Ministry of
Environment

June 2007

About the British Columbia Recovery Strategy Series

This series presents the recovery strategies that are prepared as advice to the Province of British Columbia on the general strategic approach required to recover species at risk. The Province prepares recovery strategies to meet our commitments to recover species at risk under the *Accord for the Protection of Species at Risk in Canada*, and the *Canada – British Columbia Agreement on Species at Risk*.

What is recovery?

Species at risk recovery is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a recovery strategy?

A recovery strategy represents the best available scientific knowledge on what is required to achieve recovery of a species or ecosystem. A recovery strategy outlines what is and what is not known about a species or ecosystem; it also identifies threats to the species or ecosystem, and what should be done to mitigate those threats. Recovery strategies set recovery goals and objectives, and recommend approaches to recover the species or ecosystem.

Recovery strategies are usually prepared by a recovery team with members from agencies responsible for the management of the species or ecosystem, experts from other agencies, universities, conservation groups, aboriginal groups, and stakeholder groups as appropriate.

What's next?

In most cases, one or more action plan(s) will be developed to define and guide implementation of the recovery strategy. Action plans include more detailed information about what needs to be done to meet the objectives of the recovery strategy. However, the recovery strategy provides valuable information on threats to the species and their recovery needs that may be used by individuals, communities, land users, and conservationists interested in species at risk recovery.

For more information

To learn more about species at risk recovery in British Columbia, please visit the Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

**Recovery Strategy for the Poor Pocket Moss
(*Fissidens pauperculus* M. Howe) in British Columbia**

Prepared by the Poor Pocket Moss Recovery Team

June 2007

Recommended citation

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Cover illustration/photograph

René Belland

Additional copies

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

<<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>

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Disclaimer

This recovery strategy has been prepared by the Poor Pocket Moss Recovery Team, as advice to the responsible jurisdictions and organizations that may be involved in recovering the species. The British Columbia Ministry of Environment has received this advice as part of fulfilling its commitments under the *Accord for the Protection of Species at Risk in Canada*, and the *Canada – British Columbia Agreement on Species at Risk*.

This document identifies the recovery strategies that are deemed necessary, based on the best available scientific and traditional information, to recover poor pocket moss populations in British Columbia. Recovery actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and recovery approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions and all members of the recovery team have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all individuals on the recovery team.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this strategy. The Ministry of Environment encourages all British Columbians to participate in the recovery of poor pocket moss.

RECOVERY TEAM MEMBERS

Poor Pocket Moss Recovery Team

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AUTHOR(S)

The report was written by Terry McIntosh of Biospherics Environmental Inc.

RESPONSIBLE JURISDICTIONS

The British Columbia Ministry of Environment is responsible for producing a recovery strategy for poor pocket moss under the *Accord for the Protection of Species at Risk in Canada*. Environment Canada, Canadian Wildlife Service participated in the development of this recovery strategy.

ACKNOWLEDGEMENTS

Thanks to Alex Walton, a Ranger at Lynn Canyon Park, for assisting us in looking for populations of the poor pocket moss on July 9, 2005 (he discovered three of the new populations). Funding was provided by the Ministry of Water, Land and Air Protection (now the Ministry of Environment) through the Habitat Conservation Trust Fund and the BC Conservation Foundation.

EXECUTIVE SUMMARY

The poor pocket moss is a tiny moss that forms loosely gregarious and usually tiny patches over compact soil. It is endemic to western North America, restricted to western portions of California, Oregon, Washington, and southwestern British Columbia.

In Canada, the poor pocket moss is restricted to southwestern British Columbia, where it is known from only Lynn Canyon Park in the District of North Vancouver. Population data are presented from Lynn Canyon.

The Canadian populations probably represent less than 1% of its global distribution and abundance. Detailed data on population trends for this species in Canada are lacking, although the information that is available indicates that the size and numbers of patches of this species may vary on a short-term and annual basis, possibly depending on the amount of open substrate and the degree of local erosion. The main microhabitat for this species is on a shaded and seasonally wet silt outcrop.

Threats include loss or degradation of its habitat, as the gully and the microhabitats where patches have been found appear unstable and susceptible to both localized and large scale erosional events, possibly induced in part by a trail that runs above the site.

Suitable habitat for the poor pocket moss in Canada includes seasonally moist, hard-packed silt-rich soils on steep faces in heavily shaded forested habitats. Activities that may destroy any future critical habitat of the poor pocket moss include erosion, hiking, and landslides.

Population viability is considered low, and recovery is considered feasible. The recovery goal is to protect and maintain any extant populations of the poor pocket moss, and to investigate additional areas where the poor pocket moss may be found. If the species is located, the goals are to protect and maintain those additional populations.

Recovery objectives include: to implement habitat protection for extant populations through stewardship activities and other mechanisms, to implement habitat protection for any newly discovered populations as soon as possible, once known, and to determine the level of real and potential threats. Protection measures for this species must be confirmed or assessed and more detailed information needs to be gathered about threats to this species, especially with respect to invasive plants. Data are needed to fully describe critical habitat attributes. A detailed investigation of suitable habitats along the southwestern B.C. coast is recommended. Effects on other species or ecological processes are not anticipated.

For successful implementation in protecting species at risk, there will be a strong need to engage in stewardship on various land tenures.

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BACKGROUND

Species Assessment Information from COSEWIC

Common Name: poor pocket moss

Scientific Name: *Fissidens pauperculus* M. Howe.

Status: Endangered.

Last Examination and Change: November 2001.

Canadian Occurrence: British Columbia.

Reason for Designation: This North American endemic is found in several Pacific states. Also, at only one disjunct locality in southern British Columbia, it occurs as a single small clump and a few adjacent tiny tufts of plants within a stream bed, and where it is at risk from human disturbance and stochastic events.

Status History: Designated Endangered in November 2001. Assessment based on a new status report.

Description of the Species

The poor pocket moss is a tiny moss that forms loosely gregarious and usually tiny patches over compact soil. Individual plants average 1.5–2.5 mm in length and have 3–5 pairs of leaves, which grow downwards across the substratum. All members of the genus *Fissidens* are easily distinguished from other mosses by the paired leaves flattened in one plane along the stem, somewhat reminiscent of fern fronds. Also, leaves are partly folded to the base, another distinctive characteristic of this genus. In the poor pocket moss, the folded portions average one-half to two-thirds the length of the leaf. The largest upper leaves of the poor pocket moss average 1.5–2.1 mm in length. The leaf tips are acute to short acuminate, and the upper leaf margins are nearly entire to irregularly uneven to somewhat toothed. Leaves of the poor pocket moss lack the distinct border that is characteristic of some other species of this genus. The leaf mid-rib ends 6–15 cells below the apex, another distinctive feature of this species (most other tiny species have longer mid-ribs). Leaves are similar in appearance whether wet or dry.

This species is autoecious (male and female reproductive structures on the same plant) and, in most mature populations, sporophytes are produced annually. The stalk below the capsule is yellow when young, becomes reddish with age, and is usually 2–3 mm long. Its capsule is ovoid to oblong-ovoid and inclined to slightly bent.

Figure 1 is an illustration of the poor pocket moss from the Bryophyte Flora of North America Project (Pursell 2005). Figure 2 is a photograph of plants bearing sporophytes, and Figure 3 is a photograph of its leaves. Further descriptions of this species can be found in Grout (1936), Koch (1951), Krause and Schofield (1977), Lawton (1971), Schofield (1968), and Pursell (2005).

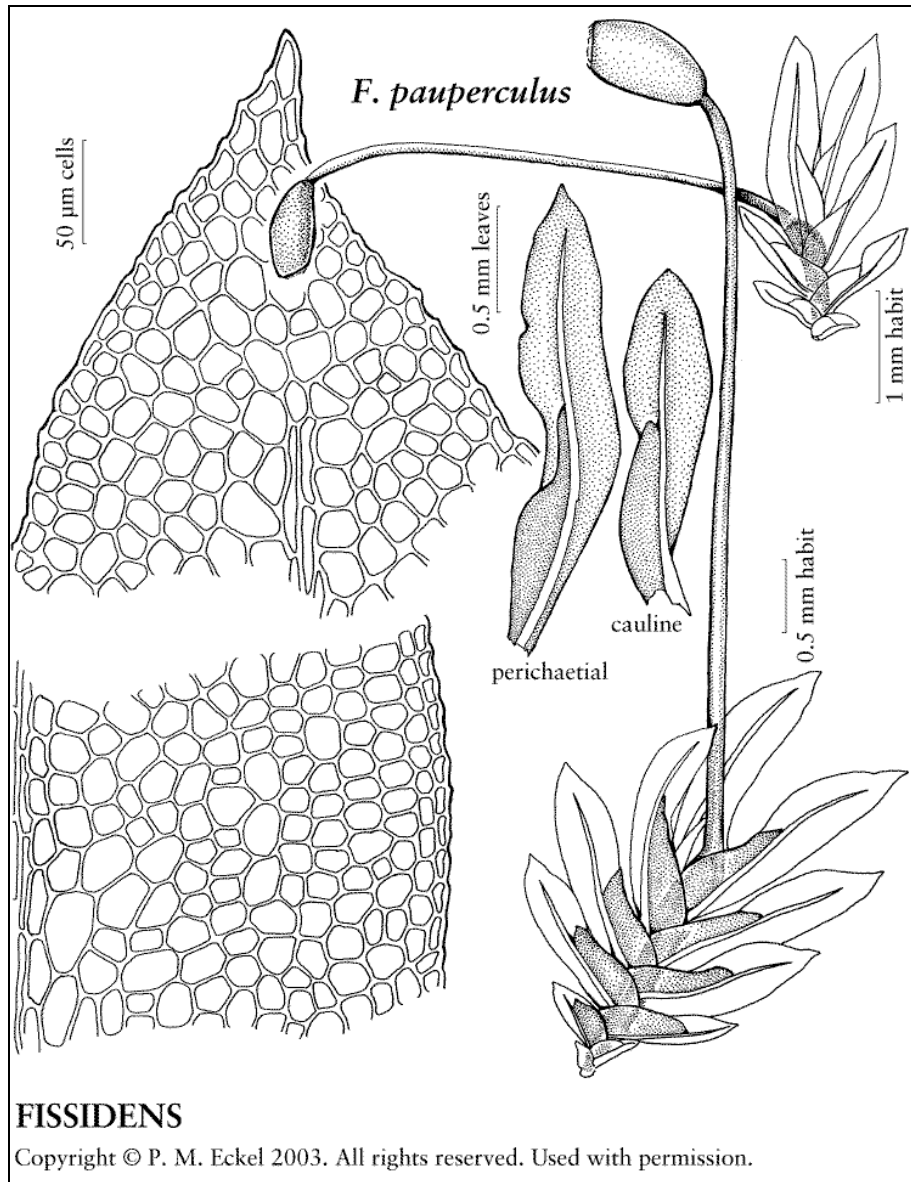


Figure 1. Illustration of the poor pocket moss (from Pursell 2005; used with permission of the artist, P.M. Eckel).



Figure 2. Photograph of the poor pocket moss showing plants and sporophytes with immature capsules (photo by R. Belland).



Figure 3. Photograph of leaves of the poor pocket moss (photo by T. McIntosh 2004).

Populations and Distribution

The poor pocket moss is endemic to western North America, restricted to western portions of California, Oregon, Washington, and southwestern British Columbia (Figure 4).

In Canada, the six patches of poor pocket moss are restricted to southwestern British Columbia, where it is currently known only from a single location in Lynn Canyon Park in the District of North Vancouver (Figure 5). Lynn Canyon Park is a dedicated urban park owned by the District of North Vancouver. It is zoned “special purpose” for the area around the Ecology Centre and Visitor Centre, and “natural park land” for the remainder. Off-trail hiking and cycling are discouraged by park officials, although off-trail hiking, at least, commonly occurs in many areas, especially where Lynn Creek can be easily accessed, such as about 40 m from the site where this moss is found. The known site for this moss is on the eastern bank of Lynn Creek, downstream of the suspension bridge in a secluded small gully.



Figure 4. North American and global distribution of the poor pocket moss (from Belland 2001).



Figure 5. Distribution of the poor pocket moss in Canada (X = Lynn Canyon, North Vancouver).

There are no detailed population data on the North Vancouver population of the poor pocket moss. There is also confusion as to the exact locations of various patches that have been reported through time (none have been permanently marked to date). W.B. Schofield visited the site at least seven times since its discovery in 1961, most recently in 2003; he has found this species each time in the same general location but at different microsites. He has reported two patches: a $\pm 625\text{-cm}^2$ patch measured in 2000, and a smaller patch less than 2 m from the larger patch that he has seen occasionally since 1961. It was not reported whether these two patches existed at the same time during this period.

T. McIntosh has visited the site five times since 2003: the first with W.B. Schofield, once in 2004, and three times in 2005 (twice in March and once in July). He observed two patches in 2003, probably the same two that Schofield reported; none in early 2005 following a severe rain event; and six during the July 2005 visit. These latter six patches ranged from about 1–2 cm^2 (three patches) and 6 cm^2 (two patches), to about 40 cm^2 (one patch at the original location reported by W.B. Schofield).

Globally, the poor pocket moss is listed as imperiled to apparently secure (G2G4) and is Red-listed (S1 – critically imperiled) in British Columbia (BC Species and Ecosystem Explorer 2003). NatureServe Explorer (2004) does not rank this species for the United States or Canada, but lists it as S1 for British Columbia, S1S2 for California, S1 for Oregon, and S1 for

Washington. NatureServe lists it as present and unranked in Saskatchewan, but there is no information on that record and this is likely a misidentification or error.

Detailed global distribution and abundance data for the poor pocket moss are unavailable at this time. It is uncommon throughout its range, and is known from fewer than 20 locations globally (Belland 2001). This species is more common in California and southwestern Oregon, with isolated occurrences in northwestern Washington and southwestern British Columbia. It is estimated that the British Columbian population accounts for less than 1% of its global distribution and abundance.

Detailed data on population trends for this species in Canada are lacking, although the information that is available indicates that the size and number of patches of this species may vary on a short-term and annual basis, possibly depending on the amount of open substrate and the degree of local erosion. Belland (2001) reported that the population appeared to have had diminished in size since its original discovery. The small patch (the first reported patch for this species on a small, silty cliff above a streamlet; Krause and Schofield 1977) had disappeared by 2001, although another, larger patch was extant about 2 m away. However, during a visit to the site on March 6, 2003, W.B. Schofield noted that the larger patch appeared to have been dislodged as well, and may have been destroyed, although a thorough survey was not completed at that time. A large patch (~50 cm²) and a smaller patch about 1 m away were found in late 2004 by T. McIntosh, and may be the same patches reported earlier, but this is unconfirmed. The site was visited again in March 2005, and, the heavier than usual rains in January significantly altered the clay bank habitat where both patches in the population were found. Part of the bank has been sheared off from an almost vertical face to about 45°, and both patches appeared to have been displaced. A survey at this time of all open areas of the silt cliff, as well as examination of a much more extensive silt cliff in an adjacent gulley about 30 m to the north of this location, did not reveal any extant patches of the poor pocket moss. However, a follow-up visit in July showed that the moss is still in the area and six relatively small patches were observed, the largest in what is possibly the original location in 1961. At least four of the new patches have not been observed before, including one in the adjacent gulley (to the north; this gulley has been investigated at least twice by W.B. Schofield and three times by T. McIntosh, and no populations had been found previously). In all cases, this species appears to be growing on freshly exposed silts.

Needs of the poor pocket moss

Habitat needs

Schofield (1968) and Krause and Schofield (1977) give the habitat at Lynn Canyon as “silty outcrop in seasonal streamlet,” and “seepy consolidated silt cliff.” Herbarium voucher label information gives also “silt of damp slope” and “silt outcrop on canyon slope.” During fieldwork that Belland conducted in 1999 and 2000, he described this species as growing on an intermittently wet, silty outcrop in a streamlet within a mature Douglas-fir/western hemlock forest. Belland (2001) states that, during the summer, the outcrop area remains mostly dry, but in the fall and winter the area is irrigated from more or less continuous runoff as a result of winter rains. However, observations by McIntosh show that the runoff over much the habitat where this

species occurs is usually light and that most of the moisture at these sites may be from seepage, except possibly in the one small gully where it was first found. Trees shade all of the known sites where patches of this moss grow, with only intermittent sunshine available later in the day. The suitable habitat can be generally described as seasonally moist, hard-packed silt-rich soils on steep faces in heavily shaded forested habitats within the CWHdm (dry Maritime Coastal Western Hemlock) biogeoclimatic subzone (Green and Klinka 1994).

A reference to the habitat of the species in other areas includes “on bare, moist soil banks, often growing with *F. bryoides*” (Lawton 1971). Voucher label information from California provides more detail (from Belland 2001): (1) earth banks in small shaded valley (Marin Co.), (2) hard moist earth under redwoods (San Mateo Co.), (3) soil at base of redwood trees (Marin Co.), (4) on logs (Humboldt Co.), (5) earth hummock on forest slope (San Mateo Co.), (6) barren clay soil in cut-over redwood forest (Humboldt Co.), and (7) earth in redwood forest (Santa Cruz Co.). In the main part of its range in California, the species appears most frequently on soil in redwood forests.

Biological needs, ecological role, and limiting factors

As with most mosses, little is known about the biological attributes that may influence the recovery potential of the poor pocket moss. Published information about the general biology and reproductive capacity is lacking, although some field observations have been made. The Canadian population produces sporophytes regularly, probably because of its sexuality, having male and female structures on the same plant (Belland 2001). There is no information on spore dispersal distances, viability, or germination success for this species, although moss spores in this type of habitat are probably water-dispersed. There is no evidence of asexual reproduction by specialized propagules or by fragmentation. Recent observations indicate that it may be somewhat ephemeral in nature, although this must be determined.

The tiny size of the poor pocket moss may influence recovery potential. It may not have the competitive ability that other mosses in the same habitat possess. Another factor that influences its recovery potential is its apparent preference for, and possibly restriction to, at least in British Columbia, seasonally moist, relatively open, and, possibly, frequently eroded compact silts. It may be an early colonizer of this type of substratum, but this is unknown. Mature plants produce sporophytes frequently which, if viable spores were produced, would help it take advantage of this habitat.

Threats

Loss and degradation of suitable habitat

The forest environment surrounding the gullies where the known population of the poor pocket moss is found is, in general, relatively stable. The site had been visited for many years by W.B. Schofield and he has not noticed any large scale changes in the adjacent areas. However, the gully as well as the microhabitats where patches have been found appear comparatively unstable and susceptible to both localized and larger scale erosional events, possibly induced by infrequent severe storms and, in part, by the trail that runs above the site. One of the patches (probably the patch that was discovered first by W.B. Schofield) is present in an intermittent seasonal streamlet, which appears to have rather constant small-scale erosional activity, at least

during the wetter portions of the year. This patch appears to have disappeared before 2001 (Belland 2001), possibly because of erosion; after it had re-established, it disappeared again in early 2005 following a large scale erosional event. This patch has re-established once again since March 2005, although smaller than when it was originally measured.

Human use or maintenance of a trail about 7 m above the site may induce erosion into the gullies. Although this trail has been blocked off at both ends and its use is not allowed, it was used by hikers, and once by a cyclist, each time that the site was examined between 2003 and 2005. During the January 2005 rain event, this path appeared to be more deeply eroded than normal along a 2-m stretch, probably because of its open nature. Debris appears to have been washed downslope, possibly into the gully where the poor pocket moss had been found. Also, a small abandoned footpath that leads downhill from the main trail passes about 2 m above the extant population and appears to be used occasionally by hikers exploring the area. If this occurs, some damage from falling soil or debris could likely impact the habitat or population. Belland (2001) noted that a small amount of debris had been washed downslope from the trail and was present close to the population. He noted that workers removing this debris from the higher trail could impact the habitat, although this trail is not to be used anymore so trail maintenance is unlikely.

Belland (2001) noted that a series of two to three hot, dry summers could desiccate the substrate on which the species depends. Although not likely given the protective overstorey and the generally wet microhabitat of the site, it remains a potential threat.

Given that this species may be adapted to survival in early successional microhabitats, natural disturbances such as bank erosion are possibly critical for the long-term survival of this species. This hypothesis needs to be investigated.

Encroachment by other species

A threat to the poor pocket moss may be the encroachment of open habitats by other bryophyte species. W.B. Schofield (pers. comm., 2003) noted that the moss *Dichodontium pellucidum*, common on the same substratum at the Lynn Canyon site, might be its main competitor, although a leafy liverwort (a species of *Jungermannia*) appears to colonize areas of the bank closer to the poor pocket moss and may be a greater competitive risk.

Knowledge Gaps

Detailed habitat requirements (e.g., geology, soil characteristics, seepage, aspect) are not well known.

The effects from competition from other moss species are not well known.

A list of sites not already surveyed by bryologists for this moss could be compiled and an inventory completed.

RECOVERY

Recovery Feasibility

Recovery is defined by Environment Canada *et al.* (2005) as “the process by which the decline of an endangered, threatened or extirpated species is arrested or reversed, and threats removed or reduced to improve the likelihood of the species persistence in the wild. A species will be considered *recovered* when its long-term persistence in the wild has been secured.” The target levels for persistence vary according to the context of the specific species. For the poor pocket moss, the feasibility of recovery depends on ensuring the survival of the existing population and the elimination of threats.

As with many other rare plant species, we lack adequate information about the historical distribution of the poor pocket moss. There is no evidence to indicate that this species was ever abundant or widespread in coastal British Columbia. Therefore, recovery of the poor pocket moss should focus on improving its probability of persistence in the wild and confirming presence or absence in other potential sites. Successful recovery, however, will depend on a combination of scientific investigations (including inventorying similar habitats for additional locations), habitat protection and management activities, and long-term population monitoring.

The level of effort required for recovery is expected to be minimal. There is currently a process to develop a master plan within the park that will include a minimum exclusion zone area to protect the species. Further studies and trials will be needed to determine whether barriers to the recovery of existing populations are insurmountable. The ecological and technical feasibility of recovery may have to be re-evaluated once further research is conducted. An assessment of the criteria for technical and biological feasibility for recovery of the poor pocket moss is found in Table 1.

Although the biology and ecology of the poor pocket moss are poorly understood, field observations suggest that regular recruitment is occurring, although at irregular intervals. However, it is unknown if the population is large enough to be self-sustaining. Overall, recovery for this species is considered feasible (see Table 1).

Table 1. Technical and biological feasibility for recovery of the poor pocket moss; criteria from Environment Canada *et al.* (2005)

Feasibility criteria	
1. Are individuals capable of reproduction currently available to improve the population growth rate or population abundance?	YES
2. Is sufficient suitable habitat available to support the species or could it be made available through habitat management or restoration?	YES
3. Can significant threats to the species or its habitat be avoided or mitigated through recovery actions?	YES
4. Do the necessary recovery techniques exist and are they demonstrated to be effective?	YES

Recovery Goal

- I. To protect¹ and maintain the extant population of the poor pocket moss.
- II. To investigate additional areas where the poor pocket moss may be found, and if located, to protect and maintain those additional populations.

Recovery Objectives

- I. To implement additional habitat protection through stewardship activities and other mechanisms for the extant population and corresponding habitat by 2010.
- II. To implement habitat protection for any newly discovered populations as soon as possible, once known.
- III. To determine the level of real and potential threats to this species and its habitat by 2010.

Broad Strategy Recommended to Address Threats

The broad approaches to address the threats (loss and degradation of suitable habitat and encroachment by other species) to this species include:

- I. Protect the habitat of any extant populations through the park master plan, legislative protection, stewardship agreements or conservation covenants, and public awareness programs.
- II. Research the potential threats to the habitats for the known population to better understand how they affect the population and how they may be mitigated.
- III. Research the known population and habitat, including the measurement of population attributes, and ecological and habitat requirements, and initiate a monitoring program at the known site to better understand how the population responds to threats.
- IV. Inventory and document any new populations (UTM coordinates), determine land ownership, and provide habitat protection through various stewardship or other actions.

Approaches Recommended to Meet Recovery Objectives

The general habitat protection measures in Lynn Canyon Park must be assessed with respect to their application to this species, and more detailed information needs to be gathered about threats to this species and its habitat. Although some specific characteristics for the habitat are known for the poor pocket moss, more data are needed to fully describe essential habitat attributes. A monitoring program could be designed and implemented. A detailed investigation of suitable habitat in adjacent areas is recommended. Even though a great deal of bryological research has been completed by W.B. Schofield and his students in this region, most of these surveys are broad-based and designed to collect mosses over wide areas; they are not usually focused on one particular species or its preferred habitat. Therefore, habitat-specific investigations should be designed to look for this species. Table 3 summarizes research and management activities.

¹ Protection can be achieved through various mechanisms including: voluntary stewardship agreements; conservation covenants; sale by willing vendors on private lands; land use designations on Crown lands; and legal protection in federal, provincial, and local government lands.

In the park master plan, an area of 1 ha (rectangular shape) as a minimum exclusion zone around the species is recommended for long-term protection (M. Brown, pers. comm., 2005). The park could ensure that access to the reserve is restricted (e.g., by full trail deactivation and revegetation).

Recovery Planning Table

Table 2. Summary of research and management activities recommended to meet objectives

Priority	Obj. no.	Broad approach / strategy	Threat addressed	Specific steps	Outcomes or deliverables
High	I	Habitat protection	Loss and degradation of suitable habitat; encroachment by other species	<ul style="list-style-type: none"> • Investigate current protection measures for this species in Lynn Canyon Park • Communicate with park personnel about the presence of the species and the importance of protecting habitat • Trail decommissioning and revegetation 	<ul style="list-style-type: none"> • Increased awareness and assistance by park personnel and the public in the protection and recovery of this species • Reduction in use of the trail above the population • Establishment of a reserve
Medium	III	Research on potential threats	Loss and degradation of suitable habitat; potential encroachment by other moss species	<ul style="list-style-type: none"> • Research and document threats to habitat at the known site • Define and describe specific population and habitat attributes 	<ul style="list-style-type: none"> • Precise information on threats to population and habitat
Medium	II	Research on known populations and habitats; establish a monitoring program	Loss and degradation of suitable habitat; encroachment by other species	<ul style="list-style-type: none"> • Research and document population sizes and health, and population change from first survey • Develop and implement standardized monitoring protocol • Report monitoring 	<ul style="list-style-type: none"> • Data on population sizes, reproduction status, and health • Detailed data on habitat attributes • Regular and standardized monitoring of populations and habitats • Annual summary of monitoring results

			results annually and assess trends in populations, area of occupancy, and habitat condition every 5 years	<ul style="list-style-type: none"> • Assessment of status of populations and effects of recovery actions
Medium	I	Inventory	<ul style="list-style-type: none"> • Submit all data to BC CDC • List areas to be surveyed • Inventory new areas 	<ul style="list-style-type: none"> • New populations • New information on threats, ecology, and populations

Performance Measures

Criteria for evaluation of the progress towards the goals and objectives of this strategy include:

- I. The species and habitat are protected through stewardship activities and other mechanisms at all known sites.
- II. All stakeholders are notified and informed of the importance of this species, and, where applicable, relevant information is supplied to the public.
- III. Threats to its survival and recovery are determined and mitigated.
- IV. A monitoring program has been put in place that will measure critical values that will benefit the survival and recovery of this moss.
- V. Areas of suitable habitat for this species in sites within its natural range have been inventoried and, if found, the new populations documented with UTM coordinates, land ownership determined, and protection provided through various stewardship activities and other actions.

Critical Habitat

Identification of the species' critical habitat

No critical habitat as defined under the federal *Species at Risk Act* (Environment Canada 2004) is proposed for identification at this time. While much is known about the habitat needs of poor pocket moss, more definitive work must be completed before any specific sites can be formally proposed as critical habitat. It is expected that critical habitat for poor pocket moss will be identified in the action plan as appropriate. A schedule of studies outlining the work necessary to identify critical habitat is found below.

Recommended schedule of studies to identify critical habitat

Only general attributes of the habitat for this species are known. Therefore, further study needs to be completed on the habitat where the poor pocket moss grows. Table 3 outlines a timeline for completion of studies, which are subject to availability of resources.

Table 3. Timeline for completion of studies to identify critical habitat for the poor pocket moss.

Study	Completion date
Determination of soil properties required for establishment, growth, and reproduction (e.g., pH, composition, moisture)	2010
Determination of other environmental attributes, including light and humidity requirements for growth and reproduction, slope, and aspect, and the importance of disturbance/erosion	2010
Determination of associated moss species, and a determination of these species' potential for competing with the poor pocket moss	2010
Surveys of additional areas in Lynn Canyon Park and the adjacent areas where poor pocket moss may be located	2010

Also, other areas that have potential habitat for the poor pocket moss could be surveyed for the presence of this species. The park rangers are looking for more suitable habitat in the area. A large bank of similar mineral composition about 20 m to the east was investigated for this moss on separate occasions by T. McIntosh and W.B. Schofield, and, until July 2005, had not been found there. Further inventory can be completed once areas that may contain habitat for this species are identified in the Lower Mainland, in particular elsewhere in the park as well as in adjacent watersheds in North Vancouver.

Existing and Recommended Approaches to Habitat Protection

The site is located in a municipal park that is zoned for ecological protection and recreational use. Through the park master planning process, an exclusion zone is being developed to protect the site. The main trail above this site, although blocked off by fencing and marked as no-access, is still frequently used (both boot marks and people have been seen along this trail in 2005 and earlier). Park Rangers have, as of 2005, been made aware of the significance of the sites and will try to keep people away. Signs restricting access and noting the significance of the site could be placed at either end of the trail. The small trail that leads down to near the population has been used infrequently, at best, but could be completely blocked off. Another measure could be the complete decommissioning of the trail.

Stewardship Approach

For successful implementation in protecting species at risk, there will be a strong need to engage in stewardship on a variety of land tenures. Stewardship involves the voluntary cooperation of landowners to protect species at risk and the ecosystems they rely on. The preamble to the federal *Species at Risk Act* (SARA) recognizes that “stewardship activities contributing to the conservation of wildlife species and their habitat should be supported” and that “all Canadians have a role to play in the conservation of wildlife in this country, including the prevention of wildlife species from becoming extirpated or extinct.” The Bilateral Agreement on Species at Risk between British Columbia and Canada recognizes that “stewardship by land and water

owners and users is fundamental to preventing species from becoming at risk and in protecting and recovering species that are at risk” and that “cooperative, voluntary measures are the first approach to securing the protection and recovery of species at risk”

Effects on Other Species

Impacts on other species or ecological processes are not anticipated during the recovery process. Some actions regarding the recovery of the poor pocket moss, such as maintaining and decommissioning the trails above the population, may benefit other species; this outcome will be assessed as work is undertaken. No other species at risk are near the known population of this moss.

Socio-economic Considerations

The socio-economic impact is considered very low for this species as the only known occurrence occurs in a municipal park that is zoned for ecological protection (and recreation).

Recommended Approach for Recovery Implementation

This recovery strategy takes a single-species approach due to the single location where it occurs; no other listed species are known from adjacent areas. However, it could be considered for integration within other conservation efforts in the region.

Statement on Action Plans

The recovery action plan is expected to be completed by December 31, 2010.

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