

**COSEWIC**  
**Status Appraisal Summary**

on the

**Southern Maidenhair Fern**  
*Adiantum capillus-veneris*

in Canada

**ENDANGERED**  
**2011**

**COSEWIC**  
Committee on the Status  
of Endangered Wildlife  
in Canada



**COSEPAC**  
Comité sur la situation  
des espèces en péril  
au Canada

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## COSEWIC Assessment Summary

### Assessment Summary – May 2011

**Common name**

Southern Maidenhair Fern

**Scientific name**

*Adiantum capillus-veneris*

**Status**

Endangered

**Reason for designation**

This delicate fern is known in Canada from three to four subpopulations in a single natural hot spring in southeastern British Columbia. It is threatened by changes in hydrology, development, recreational activities and collection, and is limited by availability of suitable microhabitat conditions. Large declines (greater than 90%) have been recorded in the past 10 years, though the plant may remain dormant underground and one subpopulation has rebounded after four survey years in which few or no fronds were detected.

**Occurrence**

British Columbia

**Status history**

Designated Endangered in April 1984. Status re-examined and confirmed in April 1998, May 2000, and May 2011.



three extant subpopulations occupying about 15 m<sup>2</sup> within an IAO of 4 km<sup>2</sup>. No individuals have been found in surveys of subpopulation A since 2005, and this occurrence may be extirpated.

The number of inferred locations is now best described as two, due to changes in numbers of subpopulations and land ownership (see Threats, below).

**Population Information:**

<i>Change in number of mature individuals:</i>	yes X	no <input type="checkbox"/>
<i>Change in total population trend:</i>	yes X	no <input type="checkbox"/>
<i>Change in severity of population fragmentation:</i>	yes <input type="checkbox"/>	no X
<i>Significant new survey information</i>	yes X	no <input type="checkbox"/>

**Explanation:**

A number of surveys of the extant population at Fairmont Hot Springs have been made since the last COSEWIC assessment in May 2000, with the most recent one made in Aug. 2009 by T. Miller (summarized in Table 1). In this species, in which individuals can grow interspersed because they spread by rhizomes that can interweave, the number of leaf fronds has been used as an index of the number of mature individuals. No spores were observed on fronds in 2009. The number of fronds has fluctuated dramatically over the last decade, reflecting both the discovery of new subpopulations as well as significant fluctuations over time at known occurrences (Southern Maidenhair Fern Recovery Team 2007).

As of the last COSEWIC assessment (May 2000), there was a single known subpopulation: Site A, which contained 16 fronds (Douglas and Smith 2003); site (subpopulation) names follow those used by the Southern Maidenhair Fern Recovery Team (2007). More detailed surveys in 2002 indicated that Site A had been reduced to two fronds. Surveys of this site have not detected any fronds since 2005, and this subpopulation may be extirpated.

Site H, first found in fall 2000, was estimated to contain 33,600 fronds in 2002. This subpopulation remained large until September 2006 when it went into precipitous decline. The most recent surveys indicate that this site has declined to an estimated 183 fronds (Table 1). The decline may be related to changes in hydrology at this site.

Subpopulations at Sites B and F were discovered in 2001. The size of site B was estimated at 50-100 fronds in 2001, while 500 fronds were counted at Site F. Site B remained roughly constant in size until at least 2006, but was recently estimated to contain 380 fronds. By 2002, only two fronds were found at site F, and no fronds were found in 2003 and 2005, but the population was estimated to contain 900-1300 fronds over an area of just 4 m<sup>2</sup> in 2009 (Table 1).

Hydrological changes seem to play a key role in influencing fluctuations in population sizes. The expansion of subpopulation F appears to be due to the resumption of water flow through the habitat from subterranean springs, which had essentially ceased during the middle years of this decade. Likewise, changing hydrological patterns are responsible for recent population declines at Site H, where only 183 fronds were counted in 2009.

In summary, total population size is currently estimated at roughly 1,450 to 1,850 fronds, a number significantly larger than the 16-68 fronds reported in the 2000 status assessment (COSEWIC 2000), but a significant decline from 2002/2003 levels of 30,000+ fronds. However, trends at individual subpopulations appear to be closely tied to changing conditions at the local scale and hence are somewhat asynchronous.

**Threats:**

*Change in nature and/or severity of threats:*

yes  no

Explanation:

Three factors had been identified as potential threats to the population: (1) habitat loss and degradation through the alteration of hot springs water flow; (2) residential and resort development; and (3) collection and trampling (White and Douglas 1998, Southern Maidenhair Fern Recovery Team 2007). A fourth threat, competition from invasive species, has also recently been identified (M. Miller, pers. obs. 2009). Of these, the greatest limiting factor at present is the inconstant and unpredictable supply of hot springs water to the individual pools associated with the Southern Maidenhair Fern subpopulations. For example, since 2003, decreased flows into the pool at Site H have led to its complete drying, allowing for the rapid encroachment of weedy species, particularly Canada Thistle (*Cirsium arvense*) and Sow Thistle (*Sonchus arvensis*), all but eliminating this site as a viable habitat for the fern. The fern is now reduced to a few fronds in a single small patch beneath a decaying rose bush. Reduction in water flow over time to the subpopulation at Site A presumably also contributed to its apparent extirpation.

Owners and managers of the Fairmont Hot Springs Resort have been made aware of the plight of the fern. They have expressed a desire to conserve the species in its natural habitat and have been receptive to suggestions for protecting the sites. They have also been supportive of monitoring efforts. There are currently no known plans for additional development on any of the sites occupied by this fern. However, in 2006, the section of property containing Site F was sold to a private developer who had expressed an interest in developing the land for residential (condominium) use. After being informed of the fern's presence on the property, the new owner agreed in principle to try to avoid activities that would directly harm the fern. Since 2006, the fern has maintained itself relatively well at this site. In 2009, the property in question was again put up for sale, casting further uncertainty on the future fate of this habitat and the subpopulation at Site F (T. Antifeau, pers. comm. 2009).

Although the main threat to all of the fern subpopulations is the inconsistent and unpredictable supply of water to pools adjacent to each, differences in land tenure and management of sites suggest that the recognition of two locations, as defined by COSEWIC, may be appropriate. The ferns at site F have a much more unpredictable future due to uncertainty over the sale of the property and subsequent land use than those on the Fairmont Resort property where the owners are sympathetic to mitigating impacts on the fern: Location 1 includes all subpopulations on the Fairmont Resort property (A, B, H); Location 2 includes the subpopulation at site F.

**Protection:**

*Change in effective protection:*

yes  no

Explanation:

Southern Maidenhair Fern is currently listed as Endangered on schedule 1 of SARA. A recovery strategy has been produced by the southern maidenhair recovery team (2007), and has been published by the BC Ministry of Environment. Critical habitat has not been identified for this species.

All known Southern Maidenhair Fern localities are on private land. The management and stewardship responsibility of the sites rests with the landowners. At present, no formal conservation plans are in place in relation to Southern Maidenhair Fern habitat. Discussion on stewardship agreements with the property owners is underway, e.g., through the Nature Conservancy of Canada (Southern Maidenhair Fern Recovery Team 2007; H. Page, pers. comm. 2009).

**Rescue Effect:***Evidence of rescue effect.*yes  no 

Explanation:

Southern Maidenhair Fern is disjunct in southeastern British Columbia from the nearest population in South Dakota. Rescue via long-range dispersal is thus extremely unlikely. However, because the fern reproduces from spores as well as vegetatively, there may be some potential for localized dispersal, allowing for colonization or re-colonization at the local scale.

**Quantitative Analysis:***Change in estimated probability of extirpation:*yes  no 

Details:

No quantitative analyses have been undertaken.

**Summary and Additional Considerations:**

The outlook for Southern Maidenhair Fern has improved slightly since the last COSEWIC assessment, in that there are now four confirmed subpopulations as opposed to one. The total inferred population size has fluctuated as a result of both changes to known populations and changes in the number of known subpopulations. However, the original subpopulation (A) is now seemingly extirpated (with a remote chance that a few individuals still persist via dormant underground rhizomes), whereas one of the three extant subpopulations (H, recently the most robust of the subpopulations with 30,000+ fronds) presently appears to have very low viability. A second extant subpopulation remains highly vulnerable to both hydrological fluctuations and future land use decisions.

It is unclear what proportion of the surface water flow fluctuations at Fairmont Hot Springs is due to natural subterranean (geomorphological) processes, and what proportion is the result of past human activities associated with the commercial hot springs development. Hydrological studies are required to determine whether the current hot spring water supplying these sites has been artificially affected in any way. Without more information on the mechanisms underlying fluctuating surficial flows, predicting future population trends will remain extremely difficult. Lack of such information will also hamper the ability to effectively manage hot spring flows for the benefit of the fern, should it be deemed necessary to take a more proactive management approach in the future.

The fact that one subpopulation (Site F) has recently “re-emerged” in response to resumed seepage flows after being deemed extirpated in 2003 (Southern Maidenhair Fern Recovery Team 2007), attests to this species’ ability to survive periods of unfavorable environmental conditions by undergoing extended vegetative dormancy (via underground rhizomes). The vital role that vegetative dormancy, a condition in which a plant does not sprout above ground for one or more growing seasons, can play in the population dynamics of some herbaceous plant species has only recently begun to be recognized (Shefferson 2009). In the case of Southern Maidenhair Fern, estimates of population size based on counts of aboveground, visible fronds may be an imprecise indicator of actual population size because in any given year, a proportion of the population could persist in the form of dormant underground rhizomes. Likewise, care must be taken before deeming any subpopulation extirpated on the grounds that no fronds have been observed for a year or two. The maximum time that individuals of this species can survive underground before re-emerging is presently unknown, but observations from recent monitoring activities at Site F suggests it could be at least three years (and possibly longer).

## Consultations:

Southern Maidenhair Fern Recovery Team  
- Ted Antifeau (BC Ministry of Environment)  
- Hillary Page (Nature Conservancy of Canada)

## Sources of information:

Douglas, G.W. and S.J. Smith. 2003. Stewardship account for southern maiden-hair fern (*Adiantum capillus-veneris*). Douglas Ecological Consultants. 17 pp.

Shefferson, R.P. 2009. The evolutionary ecology of vegetative dormancy in mature herbaceous perennial plants. *Journal of Ecology* 97:1000-1009.

Southern Maiden-hair Fern Recovery Team. 2007. Recovery strategy for the southern maiden-hair fern (*Adiantum capillus-veneris*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 17 pp.

White, D.J. and G.W. Douglas. 1998. Update COSEWIC status report on southern maiden-hair fern (*Adiantum capillus-veneris*) in Canada. Unpublished report. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 14 pp.

Author of Status Appraisal Summary: Michael T. Miller

**Table 1. Variation in frond numbers at four subpopulations by survey year since last status report<sup>1</sup>.**

Subpop/Site	Number of fronds by year						
	2000	2001	2002	2003	2005	2006	2009
A	13	20	2	1	0	0	0
B	N/A (Discovered Aug. 2001)	50-100	36-50	60	No change <sup>3</sup>	No change <sup>3</sup>	380
F	N/A (Discovered Aug. 2001)	500+	2	0	0	few	900-1,300
H	Very abundant (Discovered Fall 2000) <sup>2</sup>	Very abundant <sup>2</sup>	est. 33,600	30,000+	No change <sup>3</sup>	No change <sup>3</sup>	183

<sup>1</sup> Data from Southern Maidenhair Fern Recovery Team (2007), information in Douglas and Smith (2003), survey by Miller in 2009, and pers. comm. from T. Antifeau (2011).

<sup>2</sup> Population size estimate not available, but the population contained well over 1000 fronds (individuals), and was probably similar in size to 2002 estimates. Subpopulation H was first found in fall 2000 and was not included in the 2000 COSEWIC assessment (COSEWIC 2000).

<sup>3</sup> No population size estimate was made, but population appeared to be similar in extent and numbers of individuals to previous years.



## TECHNICAL SUMMARY

*Adiantum capillus-veneris*  
Southern Maidenhair Fern  
Range of occurrence in Canada: British Columbia

Adiante cheveux-de-Vénus

### Demographic Information

Generation time <i>Generation time is not known, but based on other ferns, likely 5-20 years.</i>	Unknown
Is there an observed continuing decline in number of mature individuals? <i>The largest subpopulation (containing more than 90% of known individuals) has undergone a decline from more than 30,000 to 183 fronds since 2006. There is uncertainty about the degree to which rhizomes can remain dormant, but there are nonetheless likely to have been true declines in the number of mature individuals.</i>	Likely
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Unknown
Observed percent reduction or increase in total number of mature individuals over the last 10 years, or 3 generations.	>90% decline since 2006
Projected percent increase in total number of mature individuals over the next 10 years.	Unknown
Inferred percent increase in total number of mature individuals over any 10 years, or 3 generations period, over a time period including both the past and the future.	Unknown
Are the causes of the decline clearly reversible and understood and ceased? <i>Declines and fluctuations are not well understood, but likely related to site hydrology. Unlikely to have ceased.</i>	No
Are there extreme fluctuations in number of mature individuals? <i>However, the causes of fluctuations are not clearly understood.</i>	Yes

### Extent and Occupancy Information

Estimated extent of occurrence <i>Distance between sites 0.6 km. Total EO well below thresholds.</i>	Not estimated
Index of area of occupancy (IAO)	4 km <sup>2</sup> (2x2 km)
Is the total population severely fragmented?	No
Number of "locations*" <i>Based on land ownership, and uncertain future of site F.</i>	2
Is there an observed continuing decline in extent of occurrence? <i>The loss of subpopulation A has reduced the extent by 150 m.</i>	Yes
Is there an observed and projected continuing decline in index of area of occupancy? <i>Invasive plants could continue the decline.</i>	No
Is there an observed continuing decline in number of populations? <i>No fronds observed at site A since 2005.</i>	Possibly
Is there an observed continuing decline in number of locations?	No
Is there an observed continuing decline in quality of habitat? Hydrological changes have impacted suitability of sites. Invasive plants continue to threaten habitat quality.	Yes

\* See definition of location.

Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

**Number of Mature Individuals (in each population)**

Population (Subpopulations are shown)	Number of Mature Individuals (2009)
Subpopulation A (2000 extant; 2002 2 fronds)	Possibly extirpated
Subpopulation B (2000 extant; 2002 36-50 fronds)	380
Subpopulation F (2000 extant; 2002 2 fronds)	900-1300
Subpopulation H (2000 extant; 2002 33,600 fronds)	183
Total	1463-1863

**Quantitative Analysis**

Probability of extinction in the wild	N/A
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**Threats (actual or imminent, to populations or habitats)**

(1) habitat loss and degradation through the alteration of hot springs water flow; (2) residential and resort development; (3) collection and trampling; (4) competition from invasive species.
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**Rescue Effect (immigration from outside Canada)**

Status of outside population(s) Globally Secure (G5) Colorado (S2) South Dakota (S1)	
Is immigration known or possible? <i>Southern Maidenhair Fern is disjunct in southeastern British Columbia from the nearest populations in Colorado and South Dakota (1300 km disjunct).</i>	No
Would immigrants be adapted to survive in Canada?	Unknown
Is there sufficient habitat for immigrants in Canada?	No
Is rescue from outside populations likely?	No

**Current Status**

COSEWIC: ENDANGERED (May 2011)
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**Status and Reasons for Designation**

<b>Status:</b> Endangered	<b>Alpha-numeric code:</b> A2b; B1ab(i,iii,v)+2ab(i,iii,v)c(iv); C2b
<b>Reasons for designation:</b> This delicate fern is known in Canada from three to four subpopulations in a single natural hot spring in southeastern British Columbia. It is threatened by changes in hydrology, development, recreational activities and collection, and is limited by availability of suitable microhabitat conditions. Large declines (greater than 90%) have been recorded in the past 10 years, though the plant may remain dormant underground and one subpopulation has rebounded after four survey years in which few or no fronds were detected.	

\* See definition of location.

**Applicability of Criteria**

<p><b>Criterion A</b> (Decline in Total Number of Mature Individuals): Meets Endangered A2b. Declines of greater than 90% since 2006; the causes of decline are not understood and not clearly reversible.</p>
<p><b>Criterion B</b> (Small Distribution Range and Decline or Fluctuation): Meets Endangered B1ab(i,iii,v)+2ab(i,iii,v)c(iv). The EO and IAO are below the thresholds and recent precipitous declines, fluctuations and the loss of one subpopulation support the application of the criteria.</p>
<p><b>Criterion C</b> (Small and Declining Number of Mature Individuals): Meets Endangered C2b, based on an observed decline in the number of mature individuals and observed fluctuations.</p>
<p><b>Criterion D</b> (Very Small or Restricted Total Population): D1 does not apply &gt;1000 individuals. Meets Threatened D2.</p>
<p><b>Criterion E</b> (Quantitative Analysis): Not done.</p>



## COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

## COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

## COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

## DEFINITIONS (2011)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

\* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

\*\* Formerly described as "Not In Any Category", or "No Designation Required."

\*\*\* Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.



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