Recovery Strategy for the Margined Streamside Moss (*Scouleria marginata* Britt) in British Columbia

Prepared by the British Columbia Bryophyte Recovery Team

BRITISH COLUMBIA
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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>

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Disclaimer

This recovery strategy has been prepared by the British Columbia Bryophyte 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 margined streamside 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 margined streamside moss.

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RESPONSIBLE JURISDICTIONS

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EXECUTIVE SUMMARY

The margined streamside moss is a relatively large, dark green to green moss that grows in strands or tufts on wet and often inundated rocks along streams and rivers. Endemic to western North America, it is found in southeastern British Columbia, Idaho, Washington, Oregon, and California. It has been found only once in British Columbia and Canada: along Boundary Creek in the Kootenay Region near the Canada–U.S. border. Detailed population data are not available as this species has not been seen since its first report in 1977.

Little is known about the biological attributes that may influence the recovery potential of this species. It produces spores frequently and may be able to reproduce by vegetative fragmentation. It is a relatively high elevation moss species that appears to be restricted to seasonally inundated rocks or bases of outcrops along streams, but there is little detailed information about the habitat needs for this species across its global range. Potential threats include severe flooding events, disturbance by domestic animals, forest fire, recreation activities (especially hiking), and competition from a related species of moss.

The critical habitat of this species cannot be identified until the species is rediscovered. The suitable habitat in Canada can be generally described as seasonally submerged rocks and possibly outcrops along creeks in montane regions. Ecological studies and inventory could be completed.

The recovery goals are to confirm the presence of margined streamside moss in Canada, and to protect and maintain any extant populations. Because the original population has not been rediscovered, there are no data for the habitat and ecology of this species in Canada, and thus current population viability cannot be estimated. Therefore, overall recovery feasibility is unknown until the species is rediscovered through inventory.

Recovery objectives include to inventory sites to relocate the previously known population; to implement habitat protection and threat mitigation through stewardship activities and other mechanisms for any extant populations; and to conduct scientific research on the ecology and habitat requirements of the populations if found or rediscovered.

The broad strategy to address threats includes inventory to relocate the species and, if found, protection of extant populations and habitats through establishment of stewardship agreements, covenants on private land, and other measures on Crown land. Also, if the species is rediscovered, to conduct research on existing populations and habitats, and on potential threats; to monitor known and potential threats, and any changes in population attributes and habitats; and to initiate an education and stewardship program.

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: margined streamside moss; Marginate splashzone moss.

Scientific Name: *Scouleria marginata* Britt Torrey Club 22: 42. 1895.

Status: Endangered.

Last Examination and Change: November 2002.

Canadian Occurrence: British Columbia.

Reason for Designation: This moss is a large, showy species that occurs just above water's edge along small montane streams. A rare North American endemic, its northern-most and single occurrence in Canada is in southern British Columbia. Although the species was not relocated at this station in recent surveys, the species may be present in nearby watersheds.

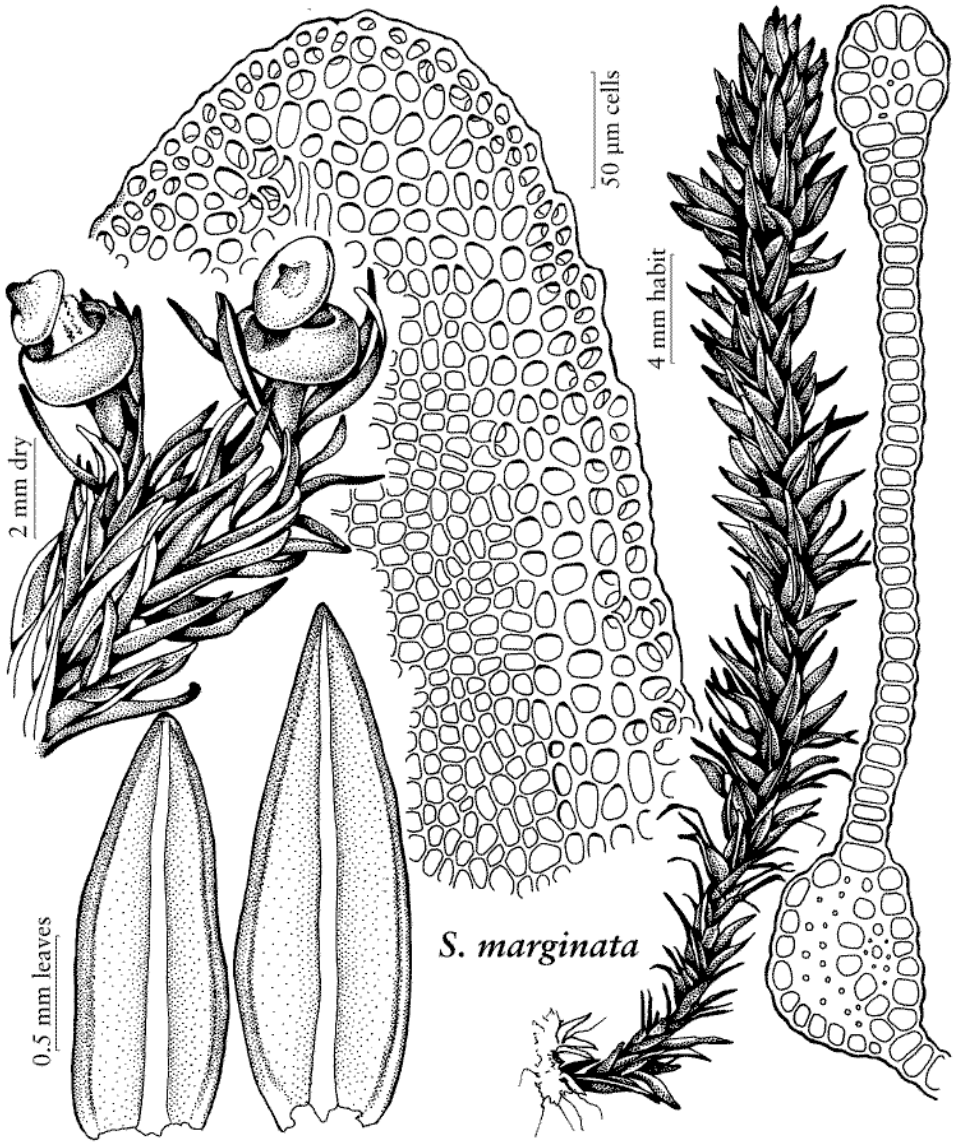
Status History: Designated Endangered in November 2002. Assessment based on a new status report.

Description of the Species

The margined streamside moss is a relatively large moss that grows in strands or tufts on wet and often inundated rocks along streams and rivers. Its stems range from 6 to 10 cm in length and are usually branched. Most of the lower leaves are dark brownish to black, whereas leaves of the growing tips are often light golden to green. Leaves are lance-shaped to somewhat tongue-shaped, range from 2.5 to 4.0 mm in length, and often have abundant rhizoids, or hair-like appendages, on their lower undersurfaces. They are slightly contorted when dry and spreading when wet. The leaf margins are weakly toothed to entire and are multi-layered, a characteristic that separates it from the much more common and closely related *Scouleria aquatica*. It is difficult to distinguish between *S. marginata* and *S. aquatica* in the field, although they can be separated by an experienced bryologist with a greater than 20× hand lens. However, additional confirmation using microscopes is highly recommended.

This species of moss has male and female reproductive units on separate plants. Possibly because of this, it produces sporophytes and spores only occasionally to infrequently. The stalk of the sporophyte is short (≤ 2 mm long), which causes the capsule to remain close to the plant when mature. The capsule is more or less spherical when wet and slightly flattened top to bottom when dry. At maturity, a thick stalk is exserted through the capsule mouth and remains attached to the lid, a characteristic that defines this genus of mosses. Unlike *Scouleria aquatica*, the margined streamside moss lacks a peristome (tooth-like appendage) around the mouth of the capsule.

Figure 1 illustrates key features of the margined streamside moss, and Figures 2 and 3 are photographs of its leaves and a whole plant. See Churchill (1985, 2004), COSEWIC (2002), Grout (1933), Lawton (1971), and Tan (1980) for additional illustrations, identification keys, and descriptive details for the margined streamside moss.



SCOULERIA

Figure 1. Illustrations of the margined streamside moss (from Churchill 2004; used with permission of the artist, P.M. Eckel).

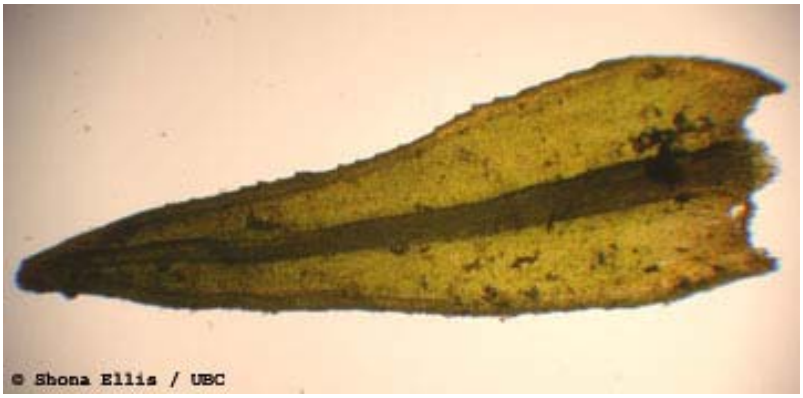


Figure 2. Leaf of the margined streamside moss; from *Species at Risk Act* (SARA) website; Environment Canada 2004 (photograph by Shona Ellis).

Figure 3. Plant of the margined streamside moss; from SARA website; Environment Canada 2004 (photograph by Shona Ellis).

Populations and Distribution

The margined streamside moss is endemic to western North America, found in southeastern British Columbia, Idaho, Washington, Oregon, and California. Figure 4 shows its North American distribution.

In Canada, it is restricted to southern British Columbia where it has been found only once in 1977: along Boundary Creek near Boundary Lake in the Kootenay Region, near the Canada–U.S. border in the southeastern part of the province (Tan 1980; COSEWIC 2002) (Figure 5). The species was reported and collected from this site in August 1977, although a detailed location (i.e., exact coordinates) was not provided at that time. This was probably because a number of collections of *Scouleria* were made in the same area at that time by B. Tan, most of them *S.*

aquatica. The discovery that one of them was *S. marginata* did not occur until he returned to the Herbarium at the University of British Columbia (B. Tan, pers. comm., 2001).

No population data are available on the Canadian population of the margined streamside moss (COSEWIC 2002; follow-up surveys by T. McIntosh in 2001 and in September 2005 did not relocate the species). Tan (1980) did not collect any information about the population. The area where the moss was originally found has since been heavily disturbed, and the margined streamside moss may be extirpated from this location (COSEWIC 2002).

The margined streamside moss is Red-listed in British Columbia with a S1 (critically imperiled) rank (BC Species and Ecosystem Explorer 2005). NatureServe Explorer (2005) lists it as G3 (globally vulnerable to extirpation or extinction) and N1 (critically imperiled) for Canada. It is listed as S1 (critically imperiled) for Oregon and S2 (imperiled) for Washington State, but it is not listed for Idaho or California.

There are no reported estimations of global distribution and abundance for this moss. There are no detailed data on the size or trends of the Canadian population of this species, as this species has not been rediscovered since 1977 (Table 1).

Table 1. Population data for the margined streamside moss in British Columbia

Site	Location coordinates	Number of patches	Land tenure
Boundary Lake	unknown	unknown	Crown land

Figure 4. North American distribution of the margined streamside moss; the northernmost dot represents the Canadian population (from Churchill 1985).

Figure 5. Canadian distribution of the margined streamside moss (X = Boundary Lake area).

Needs of the margined streamside moss

Biological needs, ecological role, and limiting factors

Little is known about the biological attributes that may influence the recovery potential of the margined streamside moss. Its dioecious sexual condition and relatively infrequent spore production may limit recovery. There is no information on spore dispersal distances, viability, or germination success with regard to this species, although spores are probably dispersed by water. Also, there is no evidence of asexual reproduction by specialized propagules or fragmentation with the margined streamside moss, although the lower leaves are often stripped or greatly eroded in habitat and may act as sources for vegetative reproduction.

Habitat needs

There is little information about the habitat needs for the margined streamside moss in British Columbia or elsewhere, although it appears to be restricted to seasonally inundated rocks or bases of outcrops along streams. In the only reported location for this species in Canada, it was found on a rock along a creek margin at about 1300 m elevation (Tan 1980). Fieldwork in 2001 showed that this location, the headwater for Boundary Creek, is partially open and surrounded by montane riparian forest. However, the exact location and habitat for this population has not been determined. Possibly, based on field observations of *S. aquatica* in the Boundary Lake area, the

habitat can be further defined as on the sides of wet rocks or, possibly, outcrops alongside seasonally flooded streams in montane areas. Elsewhere in North America, it has been found on exposed or submerged, particularly granitic, rocks and rock outcrops along streams throughout a range of elevations, from low to high (Churchill 1985).

Threats

Until the species is rediscovered, the following are considered to be potential threats:

Severe flooding
This species is characteristic of sites with moderate seasonal flooding (e.g., spring snow melt) and, in normal situations, can probably be submerged for long periods of time without damage. However, severe flooding events, one of which appears to have happened fairly recently (within the last decade) in the Boundary Lake area, may displace rocks and moss populations alongside Boundary Creek. Further, if the sediment load in floodwater is high, which appears to have happened with the recent flood event, rocks may be covered by more than usual amounts of sediment. Excess sediment may cover the moss, inhibit biological functions, and threaten the survival of some plants. Also, deposition of silt on boulders may limit the establishment of the species or may cover the rocks completely, making them unavailable for colonization by this species.

Disturbance by domestic animals
The creek mouth where this species was reported has apparently been affected by cattle usage since it was first found. Potential effects from cattle include abrasion of the mosses or rock disturbance by trampling, as well as the covering of the moss by increased amounts of litter. Also, cattle activities in a creek or on the banks of a stream will increase suspended sediments in the stream thus causing increased sedimentation; this may threaten the survival of the margined streamside moss.

Forest fire
At one point in the late 1980s or early 1990s, an apparently major forest fire occurred across the Boundary Lake site, and a number of trees that were killed during this event have fallen into the lake and creek, possibly affecting the population of the margined streamside moss. Airborne materials resulting from the fire, such as ash, may have covered the margined streamside moss, and may also have contributed to the sediment load during high water events.

Recreation activities
The Boundary Lake Recreation Site is found at the northwest part of Boundary Lake. Although relatively small (11 camping units), it is a fairly well-used site that offers fishing, boating, swimming, and hiking activities, and is popular for ATVs. Fire pits are present and campers can collect their own wood. A number of trails alongside the lake lead towards the north side of the creek. Although direct human disturbance was not observed, abrasion of the moss from walking is a potential threat to the survival of this species in Canada.

Competition
The closely related moss *Scouleria aquatica* appears to have the same ecological preferences as the margined streamside moss and may outcompete it for habitat space, thus partly accounting for the restricted range of the margined streamside moss. There are, however, no data on this.

Knowledge Gaps

Our knowledge of the biology and habitat of the margined streamside moss in Canada is inadequate to define potential management activities that would protect and maintain populations. Descriptions and assessment of potential threats to this species are not well known or understood. Therefore, inventory of the previously known site and similar sites is of value.

If the species is rediscovered, a detailed investigation of seasonally flooded streams in the Boundary Creek area is recommended.

Although general characteristics for its habitat are known, more data are needed to fully describe critical habitat attributes if this species is rediscovered.

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." For the margined streamside moss, the feasibility of recovery may depend on ensuring the survival of the existing population, if found, and the elimination of threats.

As with many other rare plant species, we lack adequate information about the historical distribution of the margined streamside moss. There is no evidence to indicate that this species was ever abundant or widespread in British Columbia; therefore, recovery should focus on improving its probability of persistence in the wild, if it is extant. Successful recovery will depend on a combination of research investigations, habitat protection and management activities, and long-term population monitoring. Because the original population has not been rediscovered, there are no data for the habitat and ecology of this species in Canada, and thus, a current estimation of population viability cannot be made. Therefore, overall recovery feasibility is unknown until the species is rediscovered through inventory (see Table 2). This determination should be reassessed as the results of additional inventories become known.

Table 2. Technical and biological feasibility for recovery of the margined streamside moss; criteria from Environment Canada *et al.* (2005)

Feasibility criteria	
1. Are individuals capable of reproduction	UNKNOWN

	currently available to improve the population growth rate or population abundance?	
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

To confirm the presence of margined streamside moss, and to protect[1] and maintain any extant populations.

Recovery Objectives

I. To investigate the previously known site in an attempt to rediscover the population of the margined streamside moss.
II. To implement habitat protection and threat mitigation through stewardship activities and other mechanisms for any extant populations.
III. To conduct scientific studies on the ecology and habitat requirements of the populations if found or rediscovered.

Broad Strategy Recommended to Address Threats

Information is lacking regarding the potential threats (flooding, domestic grazing, forest fires, recreational activities, and competition) and whether they do present a threat to any extant populations. If extant populations are found, an initial strategy would be research to identify real threats and possible mitigation measures. Anticipated general strategies to address recreational activities would include habitat protection, public education, and stewardship activities. The broad strategies to address the threats are presented in Table 3.

Approaches Recommended to Meet Recovery Objectives

Little is known about the biology and habitat of this species in Canada and elsewhere, and re-inventory is necessary to confirm the presence of this species. Addressing other threats to this

[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 on federal, provincial, and local government lands.

species through protection of populations and habitats, and habitat and species research, establishment of a monitoring program and public awareness are only a priority for this species' recovery if it is rediscovered.

Recovery Planning Table

Table 3. Recovery Planning Table

Priority	Obj. no.	Broad approach/strategy	Threat addressed	Specific steps	Outcomes or deliverables
High	I	Inventory		• Field survey of previously known and adjacent sites for species' presence • Define and describe specific populations and habitats	• Detailed location information of species • Population numbers • List of sites for protection and monitoring
Low (unless rediscovered, then higher)	II	Protect extant populations and habitats; stewardship and public awareness	Recreational activities; domestic grazing; forest fires	• Investigate extant protection in area, if any • Communicate with local authorities and property users about the presence of the species and the importance of protecting riparian habitat	• Securing of populations and habitats • Increased awareness and assistance by the public in the protection and recovery of this species
Low	III	Conduct scientific studies on the ecology and habitat requirements of the populations, including the initiation of a monitoring program	Flooding; domestic grazing; forest fires; competition	• Research and document population sizes and health • Develop and implement standardized monitoring protocol • Report monitoring results annually and assess trends in	• 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 • Assessment of status of populations and effects

	populations, area of occupancy and habitat condition every 5 years • Submit all data to BC CDC	of recovery actions

Performance Measures

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

1. Confirmation of the presence of the species in Canada.
2. If the species is rediscovered, the number of stewardship agreements and/or covenants in place on private lands, or other measures on Crown land.
3. If the species is rediscovered, the number of research projects initiated on existing populations, habitats, understanding of threats, determination of ecological and habitat requirements, and establishment of a monitoring program.
4. If the species is rediscovered, the number of educational and stewardship activities conducted with landowners and land managers.

Critical Habitat

Identification of the species' critical habitat

No critical habitat, as defined under the federal *Species at Risk Act* (Environment Canada 2004), is identified at this time. The critical habitat of this species cannot be identified until the species is rediscovered. Based on herbarium data, on information provided by B.C. Tan, and through field visits, suitable habitat in Canada can be generally described as seasonally submerged rocks and possibly outcrops along creeks in montane regions.

Recommended schedule of studies to identify critical habitat

An accurate delineation of critical habitat is not possible at this time. If the species is rediscovered, studies would need to be completed to fully identify critical habitat. Table 4 presents the studies needed (subject to availability of resources) to identify critical habitat.

Table 4. Timeline for completion of studies to identify critical habitat for the margined streamside moss

Study	Completion date
Determination of the existence of the margined streamside moss at its previously known site in the Boundary Creek area	2010
Determination of rock mineral properties (e.g., pH, composition) to see if these are	2010

required for growth and reproduction	
Determination of light and humidity requirements for growth and reproduction	2010
Inventory of other areas of suitable habitat	2010

Existing and Recommended Approaches to Habitat Protection

Boundary Lake and the upper portions of Boundary Creek are Crown land under the jurisdiction of the B.C. Ministry of Forests and Range; the Boundary Lake Recreation Site is located at the northwest side of the lake. If the species is rediscovered, protection of these riparian areas may be available through various guidelines.

If the species is rediscovered, careful management of cattle access into the area may decrease the potential impact on the habitat. Public awareness and access management may also benefit the habitat for this species.

Stewardship Approach
For successful implementation in protecting species at risk there will be a strong need to engage in stewardship on various 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."

Stewardship Approach for Private Lands
Additional populations of this species may occur on private lands. As with other species at risk found on private property, stewardship efforts would be the key to their conservation and recovery. To successfully protect many species at risk in British Columbia, voluntary initiatives by landowners are needed to help maintain areas of natural ecosystems that support these species. This stewardship approach will cover many different kinds of activities, such as: following guidelines or best management practices to support species at risk; voluntarily protecting important areas of habitat on private property; creating conservation covenants on property titles; ecogifting property (in whole or in part) to protect certain ecosystems or species at risk; or selling property for conservation. Both government and non-governmental organizations have had successfully conserved lands in the province.

Effects on Other Species

Effects on other species or ecological processes are not anticipated during the recovery of the margined streamside moss. It is anticipated that some actions during recovery may benefit other species, and this will be assessed as work is undertaken.

Socioeconomic Considerations

At this moment, there are no social or economic considerations as this species has not been rediscovered in Canada. If the species is rediscovered, the socio-economic effects will be very minor.

Recommended Approach for Recovery Implementation

This recovery strategy takes a single-species approach. If the species is rediscovered, its recovery implementation may be considered for integration within conservation efforts in the region.

Statement on Action Plans

The recovery action plan will be completed by December 31, 2010, if the species is rediscovered.

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