

# Management Plan for the Hart's-tongue Fern (*Asplenium scolopendrium*) in Canada

## Hart's-tongue Fern



2013

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## PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed species of special concern and are required to report on progress within five years.

The Minister of the Environment is the competent minister under SARA for the management of the Hart's-tongue Fern and has prepared this management plan as per section 65 of SARA. It has been prepared in cooperation with the Government of Ontario.

Success in the conservation 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 plan and will not be achieved by Environment Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Hart's-tongue Fern and Canadian society as a whole.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

## ACKNOWLEDGMENTS

Earlier drafts of this management plan were prepared by Dr. David Anthony Kirk of Aquila Conservation & Environment Consulting and Dr. Jennie L. Pearce of Pearce and Associates Ecological Research. Input from Suzanne Robinson, Karine Beriault, Bill Crins and Emma Followes (Ontario Ministry of Natural Resources (OMNR)); Frank Burrows (Parks Canada Agency, Bruce Peninsula National Park); Donald Leopold (College of Environmental Science and Forestry; State University of New York); Steve Murphy (University of Waterloo); Mike Oldham (Natural Heritage Information Centre; (OMNR)) and Mike Penskar (Michigan Natural Features Inventory) is very much appreciated. Development of this management plan was facilitated by Madeline Austen, Barbara Slezak and Christina Rohe (Environment Canada, Canadian Wildlife Service – Ontario). Contributions from Susan Humphrey, Lesley Dunn (Canadian Wildlife Service – Ontario) and Paul Johanson (Canadian Wildlife Service – National Capital Region) are also gratefully acknowledged.

## EXECUTIVE SUMMARY

Hart's-tongue Fern (*Asplenium scolopendrium*) is listed as Special Concern on both Schedule 1 of the federal *Species at Risk Act* (SARA) and under the Ontario *Endangered Species Act, 2007* (ESA 2007). The Hart's-tongue Fern is a perennial evergreen that forms a rosette of simple undivided fronds. The fronds may be described as having a distinct 'strap' or 'tongue' shape appearance. In the United States of America, disjunct populations of the Hart's-tongue Fern occur in Michigan, New York, Alabama and Tennessee. In Canada, this species occurs only in the province of Ontario, where it is generally found at sites on or near dolomitic limestone along the upper and mid-slope positions of the Niagara Escarpment region.

Threats identified to the Canadian population of Hart's-tongue Fern include, but are not limited to: limestone quarrying; thinning of forest canopy cover; housing and commercial development; recreational activities (e.g., rock climbing, spelunking, off-trail hiking); collection of wild ferns and competition with exotic species.

Approximately 74% of the species' global distribution occurs in the province of Ontario, as such, there is a high conservation responsibility for the Hart's-tongue Fern in Canada. Given the apparent stability of the Canadian population, the objective of this management plan is to maintain extant populations at their current abundance and distribution by reducing the threats that act upon the species across its range in Canada.

To achieve the management objective, three broad strategies are recommended:

1. Manage and conserve habitat.
2. Monitor and research.
3. Outreach and communication.

A number of conservation measures to achieve the management objective of this plan are proposed, none of which are expected to have any significant negative effect on the environment or other species.

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## 1. COSEWIC\* SPECIES ASSESSMENT INFORMATION

**Date of Assessment:** November 2000

**Common Name (population):** Hart's-tongue Fern

**Scientific Name:** *Asplenium scolopendrium*

**COSEWIC Status:** Special Concern

**Reason for Designation:** A fern with most of the global range and majority of populations occurring in Canada on moist mossy limestone outcrops on the Niagara Escarpment of southwestern Ontario. Populations are scattered and subject to on-going threats from land development, quarrying, logging and possible commercial collecting.

**Canadian Occurrence:** Ontario

**COSEWIC Status History:** Designated Special Concern in November 2000.

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

## 2. SPECIES STATUS INFORMATION

The global conservation status for Hart's-tongue Fern (previously known as American Hart's-tongue Fern) is apparently secure<sup>1</sup>/vulnerable<sup>2</sup> (G4T3) (NatureServe 2011). In the United States, the national conservation status is imperiled<sup>3</sup> (N2) (NatureServe 2011; Appendix B). In Canada, Hart's-tongue Fern is known from the province of Ontario where the sub-national conservation status is vulnerable (S3)<sup>4</sup> (NatureServe 2011). The national conservation status for Canada is vulnerable (N3) (NatureServe 2011).

Hart's-tongue Fern is listed as Special Concern<sup>5</sup> on Schedule 1 of the federal *Species at Risk Act* (SARA). In Ontario, the Hart's-tongue Fern is listed as Special Concern<sup>6</sup> under the provincial *Endangered Species Act, 2007* (ESA 2007). The percentage of the global distribution found in Canada is estimated to be 74% (NatureServe 2011).

<sup>1</sup> uncommon but not rare; some cause for long-term concern due to declines or other factors

<sup>2</sup> at moderate risk of extirpation due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors

<sup>3</sup> imperiled in the nation or state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province

<sup>4</sup> vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation

<sup>5</sup> a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats

<sup>6</sup> a species that lives in the wild in Ontario and may become threatened or endangered because of a combination of biological characteristics and identified threats

### 3. SPECIES INFORMATION

#### 3.1. Species Description

The Hart's-tongue Fern is a perennial evergreen. New ferns emerge at the beginning of each growing season and generally remain through the winter and two subsequent years (COSEWIC 2000). Hart's-tongue Fern arise from a short rhizome (underground stem) that is covered in cinnamon-coloured scales. The above ground portion of the fern forms a rosette of simple undivided fronds; each frond is made up of a petiole (supporting stalk or stem-like structure) and a blade (the expanded leaf part). The green / brown to straw-coloured petiole or stem of the frond is generally 3cm to 12cm long and, like the rhizome, has cinnamon-coloured scales on the surface (COSEWIC 2000; NatureServe 2011; Wagner et al. 1993). The blade portion of the frond is generally 12cm to 42cm long and 2cm to 4.5cm wide and has a 'strap-like' (COSEWIC 2000) or 'tongue-like' appearance. The base of the blade may be described as being auriculate (bearing ear-shaped lobes) to deeply cordate (heart-shaped) in appearance (NatureServe 2011). The underside of the blade has linear-shaped sori, which are clusters of spore-producing structures (sporangia); spores of the Hart's-tongue Fern are generally produced on year-old fronds (USFWS 1993) from May through August. A single frond may produce up to 18 000 spores, which are well adapted for long-range dispersal (COSEWIC 2000).

#### 3.2. Populations and Distribution

The Hart's-tongue Fern is endemic to North America. Northern populations are associated with localized widely-disjunct areas occurring at the eastern end of the Upper Peninsula of Michigan (USA), central New York (USA), and southern Ontario (Canada); and disjunct southern populations occur in northern Alabama (USA) and southcentral Tennessee (USA) (Austen 2000) (Figure 1). One population is known to occur in New Jersey, however this population was introduced from New York around 1936 (NatureServe 2011) (Appendix B). The species may also occur in the state of Maryland (Kartesz 2011; Figure 1), but records with NatureServe do not currently reflect this (NatureServe 2011).

In Canada, Hart's-tongue Fern is considered extant only in the province of Ontario. Historically, two records of Hart's-tongue Fern were reported from the province of British Columbia (BC) and one record from the province of New Brunswick (NB) (Austen 2000). Of the two records reported from Vancouver Island, BC, one was lacking sufficient documentation to accept or reject the report, and the other, along with the record reported from Meduxnakeag Valley, NB; was considered to be of a non-native variety (i.e., European Hart's-tongue Fern (*Asplenium scolopendrium* var. *scolopendrium*)) (Austen 2000).

In Ontario, Hart's-tongue Fern is known to be extant only in the Niagara Escarpment region of the province. In this region, and excluding a site at Niagara Falls (which is thought to have been planted), a total of 100 element occurrences (EO<sup>7</sup>) (EO hereafter interchangeable with

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<sup>7</sup> individuals or groups of plants separated from each other by more than 1 km are generally recognized as separate element occurrences / populations in the COSEWIC, NatureServe and Natural Heritage Information Centre records for vascular plants

“population”) were cited in the COSEWIC (2000) assessment and status report. Subsequent to the COSEWIC (2000) report, seven additional populations have been submitted to the Natural Heritage Information Centre (NHIC). Based on the current<sup>8</sup> records with the NHIC, there are 107 known Hart's-tongue Fern populations (NHIC 2011) distributed between six counties (Bruce; Grey; Simcoe; Dufferin; Peel and Halton) in the Niagara Escarpment region, with the majority of population occurrences in Bruce and Grey counties (Austen and Oldham 2000) (Figure 2). Cody and Britton (1989) suggest Hart's-tongue Fern may also occur in Wellington county, but further noted the occurrence may have been introduced. Of the 107 known populations, 74 are considered extant (where verification of the population status has been undertaken in the past 20 years), 28 are considered historic (where appropriate habitat is likely still present but the species has not been observed in the past 20 years), and 5 are extirpated (where appropriate habitat is not present and extensive surveys have not revealed plants) (NHIC 2011) (Figure 2). The NHIC has assigned EO ranks<sup>9</sup> to each of the 107 known Hart's-tongue Fern populations in Canada (NHIC 2011). As EO ranks are often used in prioritizing conservation planning (NHIC 2011), it is important to note that of the 74 known extant populations, 57 are considered viable<sup>10</sup>; 4 are considered probably not viable; and the remaining 13 have been verified as still existing, but sufficient information on the factors used to estimate viability of the occurrence are not available (NHIC 2011) (Appendix C).



Figure 1. North American distribution of Hart's-tongue Fern (adapted from Kartesz 2011).

<sup>8</sup> NHIC information accessed October 2011

<sup>9</sup> As defined using the NatureServe Element Occurrence Data Standard (NatureServe 2002); EO ranks provide a succinct assessment of estimated viability or probability of persistence (based on condition, size, and landscape factors) of occurrences of a given Element (NatureServe 2002). EO ranks are assigned on the basis of data obtained from recent field surveys (except for historical, or in some cases extirpated, occurrences) by knowledgeable individuals using EO Rank Specification Standards (NatureServe 2002)

<sup>10</sup> The basic "A" through "D" ranks are based on current known factors that are used to predict the viability of an EO. The more viable an EO is, the higher its EO rank and the higher its conservation value, with "A" being the highest EO rank. The cut-off for viability occurs at the "C" rank, with "D" ranked EO's characterized as probably not viable (NHIC 2011)



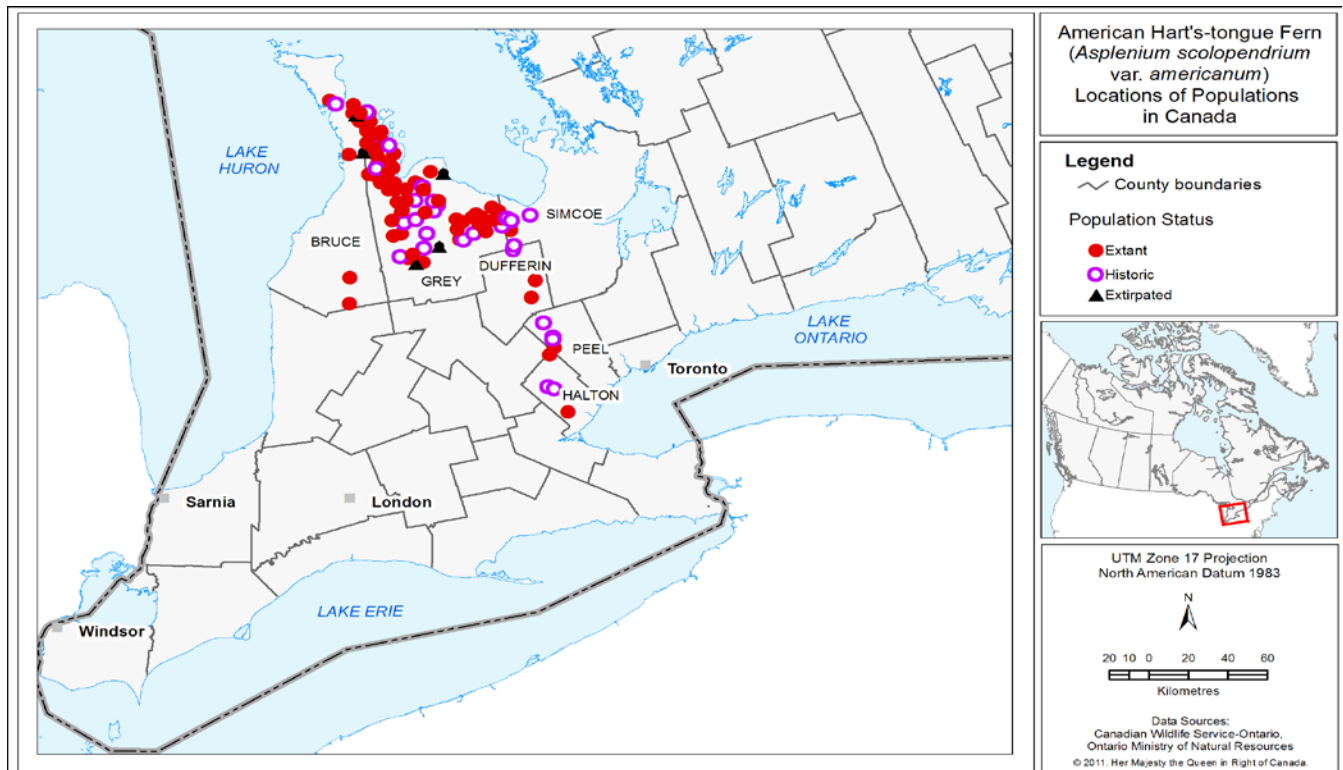


Figure 2. Locations of Hart's-tongue Fern populations in Canada. Note: one extant and two historic populations are not displayed in this figure as the geographical coordinates for these populations are currently not available (NHIC 2011).

The following information should be considered as approximate, as population trends and overall abundance are not known with certainty. For example, detailed population studies (i.e., standardized counts of individuals/clumps of Hart's-tongue Fern at all population sites) have not been conducted in Ontario (Austen 2000) and most populations have not been evaluated (e.g., population viability) for well over a decade (NHIC 2011). Where detailed studies have been conducted, it is important to note that very large populations have sometimes been documented (e.g., Hope Bay, Bruce County population estimates are 10 000 to 100 000 Hart's-tongue Fern) (Austen 2000). Short-term trends have further suggested the species has remained relatively stable over the last half-century, in large part due to large, persistent occurrences in Ontario (NatureServe 2011). Based on a partial evaluation of the populations, Austen (2000) produced a conservative abundance estimate of 30 000 Hart's-tongue Fern plants in Ontario.

### 3.3. Needs of the Hart's-tongue Fern

Hart's-tongue Fern is an epipetric fern<sup>11</sup> and a strict calciphile<sup>12</sup> (COSEWIC 2000). It is generally found at sites on or near dolomitic limestone along the upper and mid-slope positions of the Niagara Escarpment, with some additional populations occurring on open talus/scree<sup>13</sup>

<sup>11</sup> generally found growing on rocks or rocky substrate

<sup>12</sup> requires calcareous soils (usually derived from limestone bedrock)

<sup>13</sup> an accumulation of weathered rock fragments at the foot of a cliff or hillside

slopes or within the general region (e.g., near Mar and Stokes Bay) (COSEWIC 2000). Common site characteristics include: steep, mesic<sup>14</sup> slopes with a north to northeast aspect; thin calcareous soils; and a hardwood canopy cover that provides a cool, well-shaded, moist microclimate while permitting sunlight to enter (COSEWIC 2000; NatureServe 2011). Other important features may include: moderate (between 25% to 50%) herbaceous plant cover; the presence of non-evergreen shrubs; a lack of conifer cover; snow cover during periods of freezing temperatures; and a lack of drought conditions (Cinquemani Kuehn and Leopold 1993).

As in other ferns, reproduction is by spores, which are pre-adapted for long-range dispersal. Sporelings require cool, moist calcareous environments where bryophytes<sup>15</sup> are present for development (Crispin and Penskar 1990). Moreover, bryophytes appear to be critical to sporeling survival by providing the conditions necessary for fertilization, spore germination and gametophyte<sup>16</sup> development (NatureServe 2011). As ferns mature, they out-compete bryophytes for available resources and replace them (NatureServe 2011).

In Ontario, Hart's-tongue Fern is generally found in second-growth<sup>17</sup> deciduous forests dominated by Sugar Maple (*Acer saccharum*) (COSEWIC 2000). Other canopy trees often include American Beech (*Fagus grandifolia*), Ironwood (*Ostrya virginiana*), White Ash (*Fraxinus americana*), Black Cherry (*Prunus serotina*), Yellow Birch (*Betula alleghaniensis*), White Birch (*Betula papyrifera*), and Eastern White Cedar (*Thuja occidentalis*) (COSEWIC 2000; Austen and Oldham 2000). Northern Holly-Fern (*Polystichum lonchitis*), Herb Robert (*Geranium robertianum*), Walking Fern (*Asplenium rhizophyllum*) and Sharp-lobed Hepatica (*Hepatica acutiloba*) were often associated with Hart's-tongue Fern at sites surveyed in Bruce and Grey counties (COSEWIC 2000). Other plant associates included Spinulose Woodfern (*Dryopteris carthusiana*), Evergreen Woodfern (*Dryopteris intermedia*), Goldie's Woodfern (*Dryopteris goldiana*), Maidenhair Spleenwort (*Asplenium trichomanes*), Maidenhair Fern (*Asiantum pedatum*), Wild Leek (*Allium tricoccum*), Virginia Waterleaf (*Hydrophyllum virginianum*), and Blue Cohosh (*Caulophyllum thalictroides*) (COSEWIC 2000). Some bryophytes recorded with Hart's-tongue Fern include Anomodon Moss (*Anomodon attenuatus*), *Brachythecium* spp., and Ontario Rhodobryum Moss (*Rhodobryum ontariense*; formerly *Rhodobryum roseum*) (COSEWIC 2000).

### 3.4. Limiting Factors

Large-scale fluctuations in Hart's-tongue Fern populations are often associated with climatic events, particularly summer drought but also a lack of sufficient snow cover (may cause frost heaving, inadequate soil moisture, and direct cold damage to the plant). For example, populations found in the northern United States and southern Canada are found in areas with an

<sup>14</sup> relating or adapted to a moderately moist habitat

<sup>15</sup> a member of a large group of seedless green plants including the mosses, liverworts, and hornworts

<sup>16</sup> among organisms which display an alternation of generations as part of their life cycle (such as plants and certain algae), the haploid organism that produces gametes. Each of its cells has only one, unpaired set of chromosomes, as opposed to the corresponding diploid form of the organism, called the sporophyte

<sup>17</sup> a forest or woodland area which has re-grown after a major disturbance such as fire, insect infestation, timber harvest or windthrow, until a long enough period has passed so that the effects of the disturbance are no longer evident

annual snowfall range of 200cm to 300cm per year, snowfall less than this amount may lead to freeze related damage (Cinquemani Kuehn and Leopold 1990 as cited in COSEWIC 2010).

Hart's-tongue Fern is highly habitat specific and the current Canadian distribution is only found in the Niagara Escarpment region; a land type characterized by thin, calcareous soils over limestone bedrock (COSEWIC 2000).

## 4. THREATS

### 4.1. Threat Assessment

Table 1. Threat Assessment Table

Threat	Level of Concern <sup>1</sup>	Extent	Occurrence	Frequency	Severity <sup>2</sup>	Causal Certainty <sup>3</sup>
<b>Habitat Loss or Degradation</b>						
Limestone quarrying	Medium-High	Widespread	Historic / Current	Recurrent	High	High
Commercial or residential development	Low-Medium	Localized	Historic / Current	Recurrent	Unknown	Medium
<b>Changes in Ecological Dynamics or Natural Processes</b>						
Thinning of forest canopy cover	Medium-High	Widespread	Historic / Current	Recurrent	Unknown	Medium
<b>Disturbance or harm</b>						
Recreational activities (e.g., rock climbing, spelunking, off-trail hiking)	Medium	Widespread	Current	Continuous	Moderate	Medium
Collection of wild ferns	Low	Widespread	Historic	Unknown	Moderate	Medium
<b>Exotic, invasive, or Introduced Species / Genome</b>						
Invasive plant species (e.g., Greater Celandine ( <i>Chelidonium majus</i> ))	Low	Localized	Unknown	Unknown	Unknown	Low

<sup>1</sup> Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the conservation of the species, consistent with the management objective. This criterion considers the assessment of all the information in the table.

<sup>2</sup> Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).

<sup>3</sup> Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).

## 4.2. Description of Threats

### Limestone quarrying

Hart's-tongue Fern is a strict calciphile, and therefore, quarrying for limestone remains a direct threat to the species and its habitat in Ontario and across its global range (NatureServe 2011). For example, in Ontario, limestone quarry operations occur in the vicinity of most areas in which the species is known to occur, and in the United States, extensive quarrying in both Michigan and New York have been observed (NatureServe 2011). Limestone quarry operations may also cause indirect threats to the species as limestone dust from dynamite blasts can interfere with the species' photosynthesis, transpiration and respiration, as well as rendering plants more susceptible to secondary stressors, such as entry of toxins (Farmer 1993; Padgett et al. 2007).

### Thinning of forest canopy cover

Logging, insect infestations (e.g. Beech bark disease), quarrying activities, or other causes that may lead to the excessive thinning of the forest canopy can affect Hart's-tongue Fern by increasing light levels and altering other microhabitat<sup>18</sup> features. For example, increased light exposure may decrease humidity levels and, consequently, cause the desiccation of habitat leading to a deterioration of extant populations and their ability to reproduce (COSEWIC 2000). Excessive shade may also threaten Hart's-tongue Fern by reducing sunlight exposure which may also compromise microhabitat features and contribute to the deterioration of extant populations (COSEWIC 2000). However, in the case of Hart's-tongue Fern, insufficient thinning is better than excessive thinning (COSEWIC 2000), but further information is required to determine the appropriate level of canopy cover (The Nature Conservancy 1998 as cited in COSEWIC 2000).

### Commercial or residential development

The majority of the Hart's-tongue Fern populations are located along or within the Niagara Escarpment. This region continues to be pressured by expanding human populations and in particular, development (e.g., country estates, expansion of urban areas, ski resorts etc.) in the highly populated areas of southern Ontario (COSEWIC 2000).

### Recreational activities

The topography of the Niagara Escarpment is ideal for recreational activities such as spelunking<sup>19</sup>, rock climbing, and off-trail hiking. Small populations of Hart's-tongue Fern are especially vulnerable to activities that cause excessive trampling and / or physical disruption to the species or its habitat. Activities such as these may lead to the unintentional loss or mortality of individual ferns and/or bryophyte beds and as such, may contribute to a decline in the health and abundance of Hart's-tongue Fern populations.

### Collection of wild ferns

As noted in the literature, collecting of live ferns for fern gardens and herbaria, including the collection of Hart's-tongue Fern (Taylor 1934, Graves 1911, Williamson 1879) has occurred (NatureServe 2011). For example, one population in Michigan was known to have been nearly

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<sup>18</sup> the environment of a very small, specific area, distinguished from its immediate surroundings by such factors as the amount of incident light, the degree of moisture, and the range of temperatures

<sup>19</sup> cave exploration, especially as a hobby

destroyed by this activity (NatureServe 2011). It is currently unknown whether collection of this species is occurring in Ontario or to what extent, however it is believed to be a limited threat for Canadian populations (COSEWIC 2000).

### **Invasive plant species**

Invasion by non-native species does not appear to be a problem for the majority of Ontario populations, however, this potential threat to the species has not been well-studied in Ontario. Greater Celandine (*Chelidonium majus*) was noted growing along the talus slopes at the Milton Heights site, where Hart's-tongue Fern has not been reported since 1977 (COSEWIC 2000). However, it is unclear if this non-native species was part of the reason for the loss of Hart's-tongue Fern at this location.

## **5. MANAGEMENT OBJECTIVE**

Approximately 74% of the species global distribution occurs in the province of Ontario, as such, there is a high conservation responsibility for Hart's-tongue Fern in Canada. Given the apparent stability of the Canadian population, the objective of this management plan is to maintain extant populations at their current abundance and distribution by reducing the threats that act upon the species across its range in Canada.

## **6. BROAD STRATEGIES AND CONSERVATION MEASURES**

### **6.1. Actions Already Completed or Currently Underway**

*The following actions are known to have been completed or are currently underway to assist in the conservation of the Hart's-tongue Fern in Canada:*

- The Niagara Escarpment, where most Ontario Hart's-tongue Fern populations are found, was designated by The United Nations Educational, Scientific and Cultural Organization (UNESCO) as a world biosphere reserve in February, 1990. Biosphere reserves are select areas of terrestrial and coastal ecosystems that offer ways to reconcile modern development with the conservation of biodiversity (UNESCO-The Canadian Commission for UNESCO). Ontario's Niagara Escarpment is one of 16 biosphere reserves in Canada, and is part of a network of 580 reserves in 114 countries (Ontario's Niagara Escarpment 2011).
- The Niagara Escarpment is protected, to some degree, under the Province of Ontario's *Niagara Escarpment Planning and Development Act, 1973* and the *Niagara Escarpment Plan* (COSEWIC 2000). The *Niagara Escarpment Plan* outlines land use designations, development criteria and related permitted uses, including; farming; forestry and mineral resource extraction. The *Niagara Escarpment Commission*, an agency of Ontario's Ministry of Natural Resources, considers Development Permit Applications, Plan Amendments and comments on development proposals (Ontario's Niagara Escarpment 2011).

- Many of the extant populations known in Canada, occur on publicly-owned land (e.g., Provincial Parks, Conservation Authorities, Areas of Natural and Scientific Interest, Provincial Nature Reserves, etc.) and on federal land (e.g., Department of National Defence) and benefit from some degree of management and protection.
- To date, approximately 50 Ecological Gifts have been donated within the general Niagara Escarpment region. Canada's Ecological Gifts Program provides a way for Canadians with ecologically sensitive land to protect nature and leave a legacy for future generations. The Ecological Gifts Program is administered by Environment Canada in cooperation with dozens of partners, including other federal departments, provincial and municipal governments, and environmental non-government organizations <http://www.ec.gc.ca/pde-egp/default.asp?lang=En>.
- The Coalition on the Niagara Escarpment (CONE) is a non-profit alliance of environmental groups, conservation organizations, and concerned citizens and businesses dedicated to the protection of Ontario's Niagara Escarpment (CONE 2011).
- A guide promoting greater awareness of ferns, including Hart's-tongue Fern, along the northern sections of the Niagara Escarpment was developed (Bruce-Grey Plant Committee 1999).

## 6.2. Broad Strategies

The broad strategies of this management plan for the Hart's-tongue Fern in Canada are as follows:

1. Manage and conserve habitat.
2. Monitor and research.
3. Outreach and communication.

## 6.3. Conservation Measures

The conservation measures and timeline proposed to meet the broad strategies in section 6.2 are presented in Table 2.

**Table 2. Conservation measures and implementation schedule**

Conservation Measure	Priority	Threats or Concerns Addressed	Timeline
<b>1. Manage and conserve habitat</b>			
1.1 Using the EO ranks (where it is known) as a guide; identify priority areas for conservation.	High	All threats addressed	Ongoing
1.2 Develop and use best management practices and policies to manage and mitigate threats to Hart's-tongue Fern.	Medium	Quarrying; Thinning of forestry canopy cover; Commercial or residential development	Ongoing
1.3 Classify habitat using an Ecological Land Classification (ELC) system and identify additional locations of potential occurrence on this basis.	Low	All threats addressed	2013-2018
<b>2. Monitor and research</b>			
2.1 Monitor the species and using the EO Rank Specification Standards (NatureServe 2002), assess the 13 extant populations with an unknown viability status.	Medium	Population viability knowledge gap	2013-2018
2.2 Conduct detailed population studies to better understand the full species abundance, distribution and trends of populations in Canada.	Medium	Population and distribution knowledge gap; High conservation responsibility for Hart's-tongue Fern in Canada	2013-2018
2.3 Investigate the appropriate level of canopy cover and microhabitat conditions (e.g., responses to measured increases in light levels) for Hart's-tongue Fern.	Medium	Thinning of forest canopy cover	2013-2018
2.4 Encourage additional research regarding knowledge gaps for the species (e.g., spore dispersal / establishment conditions, degree of competition from invasive non-native species (e.g., Greater Celandine), and potential threat from cattle grazing) as required.	Low	Knowledge gap; Threat of Greater Celandine	Ongoing
<b>3. Outreach and communication</b>			
3.1 Promote the importance of maintaining Niagara Escarpment plant communities (e.g., brochures, educational signage, etc.).	Medium	All threats	Ongoing
3.2 Deter excessive trampling and / or physical disruption of soil and bryophyte beds with targeted communication with user groups (e.g., climbers, hikers etc.).	Medium	Recreational activities	Ongoing
3.3 Discourage plant collection within the Niagara Escarpment region.	Low	Collection of wild ferns	Ongoing

## **7. MEASURING PROGRESS**

Every five years, success of this management plan will be measured against the following performance indicators:

- The abundance of extant populations of Hart's-tongue Fern, where it is known, has not decreased.
- The distribution of extant populations in Canada has not decreased.



## 8. REFERENCES

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## APPENDIX A: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

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 plans 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 upon non-target species or habitats. The results of the SEA are incorporated directly into the plan itself, but are also summarized below.

Conservation measures that protect the Niagara Escarpment will positively affect a number of other species, including other species at risk. The Hart's-tongue Fern is one of 11 plant species entirely or largely restricted to the Niagara Escarpment (Brunton 1999); 46 fern species have been found on the Niagara Escarpment in Ontario (Britton 1969). Other species at risk found within the Niagara Escarpment region may include Butternut (*Juglans cinerea*) and Massasauga (*Sistrurus catenatus*).

While some of the proposed conservation measures will benefit the environment in general and are expected to positively affect other sympatric native species, there could be consequences to those species whose requirements differ from those of the Hart's-tongue Fern. Consequently, it is important that habitat management activities for the Hart's-tongue Fern be considered from an ecosystem perspective through the development, with input from responsible jurisdictions, of multi-species plans, ecosystem-based recovery programs or area management plans that take into account the needs of multiple species, including other species at risk.

## APPENDIX B: NATIONAL AND SUBNATIONAL CONSERVATION RANKS OF HART’S-TONGUE FERN IN THE UNITED STATES

List and description of various conservation status ranks for Hart’s-tongue Fern in the United States (from NatureServe 2011).

	Global (G) Rank	National (N) Rank (United States)	Sub-national (S) Rank
<b>Hart’s-tongue Fern</b> <i>(Asplenium scolopendrium)</i>	G4T3 (Apparently Secure / Vulnerable – Uncommon, but not rare; some cause for long-term concern due to declines or other factors / Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.	N2 (Imperiled in the nation or state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state)	Alabama (S1) Michigan (S1) New Jersey (SNA) New York (S2) Tennessee (S1)

*S1: Critically Imperilled; S2: Imperilled; SNA: Not Applicable.*

## APPENDIX C: ELEMENT OCCURRENCE RANKS FOR HART'S-TONGUE FERN IN CANADA

Element Occurrence (EO) ranks for the Hart's-tongue Fern in Canada (NHIC 2011).

EO Rank	Description	Count (n=107)
A	excellent estimated viability	11
AB		3
B	good estimated viability	11
B?		4
BC		9
C	fair estimated viability	13
C?*		5
CD		1
D	poor estimated viability	4
E	verified extant (viability not assessed)	13
H	historical	28
X	extirpated	5

\* EO ranks and the "?" qualifier may be used to indicate uncertainty about particular basic ranks (NatureServe 2002).