

The Status of  
**Northern Twayblade**

*Listera borealis*

**in Newfoundland and Labrador**



Photo: Michael Burzynski

prepared for

**THE SPECIES STATUS ADVISORY COMMITTEE  
REPORT NO. 30**

**APRIL 15, 2013**

## TECHNICAL SUMMARY

### *Listera borealis* Morong

Northern Twayblade

Listère boréale

Range of occurrence in Canada: Yukon, Northwest Territories, Nunavut, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Québec, Newfoundland and Labrador

### Demographic Information

<p>Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines (2008) is being used)</p> <p>[*] But, see discussion in “Overview of Biology” section of main report.</p>	Unknown*
<p>Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?</p>	Insufficient data
<p>Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]</p>	Insufficient data
<p>[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].</p>	Insufficient data
<p>[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].</p>	Insufficient data
<p>[Observed, estimated, inferred, or suspected] percent [reduction or 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.</p>	Insufficient data
<p>Are the causes of the decline clearly reversible and understood and ceased?</p>	Not applicable because of insufficient data
<p>Are there extreme fluctuations in number of mature individuals?</p> <p>[**] In some orchids, the number of flowering stems or leaf rosettes visible above ground year does not necessarily reflect the actual number of established plants present below ground.</p>	Yes, if based on counts of flowering stems**

## Extent and Occupancy Information

Estimated extent of occurrence*	~16.5 km <sup>2</sup>
Index of area of occupancy* (IAO) (reported as 2 km x 2 km grid value)	8 km <sup>2</sup>
Is the total population* severely fragmented?	Yes
Number of locations*	2
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	Insufficient data
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	Insufficient data
Is there an [observed, inferred, or projected] continuing decline in number of populations?	Insufficient data
Is there an [observed, inferred, or projected] continuing decline in number of locations?	Insufficient data
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Yes (projected, quality)
Are there extreme fluctuations in number of populations?	Insufficient data
Are there extreme fluctuations in number of locations?	Insufficient data
Are there extreme fluctuations in extent of occurrence?	Insufficient data
Are there extreme fluctuations in index of area of occupancy?	Insufficient data

[\*] See "Definitions and Abbreviations", on [COSEWIC website](#) and [IUCN 2010](#) for more information on this term.

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

<b>Population</b>	<b>No. of Mature Individuals</b>
Lomond, 2008	1
Lomond, 2009	1
Lomond, 2010	60
Lomond, August 2012 (late season count; numbers apparently reduced by slug herbivory, and, also, probably, by dry summer conditions)	10
Eddies Cove [East], 2013	21
Total:	81 (approx. max.)

**Quantitative Analysis**

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Unknown
--	---------

**Threats (actual or imminent, to populations or habitats)**

<ul style="list-style-type: none"> <li>- Habitat change owing to suppression of forest regeneration by over-abundant introduced moose.</li> <li>- Herbivory by native and introduced gastropods.</li> <li>- Competition with introduced, invasive, weedy, understory plant species.</li> <li>- Disturbance by orchidophiles (actual plant extraction) and nature photographers (accidental trampling).</li> </ul>
---

**Rescue Effect (immigration from outside Newfoundland and Labrador)**

<p>Status of outside population(s)?</p> <p>In the rest of Canada, the status of this species ranges from “Apparently Secure” in Alberta, to “Vulnerable” in British Columbia, to “Imperiled” in Manitoba, to “Critically Imperiled” in Ontario and Québec.</p> <p>In the U.S.A., it is found only in the Mid-west and West, where its status ranges from “Vulnerable” to “Critically Imperiled”.</p>	
Is immigration known or possible?	Natural immigration is possible, but highly unlikely

Would immigrants be adapted to survive in Newfoundland?	Probably
Is there sufficient habitat for immigrants in Newfoundland?	Probably somewhat limited, given the rarity of the species here
Is rescue from outside populations likely?	No

**Current Status**

COSEWIC: Not Assessed
SSAC: Not Assessed

Author of the original draft report and technical summary: Michael Burzynski

SSAC Botany Report Editor: John E. Maunder.

Supplementary information from June, July and August, 2013, assembled by Diane Allen and Paul Hines, was added to the original report, in September 2013, by the SSAC Botany Report Editor.

Additional contributions: Andrus Voitk.

## Recommended Status and Reasons for Designation

<b>Recommended Status: ENDANGERED</b>	<b>Alpha-numeric code:</b> B 2 a) and b)iii); D1
<b>Reasons for designation:</b> <ol style="list-style-type: none"><li>1. IOA = 8 km<sup>2</sup></li><li>2. locations = 2</li><li>3. projected, <i>continuing</i>, decline in the quality of habitat, owing to: the suppression of forest regeneration by over-abundant, introduced, moose; herbivory by native and introduced gastropods; development of an understory of introduced, invasive, weedy, plant species; and physical extraction by orchidophiles, plus accidental trampling by nature photographers.</li><li>4. extensive searching has located a maximum of only about 81 mature individuals</li></ol>	

### Applicability of Criteria

<p>B2 a, b(iii) - IAO is known to be less than 500 km<sup>2</sup>, there are fewer than 5 locations, and there is a projected, continuing, decline in the quality of habitat.</p> <p>D1 - fewer than 250 mature individuals.</p>
--

## TABLE OF CONTENTS

TECHNICAL SUMMARY.....	1
STATUS REPORT .....	1
Distribution.....	1
Description.....	4
Habitat .....	7
Overview of Biology .....	9
Population Size and Area of Occupancy .....	12
Aboriginal, Traditional and Local Ecological Knowledge.....	12
Trends .....	12
Threats and Limiting Factors .....	14
Existing Protection .....	14
Special Significance.....	14
References .....	15
Personal Communications .....	18
Collections Examined .....	18
Rank or Status .....	19
Appendix A .....	20
Appendix B .....	25



## STATUS REPORT

*Listera borealis* Morong

Northern Twayblade; Listère boréale

Synonyms: *Listera borealis* Morong  
*Neottia borealis* (Morong) Szlachetko  
*Ophrys borealis* (Morong) Rydberg

Family: Orchidaceae (Orchid Family)

Life Form: Herbaceous, terrestrial, perennial, autotrophic orchid

### Distribution

#### Global:

*Listera borealis* is found only in North America.

In the United States of America, the species grows over a large area of the northwest: Alaska, Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Colorado (Flora of North America, volume 26).

#### National:

*Listera borealis* is found in most provinces (except for the Maritime Provinces) and all territories of Canada: Yukon, Northwest Territories, Nunavut, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Québec (Flora of North America, volume 26), and the Island of Newfoundland (but, NOT Labrador, as far as is presently known, despite the map in Flora of North America, volume 26; see below). In Québec, it is more specifically known from the Gaspé Peninsula, from Anticosti Island, and from the Mingan Archipelago (Marie-Victorin 1997).

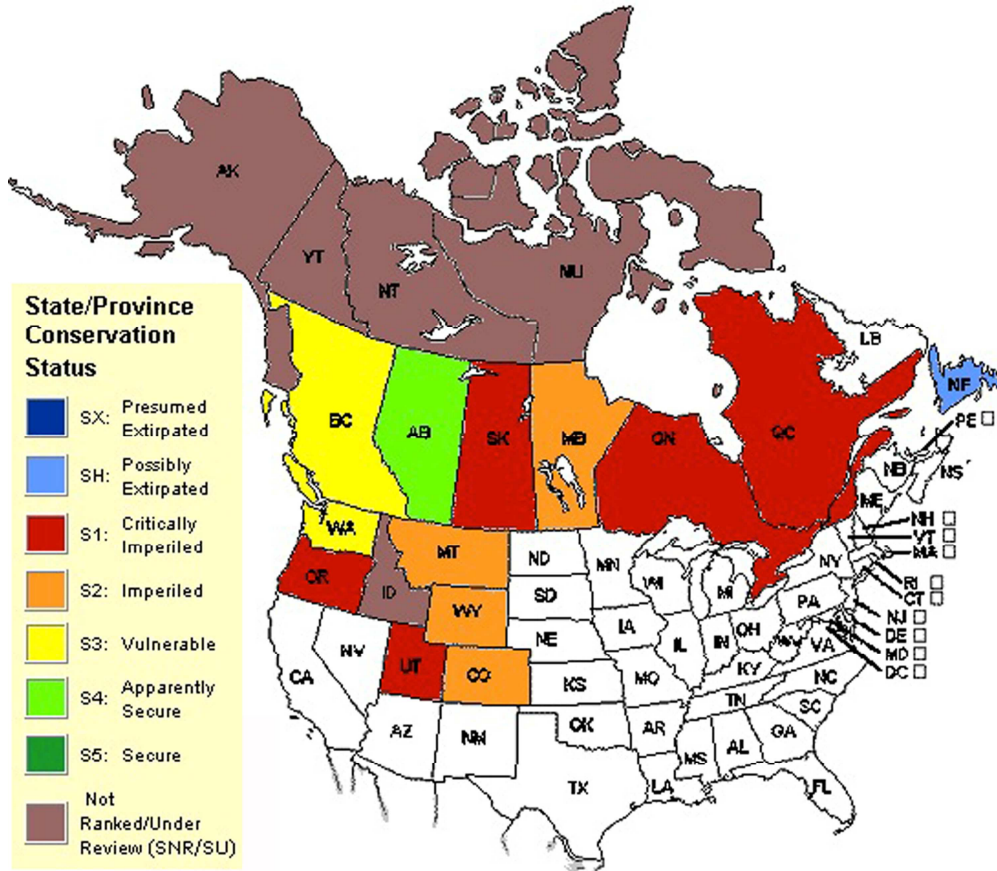


Figure 1. Distribution of *Listera borealis* in North America. Note that the Newfoundland Island status has not been updated since the species was reconfirmed in the province. Map: NatureServe.

**Provincial:**

In the Province of Newfoundland and Labrador this species is currently known from only two very small sites on the Island of Newfoundland: [1] on the Lomond peninsula in Gros Morne National Park, and [2] at Eddies Cove [East]. Both sites are on the west coast of the Great Northern Peninsula. There is also an historical record at Eddies Cove West (Fernald 1929), and an unverified report from Burnt Cape (P. Martin Brown *vide* A. Voitk).

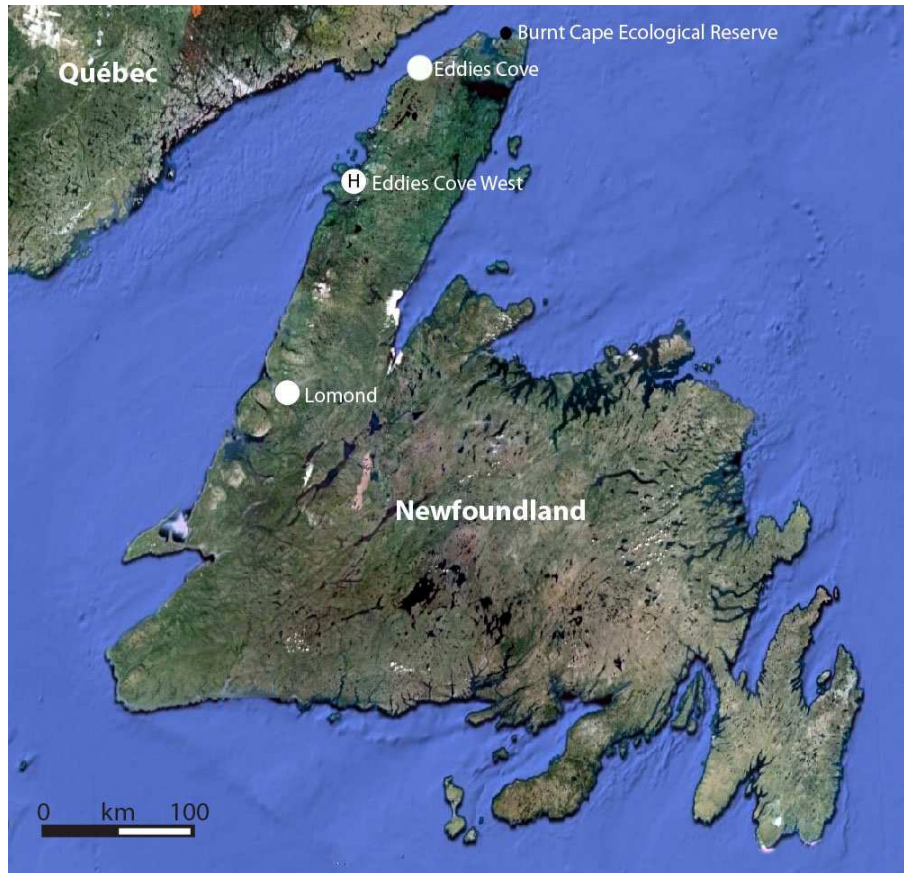


Figure 2. Distribution of *Listera borealis* in Newfoundland and Labrador. White dots at Lomond and Eddies Cove [East] mark present known distribution. White dot with an “H” marks Fernald’s (1929) historical site. Small, black dot marks an unverified report by Paul Martin Brown. Base map: Google Earth.

The VASCAN database currently excludes the species from Labrador (<http://data.canadensys.net/vascan/taxon/6883>), as does NatureServe (Fig. 1). Additionally, the database of the “Flore du Québec-Labrador nordique” project (Université Laval) (for the area N of 54 degrees) contains no records of the species (pers. comm. Kim Damboise).

Thus, the map in the Flora of North America (online) ([http://www.efloras.org/object\\_page.aspx?object\\_id=8065&flora\\_id=1](http://www.efloras.org/object_page.aspx?object_id=8065&flora_id=1)), which includes a Labrador distribution, is apparently in error.

## Description

*Listera borealis* is a small ( $\leq 20$  cm high) perennial orchid with herbaceous stems. The stems are green, succulent, minutely hairy, and somewhat four-angled. Leaves and flower buds are green and without hairs or glands. A pair of sub-opposite leaves are borne about a third of the way up the stem. The leaves are thin; lanceolate, ovate, or oblong; and lack petioles. Lanceolate green bracts subtend each filiform pedicel. Flowers are green with all sepals and petals reduced except for the labellum, which has a dark-green to metallic-blue stripe running down its middle. On full-sized plants, an inflorescence of 5 to 20 flowers forms a lax raceme. In newly opened flowers, the labellum hangs down, but becomes horizontal and then points upward as the ovary matures. Labellum is oblong, and slightly narrower at the centre. At the attachment it bears rounded divergent auricles, and the distal end is slightly widened and split into two rounded lobes with an apicule in the centre.



Figure 3a. *Listera borealis* in *Rhytidiadelphus* moss, Lomond. Note previous year's stalk on right. Photo: Michael Burzynski.



Figure 3b. *Listera borealis* in fruit, Eddies Cove [East]. Note previous year's opened capsule on right. Photo: Diane Allen.

## Habitat

Typical habitat for this species is described as "...moist, rich humus of mossy coniferous or mixed hardwood forests, swamps, often along cold streams fed by melting snow, prefers high acidic soils; 1500-3000 m" (Flora of North America, volume 26).

In Newfoundland, the species has only been found close to sea level:

Eddies Cove West – 0-10 m  
Eddies Cove [East] – 12-20 m  
Lomond – 5-20 m

M. L. Fernald (1933) first reported it from Eddies Cove West, and described the plants, collected on August 2, 1929, as growing around the community in an "...unspoiled forest-carpet..." that had, for the most part, been destroyed by grazing cattle (he also found the Fairyslipper Orchid (*Calypso bulbosa*) in the same area (see, below)). Neither *Listera borealis* nor *Calypso bulbosa* have been seen at this site since Fernald's record, so grazing and/or general community development may have destroyed the original habitat.

The forest at Lomond is comprised of large Balsam Fir (*Abies balsamea*) and White Spruce (*Picea glauca*), about 60 years old (M. Burzynski, pers. obs.) with intermixed Mountain White Birch (*Betula cordifolia*), and with a moist, open, shaded understory of Shaggy Moss (*Rhytidiadelphus triquetrus*) and other small plant species. In the last decade, many of the mature conifers in this area have fallen as a result of wind damage. Over-abundant, introduced, moose are hindering the regeneration of hardwoods and balsam fir (Burzynski *et al.* 2005), and more and more low understory species are moving in, including introduced, invasive, plant species such as Coltsfoot (*Tussilago farfara*), Creeping Buttercup (*Ranunculus repens*), and Black Knapweed (*Centaurea nigra*) (Rose and Hermanutz 2004). These invasive species, the fallen trees, and the drier, sunnier conditions (resulting from the more open canopy) may, or may not, render this site unsuitable for Northern Twayblade in the next few years (most of the twayblades are found in the shade of the still-standing trees, but very few are seen in the openings).



Figure 4: *Listera borealis* habitat at Lomond in Gros Morne National Park. Photo: M. Burzynski.



At Eddies Cove [East], the habitat is low spruce-fir forest, with an understory of *Rhytidiadelphus* sp., and other mosses, as well as Bunchberry (*Cornus canadensis*), Starflower (*Trientalis borealis*), Twinflower (*Linnaea borealis*), Threeleaf False Solomon's-seal (*Maianthemum trifolium*), Mitrewort (*Mitella nuda*), Hairy Plumboy/Dwarf Raspberry (*Rubus pubescens*), Heartleaf Twayblade (*Listera cordata*), and Bluntleaf Bog Orchid (*Platanthera obtusata*). Also found in the general area, are the orchids Early Coralroot (*Corallorhiza trifida*), Broadlip Twayblade (*Listera convallarioides*), Scentbottle (*Platanthera dilatata*), and Northern Green Orchid (*Platanthera aquilonis*). (Diane Allen and Paul Hines, pers. comm *vide* John Maunder).

With reference to his two Newfoundland records (Burnt Cape [unconfirmed], and Eddies Cove [East] [confirmed]), Paul Martin Brown makes the following statements (Paul Martin Brown *vide* John Maunder and A. Voitek):

Burnt Cape [unconfirmed]: "... *L. borealis* is near the tip of the cape in open [limestone] gravel ... The key plant to look for in that area is *Huperzia selago*."

Eddies Cove [East]: "It grows most often in [limestone] gravel around some of the more barren spruce and fir hummocks and not in moist woodlands as does *L. convallarioides* and *L. auriculata*."

However, throughout its range (*including* both the historic and recent locations known for the Island of Newfoundland), *Listera borealis* typically grows in "moist, rich humus of mossy coniferous or mixed hardwood forests, swamps, often along cold streams fed by melting snow, prefers high acidic soils" (ref. Flora of North America, volume 26). Given that *Listera borealis* has never been verified from calcareous sites in Newfoundland, the above statements by Paul Martin Brown are considered to be incorrect.

## Overview of Biology

Flowering in the second and third weeks of June, *Listera borealis* dies back to the ground in Fall. The only visible indication of plants from then on is the occasional stem bearing seed capsules. These plants are small, green, and difficult to see against the background vegetation.

In this species, as with most orchids, self-pollination within a single flower is probably unlikely because of flower morphology, but fertilization by other flowers on the same stalk is a possibility. So, a single successful plant might eventually seed a colony. *Listera borealis* is the first of the twayblades to flower each summer. The potential for hybridization with other species is unknown.

As with most other orchids, this species has an obligate relationship with soil fungi from germination to maturity. Seeds are minute and are incapable of surviving germination without encountering appropriate soil fungi. Many orchids take up to a decade to mature and flower. Generation time is not known for *Listera borealis*. However, the related *Listera ovata* is known to live at least as long as 28 years in cultivation (Tamm, 1972).

Although this species' leaves are reduced to one small pair, it is capable of photosynthesis, and indeed all above-ground plant parts contain chlorophyll. While it does not seem to be known if this species can survive underground for one or more years without flowering, as can some other species of terrestrial orchids, such an ability would certainly be expected.

At Lomond, *Listera borealis* seems to always be associated with *Rhytidiadelphus* moss, although Internet photos from other parts of North America show it growing with *Pleurozium* and *Ptilium* mosses.



Figure 5. Maturation of *Listera borealis* flowers. Left to right: young buds, buds beginning to show colour, fully opened flowers, flowers beginning to reflex as capsules swell. Photos: M. Burzynski.

## *Herbivory*

Many plants at Lomond show signs of herbivory, apparently by slugs and snails. In some cases, entire plants have disappeared from one visit to another. Herbivory may be one of the most important controlling factors for this species, especially with respect to reducing seed production. Slugs have been seen on and around the plants, and slime trails were evident on some chewed leaves.



Figure 6. *Listera borealis* at Lomond showing damage by gastropods. This plant had completely disappeared a week later. Photo: M. Burzynski

## Population Size and Area of Occupancy

The only sites from which *Listera borealis* has been verified, since Fernald's original (1929) collection from Eddies Cove West, are Lomond and Eddies Cove [East].

Lomond: The number of plants visually evident in this population has fluctuated dramatically during the few years since the population was discovered, in 2008. That first year, a single (flowering) specimen was found. In 2009 the same plant was still there, but no others were seen. In 2010, following a concerted search that covered about 2 ha in the same area, 64 plants (4 of these were non-flowering) were found. In 2012, during a late August visit, only 10 were counted.

Eddies Cove [East]: The number of plants located after extensive searching in 2013 was: 21 in flower, 6 vegetative = total of 27. All plants were within ~80 m of each other.

The Extent of Occurrence of this species is ~ 16.5 km<sup>2</sup>, and the Index of Area of Occupancy (based on a 2 x 2 km<sup>2</sup> grid) is 8 km<sup>2</sup>.

## Aboriginal, Traditional and Local Ecological Knowledge

This species is not mentioned in "Use of plants for food and medicine by native peoples of eastern Canada" (Arnason *et al.* 1981).

No information is available about Mi'kmaq use of this species on the Island of Newfoundland.

## Trends

M. L. Fernald's original Newfoundland record of this species, at Eddies Cove West (Fernald 1933), indicated that there was considerable grazing pressure on forest-floor and meadow plants by domestic livestock at that time.

In the intervening 83 years, the settlement of Eddies Cove West has dwindled to a summer fishing station, and it has been a long time since any livestock was pastured along the coast there. The vegetation is recovering, but recent searches have not revealed any surviving *Listera borealis* (J. E. Maunder, pers. comm).

The Lomond site was discovered in 2008, when a single plant was found. That single plant was still present the following year (2009). In 2010 a thorough survey found 60 flowering and 4 non-flowering *Listera borealis*. In late August of 2012 only 10 flowering plants were seen; this late season number may reflect herbivory,

and/or, since the summer of 2012 was very dry, it may also reflect a stress response.

The Eddies Cove [East] site (or a similar site quite near it) was re-discovered in 2013. Paul Martin Brown had originally reported a single plant from the immediate area in the 1990s, but no significant search effort appears to have been made at the time. Modest searches of the area were made in 2001, 2002, and 2006. A much more extensive search of the area in 2013, by members of the Wildflower Society of Newfoundland and Labrador (most particularly by Diane Allen and Paul Hines) finally revealed 21 flowering and 6 non-flowering plants.

However, the extreme differences in search efforts, over the years, necessarily negates any attempt to determine trends at the two extant sites.

## Threats and Limiting Factors

Threats	Cause	Type	Scope	Severity	Frequency
Habitat change	Suppression of forest regeneration by over-abundant, introduced, moose	Introduced species	Ubiquitous	Severe	High
Herbivory	Native and introduced gastropods	Introduced species	Ubiquitous	Moderate	Moderate
Competition for habitat	Introduced, invasive, weedy, understory plant species	Introduced species	Ubiquitous	Moderate	Moderate
Human disturbance	Orchidophiles (actual plant extraction), and nature photographers (accidental trampling)	Anthropogenic	Focused	Moderate	Low

## Existing Protection

The plants occurring within Gros Morne National Park fall under the protection of the Canada National Parks Act.

## Special Significance

No known special scientific or cultural significance for this species.

## References

- Arnason, T., R. J. Hebda, and T. Johns. 1981. Use of plants for food and medicine by native peoples of eastern Canada. *Canadian Journal of Botany* 59: 2189-2325.
- Bouchard, A., S. Hay, L. Brouillet, M. Jean, and I. Saucier. 1991. The rare vascular plants of the Island of Newfoundland. *Canadian Museum of Nature, Ottawa, Syllogeus No. 65*. 165 pp.
- Burzynski, M., T. Knight, S. Gerrow, J. Hoffman, R. Thompson, P. Deering, D. Major, S. Taylor, C. Wentzell, and A. Simpson. 2005. State of the park report: Gros Morne National Park of Canada, an assessment of ecological integrity. Parks Canada document. 19 pp.
- Burzynski, M. 2010. *Listera borealis* Morong (Northern Twayblade): first collection in the Province of Newfoundland and Labrador since 1929, Lomond River, Gros Morne National Park. Gros Morne National Park internal document. 2 pp.
- Centre de données sur le patrimoine naturel du Québec (CDPNQ). 2008. Les plantes vasculaires menacées ou vulnérables du Québec. 3e édition. Gouvernement du Québec, ministère du Développement durable, de l'Environnement et des Parcs, Direction du patrimoine écologique et des parcs, Québec. 180 pp.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Definitions and Abbreviations. [http://www.cosewic.gc.ca/eng/sct2/sct2\\_6\\_e.cfm](http://www.cosewic.gc.ca/eng/sct2/sct2_6_e.cfm). Last accessed 7 Feb. 2013
- Department of Environment and Conservation, Newfoundland and Labrador, [http://www.env.gov.nl.ca/env/env\\_assessment/projects/Y2010/1407/index.html](http://www.env.gov.nl.ca/env/env_assessment/projects/Y2010/1407/index.html). Last accessed 1 Feb. 2013.
- Digital Natural History of Newfoundland and Labrador. [http://digitalnaturalhistory.com/flora\\_orchidaceae\\_index.htm#listeraborealis](http://digitalnaturalhistory.com/flora_orchidaceae_index.htm#listeraborealis) Last accessed 23 Jan. 2013.
- Fernald, M. L. 1933. Recent discoveries in the Newfoundland flora. *Rhodora* 35: 1-16, 47-63, 80-107, 120-140, 161-185, 203-223, 230-247, 265-283, 298-315, 327-346, 364-386, 395-403. Paper contained within: <http://www.biodiversitylibrary.org/item/14505#page/5/mode/1up>

- Fernald, M.L. 1950. Gray's Manual of Botany. Eighth edition. American Book Company. lxiv + 1632 pp.
- Flora of North America - online. Volume 26. *Listera borealis* page [http://www.efloras.org/florataxon.aspx?flora\\_id=1&taxon\\_id=242101752](http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242101752) . Accessed Jan 20, 2013.
- IUCN Standards and Petitions Subcommittee. 2010. Guidelines for using the IUCN Red List categories and criteria. Version 8.1. Prepared by the Standards and Petitions Subcommittee in March 2010. Downloadable from <http://intranet.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf> .
- Meades, S. J., S. G. Hay, and L. Brouillet. 2000. Annotated checklist of the vascular plants of Newfoundland and Labrador. <http://www.digitalnaturalhistory.com/meades.htm>).
- Marie-Victorin, Fr. 1995. Flore Laurentienne, 3e éd. Edited and annotated by L. Brouillet, S.G. Hay, I. Goulet, M. Blondeau, J. Cauouette, and J. Labrecque. Guétan Morin éd. Les Presses de L'Université de Montréal, Montréal, Québec. 1093 pp.
- Meades, W. J. and L. Moores. 1994. Forest site classification manual; a field guide to the Damman forest types of Newfoundland. Forestry Canada and the Department of Forestry and Agriculture, NL. 326 pp.
- NatureServe. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer> . (Accessed: January 31, 2013 ).
- Quinn, G., J. Maunder, M. Burzynski, A. Marceau, C. Hanel, H. Mann, P. Mann, M. Voitk, A. Voitk. 2010. *Listera borealis* Morong: historic orchid relocated at a new site in Gros Morne National Park. *Sarracenia* 18(2): 21-24 (Wildflower Society of Newfoundland and Labrador).
- Rose, M., and L. Hermanutz. 2004. Are boreal ecosystems susceptible to alien plant invasion? Evidence from protected areas. *Oecologia* 139: 467-477.
- Tamm, C. O. 1972. Survival and flowering of some perennial herbs II. The behaviour of some orchids on permanent plots. *Oikos* 23: 23-28.
- Tropicos. [www.tropicos.org/Name/26602776?tab=synonyms](http://www.tropicos.org/Name/26602776?tab=synonyms) Last accessed 11 December 2012.



VASCAN database.

<http://data.canadensys.net/vascan/name/Cystopteris%20montana?lang=fr>.

Last accessed 24 Jan. 2013.

Voitk. A. and M. Voitk. 2006. Orchids on The Rock; the wild orchids of Newfoundland. Gros Morne Co-operating Association. 96 pp.

## Personal Communications

Allen, Diane and Paul Allen. Naturalists and Rare Plant Inventory Volunteers, Hollis, New Hampshire, U.S.A.

Damboise, Kim, Technicienne en travaux d'enseignement et de recherche, Herbar Louis-Marie, Université Laval, Québec City, QC.

Durocher, Adam, Atlantic Canada Conservation Data Centre, Corner Brook, NL.

Hanel, Claudia. Claudia Hanel, Claudia, Ecosystem Management Ecologist (Botany), Endangered species and Biodiversity Section, Wildlife Division, Newfoundland and Labrador Department of Environment and Conservation, Corner Brook, NL.

Maunder, John E., Curator Emeritus, Natural History, Provincial Museum of Newfoundland and Labrador (now "The Rooms Provincial Museum"), St. John's, NL.

Voitk, Andrus. Author and Naturalist, Corner Brook, NL.

## Collections Examined

Canadian Museum of Nature Herbarium (CAN), online data examined - no NL collections.

Digital Flora of Newfoundland and Labrador Vascular Plants  
[http://digitalnaturalhistory.com/flora\\_orchidaceae\\_index.htm#listeraborealis](http://digitalnaturalhistory.com/flora_orchidaceae_index.htm#listeraborealis),  
52 images examined.

Gros Morne National Park Herbarium (GMNP) Two specimens:  
Dried fruiting stem from 2008, collected in 2009 by M. Burzynski  
Complete plant (minus roots), collected in 2010 by M. Burzynski

Herbarium of the Provincial Museum of Newfoundland and Labrador (NFM) does not have any specimens (J. E. Maunder, pers. comm.).

Marie-Victorin Herbarium (MT), Institut de recherche en biologie végétale, University of Montréal, online data examined - no NL collections.

Michael Burzynski, Photograph collection, 95 photographs examined.

Agnes Marion Ayre Herbarium (NFLD) does not have any specimens (J. E. Maunder, pers. comm.).

## Rank or Status

<b>Global</b>	
G-rank	G4 NatureServe Last changed 8 Feb 1994
IUCN	
<b>National</b>	
N-rank	NNR
National General Status	Not ranked
COSEWIC	Not ranked
<b>Provincial</b>	
Provincial General Status	Not ranked
Newfoundland S-rank	SH NatureServe Not re-assessed since being re-located
Newfoundland General Status	Hypothetical
Labrador S-rank	Not present
Labrador General Status	N/A
<b>Adjacent Jurisdictions</b>	
Nova Scotia S-Rank	Not present
Nova Scotia General Status	N/A
Prince Edward Island S-Rank	Not present
Prince Edward Island General Status	N/A
New Brunswick S-Rank	Not present
New Brunswick General Status	N/A
Québec S-Rank	S1 NatureServe
Québec General Status	At Risk

## Appendix A. Population Information

### Recently Verified Occurrences/Range Use (recorded within the last 25 years)

Lomond:

2008. Discovered on July 10, during a Wildflower Society of Newfoundland and Labrador field trip. A single plant was found by Glenda Quinn, and identified by John Maunder and Andrus Voitk.

2010. A concerted site census of the Lomond location was conducted on June 11 by Andrus Voitk, Maria Voitk, Henry Mann, Phyllis Mann, Claudia Hanel, Anne Marceau, and Michael Burzynski. 64 plants (including 60 mature plants) were recorded.

[The Lomond locality is on a very steep slope, near an old wooden stairway that has long-connected the Killdevil Lodge, above, with the Lomond Estuary, below. The area where the Northern Twayblade is found, ranges between 5 and 20 m above sea level, and is about 60 metres square (ca. 0.36 ha).]

2012. Ten plants were recorded by Diane Allen and Paul Allen on August 30. J. E. Maunder (pers. comm.) suggests that the small number of *Listera* seen at this late date may have been the result of herbivory during the summer. M. Burzynski noted, also, that the summer of 2012 was very dry.

Eddies Cove [East]:

1990's. Paul Martin Brown mentioned seeing *L. borealis* in the late 1990s at Eddies Cove [East]. The following is a description provided by Paul Martin Brown to J. E. Maunder and A. Voitk:

"I just stumbled upon [*Listera borealis*] near Eddy's Cove East July 20 ...less than 100 feet from the car. It was in a thicket along the right side of the highway not far from the sign that said [Entering] Eddy's Cove. It grows most often in gravel around some of the more barren spruce and fir hummocks and not in moist woodlands as does *L. convallarioides* and *L. auriculata*."

It should be noted that, throughout its range (*including* both the historic and recent locations known for the Island of Newfoundland), *Listera borealis* typically grows in "moist, rich humus of mossy coniferous or mixed hardwood forests, swamps, often along cold streams fed by melting snow, prefers high acidic soils" (ref. Flora of North America, volume 26). Given

that *Listera borealis* has never been verified from calcareous sites in Newfoundland, the above statement by Paul Martin Brown is considered to be incorrect on that point.

2013. Paul Martin Brown's Eddies Cove [East] site (or a similar site quite near it) was re-discovered on June 26, following a targeted search of the area by members of the Wildflower Society of Newfoundland and Labrador.

GPS Coordinates for *Listera borealis* at Eddies Cove [East]  
(Diane Allen, pers. comm. *vide* John Maunder):

Lat/Long (a partial list):

51.40792 N 56.43862 W  
51.40778 N 56.43814 W  
51.40777 N 56.43832 W  
51.40785 N 56.43812 W  
51.40782 N 56.43818 W  
51.40782 N 56.43823 W  
51.40788 N 56.43796 W  
51.40766 N 56.43819 W  
51.40783 N 56.43796 W  
51.40772 N 56.43808 W  
51.40792 N 56.43821 W  
51.40844 N 56.43829 W

The area where the Northern Twayblade is found, ranges between 12 and 20 m above sea level, and is about 80 metres square (ca. 0.64 ha).

### **Historical Verified Occurrences/Range Use (recorded prior to the last 25 years)**

1929. Bayard Long collected a single example of this species at Eddies Cove West. Altitude 1-10 m. (Fernald 1933)

### **Additional Reports (unverified)**

Paul Martin Brown also mentioned seeing *L. borealis* in the late 1990s at Burnt Cape. The following description was provided by P. Martin Brown to J. E. Maunder and A. Voitk:

“On Burnt Cape *L. borealis* is near the tip of the cape in open gravel; if you

are looking at the mainland, further out from opposite Raleigh. The key plant to look for in that area is *Huperzia selago*, the only place that I found the latter on Burnt Cape, not far from the furthest point you could drive a car.”

Unfortunately P. Martin Brown did not collect voucher specimens, or determine precise locations for either of his Newfoundland sightings, and his photographs do not contain much information. Significant recent searches by members of the Wildflower Society of Newfoundland and Labrador have not been successful. Thus, *Listera borealis* remains unverified for Burnt Cape.

### **Recent Search Effort (areas searched within the last 25 years with estimate of effort)**

Eddies Cove West (south of hamlet only):

John E. Maunder. 2001, 2002. Brief surveys, while travelling in the area.

Wildflower Society of Newfoundland and Labrador, June 26, 2013. Search effort about 4 person hours

Diane Allen, Paul Hines, July 6, 2013. Search effort 6 person hours

Lomond:

Wildflower Society of Newfoundland and Labrador, July 2008. General botanizing in the area led to brief, chance, first encounter.

M. Burzynski, July 1, 2009. Checked on and photographed the known plant and made a careful search of the surrounding area (10 m in all directions) without finding any more plants. Search effort 1 person hour.

Andrus Voitk and Maria Voitk, July, 2009. Photographed the known plant and searched the surrounding area without finding any more plants. Search effort 2 person hours.

Andrus Voitk, Maria Voitk, Henry Mann, Phyllis Mann, Claudia Hanel, Anne Marceau, and Michael Burzynski, June 11, 2010. Search effort 15 person hours; area searched about 2 ha.

Diane Allen and Paul Allen, September 2, 2012. Search effort 4.5 person hours.

#### Eddies Cove [East]:

Paul Martin Brown. 1990's. Brief, chance, first encounter.

John E. Maunder,. 2001, 2002, 2006. Focused search efforts, looking specifically for *Listera borealis*, totalling approximately 3 person hours.

Diane Allen, Paul Hines, Jim Goltz, Michael Burzynski, June 26, 2013. Focused search effort about 8 person hours

Diane Allen, Paul Hines, July 5, 8 and July 12, 2013. Focused search effort about 16-20 person hours.

Gini Proulx and "daughter Lisa". July 24, 2013. Search effort 2 person hours.

Diane Allen, Paul Hines, August 11, 2013. Search effort not significant.

#### Burnt Cape:

Wildflower Society of Newfoundland and Labrador, June 24, 2013. Targeted search effort of about one person hour

Diane Allen and Paul Hines, July 13, 2013. Targeted search effort 6 person hours, covering both west and east sides of the height of land near the north end of the road.

#### Other:

In 1999 and 2001, the Newfoundland Rare Plant Project surveyed 1,645 sites on the west and northeast coasts of Newfoundland, with special emphasis on the Point Riche-Port au Choix-St. John Island area. Rare plant inventories have been conducted by Parks Canada personnel in Gros Morne, Port au Choix, and other Parks Canada Agency sites in western Newfoundland and Labrador since 1996. John E. Maunder, formerly of the Provincial Museum, has checked sites throughout the west coast of the Island, as have Susan J. Meades, botanical researcher; Henry Mann, formerly of Sir Wilfred Grenfell College; and Nathalie Djan-Chékar, of the Provincial Museum. Claudia Hanel, Ecosystem Management Ecologist, Wildlife Division, Newfoundland and Labrador Department of Environment and Conservation, has done recent, intensive searches for the orchid *Platanthera foetida* at a location very close to Eddies Cove West (*P. foetida*

is an SSAC reported species), and has carried out extensive botanical field work in the nearby Doctor's Brook area.

In 1976, Stuart G. Hay researched and produced *The Vascular Flora of St. Barbe South, Newfoundland*. André Bouchard and his team from l'Université de Montréal did botanical field work throughout western Newfoundland between 1984 and 1990, leading to the publication of *The Rare Vascular Plants of the Island of Newfoundland* in 1991. They also concentrated on Parks Canada sites, producing rare plant reports for Gros Morne National Park (1986 and 1996), Port au Choix National Historic Site (1992), and L'Anse aux Meadows National Historic Site (1993). Claudia Hanel, has conducted surveys and inventories of rare plant species throughout western Newfoundland, with special emphasis on limestone barrens and slopes.

### **Potential Sites Unexplored or Underexplored**

Eddies Cove West. The historical site should be searched once more, particularly NORTH of the hamlet. Estimated time: 2 person days.

Lomond Peninsula. This general area should be carefully checked again to monitor changes to the known population and to see whether there are any other plants in similar habitat farther away from the locality already searched (including across the Lomond River). Estimated time: 2 person days.

Burnt Cape. Some additional time should be spent there to attempt to verify P. Martin Brown's report. Estimated time: 2 person days.

St. John Island. This island, which is offshore from Eddies Cove West, and where there is a large area of ungrazed coniferous forest, has received very little botanical attention despite its size (25 km<sup>2</sup>). Estimated time: 8 person days.



## Appendix B. Supplementary Details

### Habitat:

M. L. Fernald's original Newfoundland record of this species, at Eddies Cove West (Fernald 1933), indicated that there was considerable grazing pressure on forest-floor and meadow plants by domestic livestock at that time. His notes give some indication of the conditions of the coastal forest and meadows at that time:

"The woods near the settlement at Eddy's Cove are terribly overrun by cattle, and almost none of the unspoiled forest-carpet remains. While Stanley Lavers and his father were packing the motor boat for the return to Old Port au Choix, Long [= Bayard Long], never through botanizing until the boat is leaving, crept on hands and knees among the ruined and pastured knolls; and, when "all aboard" was shouted, he came half beaming, half-reluctant, to the shore. For he held *Calypso bulbosa*, one of the rarer Newfoundland orchids, which the cattle had not wholly exterminated; and with it *Listera borealis* Morong, the northern cordilleran species which Marie-Victorin had been finding in the seashore spruce thickets of Anticosti and the Mingan Islands. Long had but one individual of *Listera borealis* and he wanted another, for the agreement was that the first set of specimens should come to the Gray Herbarium! So, on Aug 5th we tried again ... Starting out on a real search for *Listera borealis*, we first landed on two islands at the entrance of Old Port au Choix, Savage's Island and Grassy Island ... [but found no *Listera borealis*, so we] ... started for Back (or Bustard) Cove and Eddy's (or Old Man's) Cove for the *Listera*. Fogg and I were landed at the former place and were to follow the shore for four miles to Allan Ofrey's; Long went on to renew the search at the original spot ... Reaching Allan Ofrey's house (a tiny house with a large family) in the late afternoon we were met by Long. We all had the same sad report: no *Listera borealis*. He and the cows before him had got it all; but we optimistically feel that another year (especially in July, instead of in August) it will be found in quantity. Accepting the cordial invitation of Allan and Mrs. Ofrey to have tea with them, we ... enjoyed such a delicious feast of lobster, lettuce, cream and hot biscuit as we shall never forget; but, while eating the rich cream, we could not help mourning that we were not getting the *Listera borealis* and *Calypso* in undigested form."

Description:



Figure 7. Comparison of flowers of *Listera* species found in Newfoundland and Labrador. Left to right: *L. cordata*, *L. convallarioides*, *L. borealis*, *L. auriculata* (*Listera* x *veltmanii*, a hybrid of *L. convallarioides* and *L. auriculata*, is not shown). Photos: M. Burzynski.