

**Recovery Strategy  
for the  
Newfoundland Population of the Low Northern Rockcress  
(*Neotorularia humilis* (C.A. Meyer) Hedge & J. Léonard)**

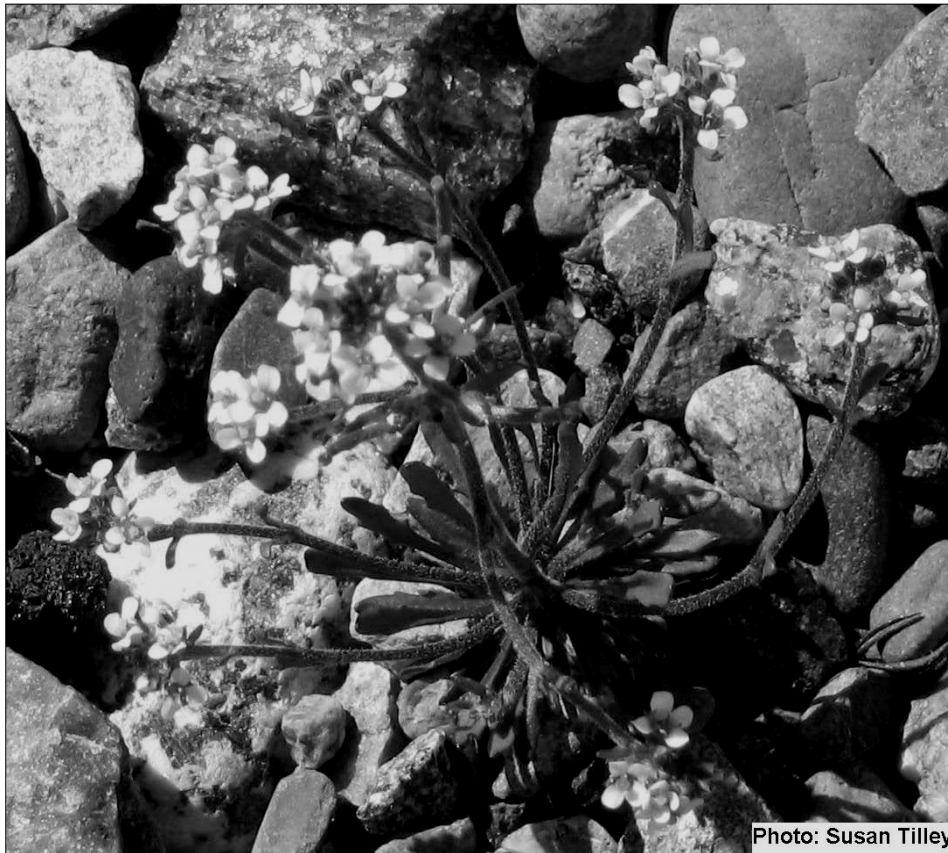


Photo: Susan Tilley

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**Disclaimer:**

This Recovery Strategy for the Low Northern Rockcress (*Neotorularia humilis*) has been prepared in cooperation with the members of the Limestone Barrens Species-at-Risk Recovery Team. The document defines the goals and objectives deemed necessary to protect and recover the Low Northern Rockcress. It does not necessarily represent the official positions of the governmental or non-governmental organizations, or individuals, involved. The recovery goals and objectives identified in this strategy are based upon the best knowledge available and may change over time in light of new findings and revised priorities. Implementation of the goals and objectives identified in this document ultimately depend upon the ongoing program priorities and budgetary constraints of the participating departments and organizations.

**Acknowledgments:**

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## Species Information:

<b>Common Name:</b>	Low Northern Rockcress
<b>Scientific Name:</b>	<i>Neotorularia humilis</i> (C.A. Meyer) Hedge & J. Léonard = <i>Sisymbrium humile</i> C.A. Meyer in Ledebour = <i>Braya humilis</i> (C.A. Meyer) B.L. Robinson = <i>Braya humilis</i> var. <i>abbei</i> (Böcher) B. Boivin = <i>Braya humilis</i> var. <i>americana</i> (Hook.) B. Boivin = <i>Braya humilis</i> var. <i>laurentiana</i> (Böcher) B. Boivin = <i>Braya humilis</i> var. <i>novae-angliae</i> (Rydb.) Fernald = <i>Braya novae-angliae</i> (Rydb.) Sørensen = <i>Braya novae-angliae</i> subsp. <i>abbei</i> Böcher = <i>Pilosella novae-angliae</i> Rydberg
<b>Global Occurrence:</b>	Greenland, Canada, USA, Asia
<b>Newfoundland and Labrador Occurrence:</b>	Pine Tree Property on Table Mountain UTM: NAD 83 21U 377352E 5388591N
<b>Provincial Legal Status:</b>	Endangered
<b>Status History:</b>	Listed as endangered under the Newfoundland and Labrador Endangered Species Act December 2004.
<b>Reason for Designation:</b>	Highly localized limestone barrens endemic; occurring at only one small site, which has been subject to habitat loss and degradation from land use activities.

## Executive Summary:

The Low Northern Rockcress (*Neotorularia humilis*) is a limestone barrens endemic restricted to disjunct localities in Greenland, Canada, USA, and Asia. There is only one population in Newfoundland and Labrador. This population occurs on Table Mountain, which is located adjacent to the Port au Port Peninsula. It was assessed by the Species Status Advisory Committee in 2004 as an endangered species, and listed as such under the Newfoundland and Labrador Endangered Species Act in December 2004.

The recovery goal for the Low Northern Rockcress in Newfoundland is to secure its long term persistence within its natural distribution. This goal will be addressed primarily by using stewardship to implement site management plans with landowners to prevent future habitat degradation and loss due to infrastructure maintenance, upgrades, and/or new construction. This document outlines six recovery objectives, for the Low Northern Rockcress, which should be undertaken over the next five years in order to accomplish the primary goal.

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## **PART I: BACKGROUND**

### **1. Description**

#### **1.1. Description of the species**

##### **1.1.1. The species**

The Low Northern Rockcress is a member of the Brassicaceae (Mustard) Family. It is a small herbaceous perennial, bearing four-petalled white flowers, and is found on calcareous substrates such as the limestone barrens of Table Mountain.

In the Newfoundland population of the Low Northern Rockcress, stems are simple, 1 to several, erect, and originate from a taproot. Stems can attain a height of 80 mm; however on average their height is 28 mm (Tilley & Hermanutz, unpublished data). Basal leaves are oblanceolate to spatulate, toothed or entire, and glabrous or pubescent, with simple or branching hairs. On average, the basal leaves are 14 mm long (Tilley & Hermanutz, unpublished data). Stem leaves can be entire or toothed. They are alternate and are scattered on the stem, becoming smaller towards the tip of the stem. (Tilley, personal observation; Aiken *et al.*, 1999; Cody 1996)

In Newfoundland the Low Northern Rockcress flowers in early June (Tilley & Hermanutz, unpublished data). Inflorescences are capitate and become elongated in fruit by early July.

In other populations the petals are 2.8-5.0 mm long, ascending, and white or lilac; the sepals are about half the length of the petals, greenish, and deciduous; and the siliques are 0.7-25.0 mm long, linear, and about 1 mm wide (Aiken *et al.*, 1999; Cody 1996). This information has not been verified for the Newfoundland population.

##### **1.1.2. Populations and distribution**

The Low Northern Rockcress is a limestone barrens endemic. Globally it is uncommon, but not rare, and is therefore ranked as a G4 species. Populations are restricted to Greenland, Canada, USA, and Asia.

Within North America, several extremely disjunct populations occur in: *Canada* - Newfoundland, Alberta, British Columbia, and the Arctic islands (Baffin, Ellesmere, Banks, Victoria Islands, and the Queen Elizabeth group); *United States of America* – Vermont, Michigan, Colorado, Wyoming, Montana, and Alaska.

Provincially, the Low Northern Rockcress is ranked as an S1 species because there is only one known population. This population is located on the limestone barrens of the Pine Tree Property of Table Mountain, adjacent to the Port au Port Peninsula (Figure 1; Figure 2).

The Low Northern Rockcress was first collected on Table Mountain in 1914 by Merritt Lyndon Fernald. A 1999 survey found 55 individuals (20 juveniles and 35 adult reproductive plants) in an 18 m x 44 m area, plus a few individuals found scattered close by (Hermanutz, unpublished data). More extensive field work conducted in 2004 and 2005 indicated that the

population on the Pine Tree Property was approximately 250 mature individuals, plus a number of juvenile plants (Hermanutz & Tilley, unpublished data). Neither historic nor recent data are sufficient to determine either trends in population size or the percent of the global population living in Canada.

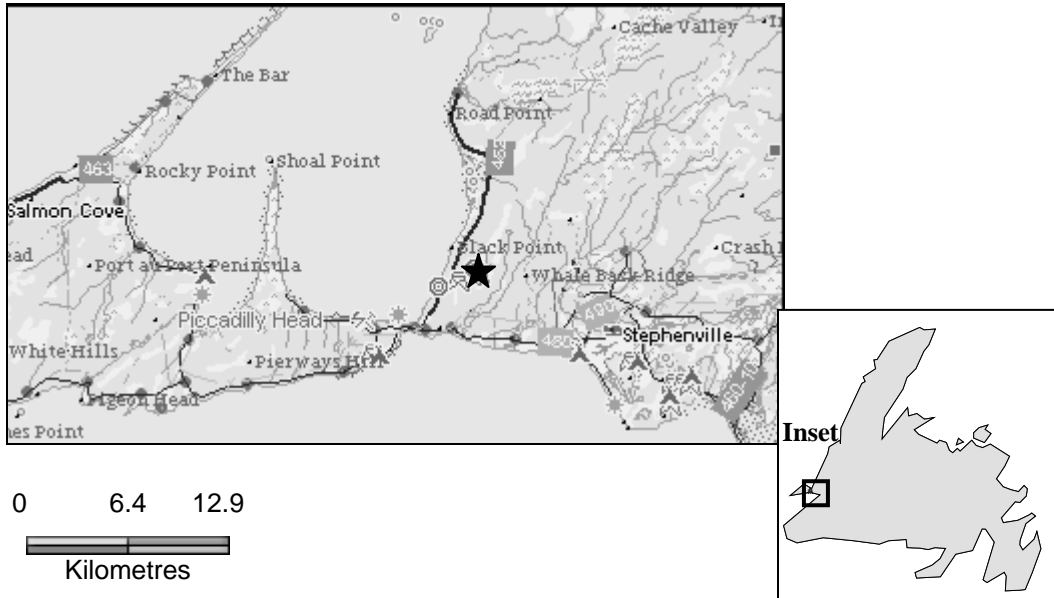


Figure 1: Location of the Low Northern Rockcress (*Neotorularia humilis*) in Newfoundland, as indicated by a star (The Species Status Advisory Committee Report No.1, 2004; Inset- Directory of Federal Real Properties, 2005).

## 1.2. Description of the species' needs

### 1.2.1. Biological needs, ecological role, and limiting factors

The Table Mountain limestone barrens are at the southern limit of a larger disjunct ecosystem that extends up the west coast of the island as far north as the Burnt Cape Ecological Reserve. The arctic-like climatic conditions of this limestone barrens ecosystem support many vascular plant species that are both rare in Newfoundland, and at their southern limit globally, including: Velvet Bells (*Bartsia alpina* L.), Dwarf Hawks' Beard (*Crepis nana* Richardson), and "Burnt Cape Cinquefoil" (*Potentilla pulchella* R.Br. ex Ross var. *pulchella*).

The limestone barrens on the Great Northern Peninsula also support three vascular plant species which are endemic to Newfoundland-Long's Braya (*Braya longii* Fernald), Fernald's Braya (*Braya fernaldii* Abbe), and Barrens Willow (*Salix jejuna* Fernald). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has assessed Long's Braya as endangered and Fernald's Braya as threatened (Hermanutz *et al*, 2002). The Government of Newfoundland and Labrador listed Long's Braya and Barrens Willow as endangered, and Fernald's Braya as threatened, in 2002; all three became Schedule 1 species under

the Species at Risk Act in 2003 (Djan-Chékar *et al.*, 2003; Hermanutz *et al.*, 2002).

The distinctiveness of the limestone barrens makes habitat specificity the most significant biological factor limiting the distribution of the Low Northern Rockcress. The limestone barrens are restricted to exposed coastal and upland locations that are characterized by Arctic-like climatic conditions, such as low temperatures, high winds, and cryoturbated substrate. These conditions limit plant growth. Within the limestone barrens habitat, substrate is heterogeneous (see Habitat Requirements below), limiting the number of suitable and available microsites for seedling germination and recruitment.

Existing data on Long's Braya and Fernald's Braya suggest that the lifespan and age to maturity of these plants may be decades, increasing the importance of adult survival and seedling recruitment for population trends (Hermanutz *et al.*, 2002).

Previous observations have documented herbivory by the Diamondback Moth (*Plutella xylostella* L.) on the Low Northern Rockcress. Presently, this herbivore does not appear to be significant in limiting the distribution of the Low Northern Rockcress (Tilley, unpublished data).

### **1.2.2. Habitat requirements**

The Low Northern Rockcress occupies exposed coastal and mountain limestone barrens habitat where vegetation cover is sparse. The Newfoundland population of the Low Northern Rockcress is found on an exposed limestone ridge near the 340-m-high summit of Table Mountain (Figure 2). The summit of Table Mountain is underlain by the Catoche Formation of the St. George geological group (Palmer *et al.* 2002, Figure 2; Dickson, 2003, Figure 2). This formation is characterized by medium to thickly bedded grey limestone and dolomite-mottled and bioturbated lime mudstones (Knight and Boyce, 2002). Minor glacial deposits are also present.

The limestone barrens are characterized by cold-climate surface processes, such as frost heave, frost shattering, and cryoturbation. These processes constantly disturb the ground surface and result in a mosaic of weathered bedrock and sorted (coarse alternating with fine) and non-sorted (coarse mixed with fine) limestone substrate.





Figure 2: Photograph of typical limestone barrens habitat for the Low Northern Rockcress (*Neotorularia humilis*). Photo was taken on the Pine Tree Property on Table Mountain looking north from the site. Note road (top left) running along the western periphery of the critical area.

### **1.2.3. Residence**

It is impossible to define the residence of the Low Northern Rockcress so as to meet the legal definition in the Newfoundland and Labrador Endangered Species Act, because of the unknown distribution and longevity of the seed bank. The distribution of the seed bank can not be determined without disturbing the substrate.

## **2. Threats**

### Habitat Degradation and Loss

The degradation of the habitat of the Newfoundland Low Northern Rockcress population began in the early 1950s when a radar station was erected on the summit of Table Mountain. This radar station was part of the “Pine Tree Line”, a system of radar stations across Canada that were used during the Cold War. The station was closed in 1971 and subsequently demolished. Additional habitat degradation was associated with the various decommissioning activities.

Current site infrastructure, which includes various federal agency communication towers, is dispersed throughout the critical habitat of the Low Northern Rockcress. Further maintenance to, and upgrades of, the roads, power lines, and communication towers can be expected to affect the recovery of both the plants and habitat. Many activities associated with the infrastructure may not be regulated by an environmental assessment (Appendix A). General site activities, such as snow clearing may also affect both the plants and the habitat. In addition to ongoing operational use of this property other potential impacts to

habitat include anticipated future remediation activities currently under review by the property owner (PWGSC).

The Pine Tree Property is gated, therefore vehicle access is restricted. Nonetheless it will be important to determine the effect of public use of the property by pedestrians and off-road vehicle users, specifically All Terrain Vehicles and snowmobiles.

### Small, Restricted Population Size

The Newfoundland population of the Low Northern Rockcress is currently known to contain approximately 250 mature (reproducing adult) individuals, all of which are located within the boundaries of the Pine Tree Property of Table Mountain. The precarious location of the population increases the importance and need for habitat protection and the prevention of an accidental loss of individuals and genetic diversity.

### Diamondback Moth Herbivory

Herbivores do not appear to limit seed production or seed output. However, in 2005, researchers found eggs of the Diamondback Moth on one flowering adult plant (Figure 3) (Tilley & Hermanutz, unpublished data). The Diamondback Moth is a global agricultural pest that feeds on all plants of the mustard family (Talekar and Shelton, 1993) including Long's Braya and Fernald's Braya, close relatives of the Low Northern Rockcress (Hermanutz *et al.*, 2004). This insect causes a decline in both the seed production and seed output of Long's Braya and Fernald's Braya, and results in a high annual loss of leaf biomass (Hermanutz *et al.*, 2004). Consequently, any increase in the population size of the Diamondback Moth in the area of Table Mountain might present a threat to the persistence of the Low Northern Rockcress, and should be monitored.



Figure 3: Photograph of a Low Northern Rockcress (*Neotorularia humilis*) infested with Diamondback Moth eggs (*Plutella xylostella*) in 2005. The black square on the photograph highlights the location of a white Diamondback Moth egg on the leaf (Tilley, 2005).

## Climate Change

A potentially important threat to the long-term persistence of the Low Northern Rockcress is ongoing climate change. The limestone barrens on Table Mountain define the southern limit of a larger ecosystem that extends up the west coast of the island. These barrens are predicted to experience an overall increase in mean annual air temperature of approximately 4°C over the next century (Slater, 2005). Local climate should be monitored to determine changes in temperature on Table Mountain, and the direct effects of such changes, if any, on the Low Northern Rockcress. Climate change may also affect the population distribution and abundance of the Diamondback Moth, since the survival rate of the species increases and the generation time decreases with increasing temperature (Talekar and Shelton, 1993).

### **3. Critical Habitat**

#### **3.1. Identification of the species' critical habitat**

The critical habitat for the Low Northern Rockcress is within the exposed limestone substrate on the summit of Table Mountain. This property is owned by the Government of Canada and Public Works and Government Services Canada are the property custodians (Figure 4; Figure 5). Smaller properties, leased by Transport Canada, Department of Fisheries and Oceans, the Royal Canadian Mounted Police, and the Canadian Broadcasting Corporation, are nested within the main property (Figure 5). In order to support the survival and recovery of the Low Northern Rockcress it is vital to inform property users about the importance of protecting the critical habitat described.

The full extent of the distribution of the Low Northern Rockcress is not yet known because nearby limestone barrens have not yet been completely surveyed. These nearby limestone barrens are on Crown Lands, which are owned by the Government of Newfoundland and Labrador, and administered by the Department of Environment and Conservation. Should individuals of the Low Northern Rockcress be found on the nearby limestone barrens, it would be important to expand the proposed boundaries of critical habitat to include these areas.

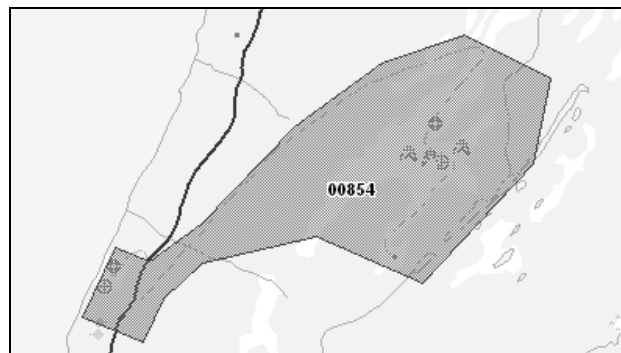


Figure 4: Map of the boundary of the Pine Tree Property on Table Mountain (Directory of Federal Real Property).

# Pine Tree Radar Site (Table Mountain) *Stephenville, NL.*

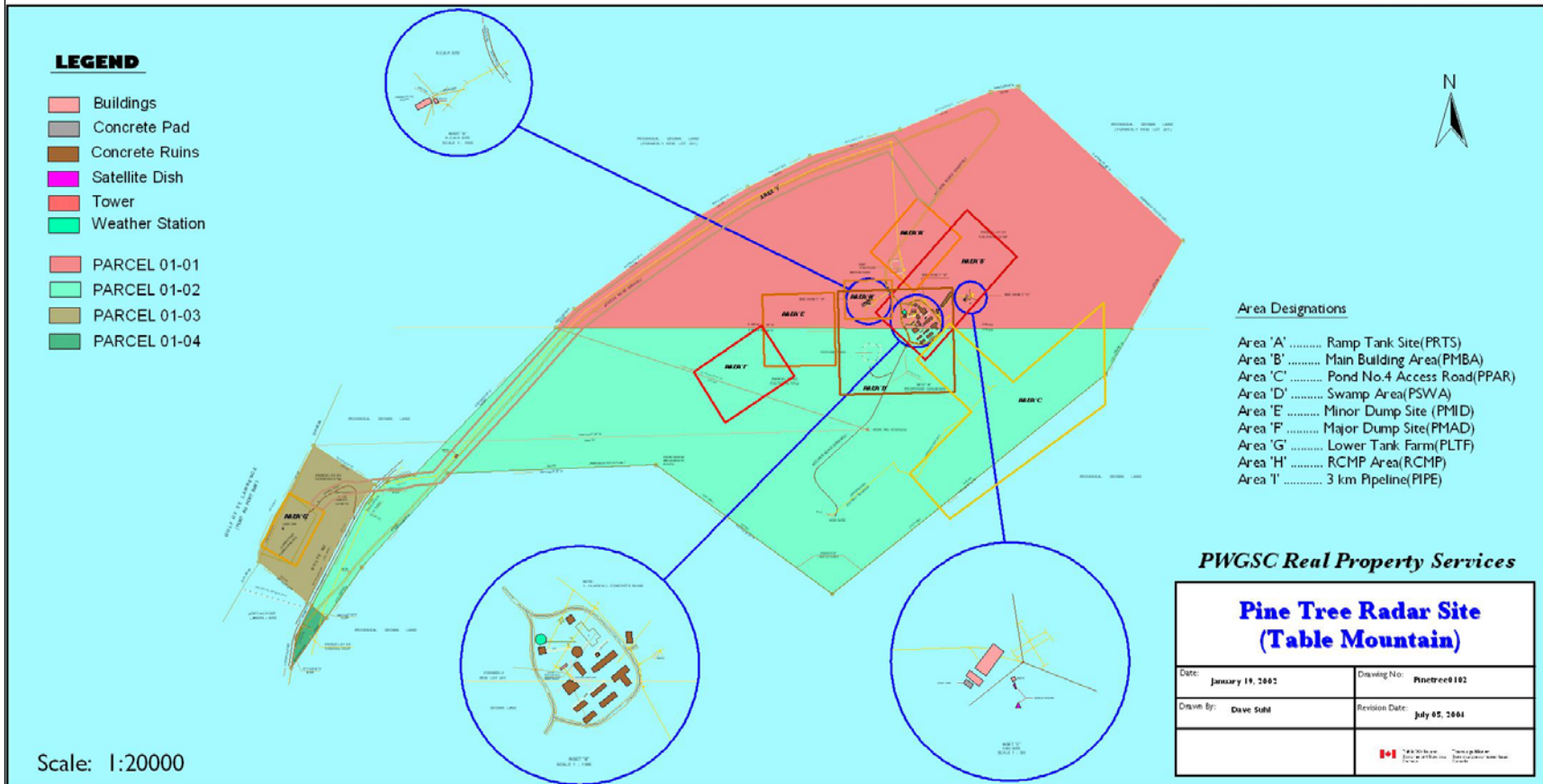


Figure 5: Map of the Pine Tree Property on Table Mountain showing the details (location, ownership, and infrastructure) of leased sub-properties (Environment Canada).

### **3.2. Examples of activities likely to result in destruction of the critical habitat**

Maintenance and upgrading of roads, power lines, and communication towers, as well as new construction within the area, especially directly adjacent to the Low Northern Rockcress population will likely degrade or destroy critical habitat. Many on site activities may not be regulated by an environmental assessment (Appendix A). The use of off-road vehicles at this site will also cause degradation of habitat and death of plants (Rafuse, 2005).

A risk assessment is in progress to determine the extent and impact of the historical PCB contamination on the site. Consultants completing this risk assessment are aware of the presence and location of the Low Northern Rockcress on the site. Depending on the outcome of this assessment, proposed remediation of PCB contamination on the site may threaten rare plants and critical habitat.

### **3.3. Existing and recommended approaches to habitat protection**

Environment Canada advises on, and establishes requirements for, land and species within federal jurisdiction under the Species at Risk Act. Through Environment Canada, Public Works and Government Services Canada has been notified that the Low Northern Rockcress occurs on their property. All other landowners and property managers should be informed of the presence of the Low Northern Rockcress on their property, and they should be provided with the appropriate information necessary to mitigate any on-site work.

The Province of Newfoundland and Labrador should formally request that the Federal Government provide legal protection to the Low Northern Rockcress under its Species at Risk Act, where this plant occurs on federal property. This may occur through either a direct request or the bilateral agreement for the conservation of species at risk. This is being worked out between the two levels of government

### **3.4. Schedule of studies**

While critical habitat for the Low Northern Rockcress has been roughly defined, it will have to be mapped in more detail. This will be carried out over the next two years.

## **4. Completed and Ongoing Recovery Actions**

During the past 25 years, both upland and coastal limestone barrens on the west coast of Newfoundland have been searched extensively for rare plants in an attempt to relocate those originally reported by Merritt Lyndon Fernald and his teams of the 1920s, and by others – notably Ernest Rouleau – during the 1950s and 1960s. Recently, the Newfoundland Rare Plant Project and the Newfoundland and Labrador Wildflower Society have made trips to the Pine Tree Property and to the nearby Port au Port Peninsula in search of the Low Northern Rockcress. Prior to this, teams of experts from the Institut de recherche en biologie végétale, Université de Montréal, conducted surveys in preparation for the publication of *The Rare Vascular Plants of the Island of Newfoundland*

(Bouchard *et al.*, 1991). All surveys were unsuccessful in locating other populations of this species. However, a number of other potential sites have been only partially explored because of their high elevation, large size, or inaccessibility. These sites include the limestone ridges on the Port au Port Peninsula, between Cap St. George and Mainland, and those on Big Hill and Mount Fernald in the Bonne Bay area.

Data on the basic biology and demography of the Low Northern Rockcress were collected from 50 tagged individuals of random ages and sizes in 2004. Growth, reproductive, and survival parameters were measured on each tagged plant (e.g. basal diameter, longest leaf, number of flowering stalks, number of flowers and fruits per stalk, and herbivore presence and damage; Tilley and Hermanutz, unpublished data). These tagged plants were re-evaluated in 2005, when their survival rate was also recorded. Of the 50 plants tagged in 2004, 7 plants had died by 2005 (Tilley and Hermanutz, unpublished data). As well, five 1 m x 1 m permanent plots were established to monitor changes in population structure and seedling germination (Tilley and Hermanutz, unpublished data).

## **5. Knowledge Gaps**

Additional information is needed on the population size, distribution and demography of the Low Northern Rockcress, as well as on the extent to which habitat degradation is a threat to its long-term persistence.

### Survey Requirements:

Adjacent limestone barrens where there is suitable habitat, notably the area on the Port au Port Peninsula between Cap St. George and Mainland; and on Big Hill and Mount Fernald in the Bonne Bay area, need to be surveyed to determine whether any other populations of the Low Northern Rockcress exist in Newfoundland. This information is essential for accurately defining the critical habitat for the Low Northern Rockcress.

### Biological and Demographic Research Requirements:

Information about the demography of the Low Northern Rockcress - specifically its life history parameters (survival, mortality, growth) - is needed in order to carry out a population viability analysis. This information will also be important in supporting the *ex situ* population of this species, which has been primarily established to conserve genetic diversity and to act as a fail-safe in the event that the natural populations become seriously depleted or extinct.

## **PART II: RECOVERY**

### **6. Recovery Feasibility**

The primary limiting factor in the recovery or expansion of the species is habitat specificity. Habitat specificity of the Low Northern Rockcress dictates that it is likely to always remain rare within the province and globally.

Nonetheless, recovery and the prevention of any further population decline are possible provided that existing anthropogenic disturbance is mitigated and further disturbance is prevented. Therefore, mitigation of any on-site work conducted by Public Works and Government Services Canada or other property users is essential to the success of recovery goals and objectives. Should the ownership of the property be transferred to another party, it may be advantageous to have that party carry out the remediation or develop a property conservation plan outlining how the conservation and recovery goals stated in this recovery strategy and future action plans will be met.

As noted above, climate change may be another critical factor in the long term persistence of the Low Northern Rockcress. Climate change can not be prevented at the local level without national and global intervention. Nonetheless, the monitoring of local climate change at the Low Northern Rockcress site may be useful in understanding the bioclimatic sensitivity of the Low Northern Rockcress. Furthermore, monitoring will guide researchers in planning appropriate management actions, such as increasing the size of the *ex situ* population, should climate change increase the probability of extinction.

## **7. Recovery Goals, Objectives, and Corresponding Approaches**

### **7.1. Recovery goal**

The primary recovery goal is to secure the long-term persistence of the Low Northern Rockcress within its natural distribution by protecting critical habitat. As noted above the habitat specificity of the Low Northern Rockcress dictates that it is likely to always remain rare within the province, and globally.

### **7.2. Recovery objectives**

Recovery actions undertaken over the next five years should address the following objectives:

- I. Assess and monitor the status of the natural population to determine growth, reproductive and survival parameters, and herbivore damage.
- II. Offer information to the landowner and employees who own the land and work in the area to facilitate stewardship initiatives.
- III. Seek the cooperation of the landowners, who own property or infrastructure adjacent to and including the Low Northern Rockcress population, in the development of management practices to protect against additional habitat loss and degradation, or the loss of individuals.
- IV. Survey nearby limestone barrens to further define the distribution and population size of the Low Northern Rockcress.
- V. Monitor the climate conditions - in particular air and ground temperature - of the Low Northern Rockcress population.
- VI. Determine the taxonomic status of the Low Northern Rockcress relative to other populations.

### 7.3. Broad strategy to be taken to address threats

Priority	Objectives	Threat Addressed	Strategy	Specific Steps	Key Performance Indicators
Urgent	II & III	Habitat degradation	Site management & Stewardship	<ul style="list-style-type: none"> <li>-Assess threats from each type of infrastructure and associated activity on critical habitat</li> <li>- Inform landowners of the importance of habitat preservation in the recovery of species</li> <li>-Develop management actions in communication with landowners and users to reduce possibility of habitat loss and degradation</li> <li>- Provide signage for landowners to place around property indicating the presence of an endangered species</li> <li>- Provide communications protocols to landowners and users regarding all site activities</li> </ul>	<ul style="list-style-type: none"> <li>-All plant locations assessed to quantify threats to critical habitat</li> <li>- Landowners informed of the importance of habitat preservation in the recovery of species</li> <li>- Management actions and mitigation measures developed with each landowner</li> <li>- Signage erected on property</li> <li>- Communications protocols for landowners and users</li> </ul>
Urgent	IV	Habitat loss and reduction	Survey of population distribution	<ul style="list-style-type: none"> <li>- Survey suitable habitat within and around the species' known distribution to improve accuracy of population size and distribution</li> <li>- Identify, geo-reference, and map areas where the species occurs</li> <li>- Provide regular updates of</li> </ul>	<ul style="list-style-type: none"> <li>- Revised population distribution map</li> <li>- Revised population size data</li> <li>- Map of population distribution available to landowners, stakeholders, and government</li> </ul>



				species' known distribution to landowners, stakeholders, and government (Environment Canada)	
Necessary	I & VI	Knowledge gap	Trend assessment	- Establish long-term monitoring of individual plants	- Ongoing record of mortality, growth, and reproductive rates of tagged individuals
Necessary	I	Population decline	Demographic research	- Determine demographic parameters (reproduction, growth, survival) based on monitoring data - Determine seed bank persistence and seed longevity	- Demographic profile of population sample - Establishment of a seed bank longevity - Assessment of seed viability
Necessary	III	Small, Restricted Population size	<i>Ex situ</i> conservation	- Establish an <i>ex situ</i> collection of living plants and a seed bank	- Existence of an <i>ex situ</i> collection of living plants and a seed bank
Necessary	I	Diamondback Moth herbivory	Monitoring & Impact Assessment	- Monitor the presence of all the Diamondback Moth lifecycle stages (adults, eggs, larvae, pupae) on tagged individuals - Determine the impact of herbivory on plant growth, reproduction, and survival - Develop management actions	- Threat assessment of herbivory from Diamondback Moth - Management actions to reduce Diamondback Moth impact

Necessary	V	Climate change	Climate monitoring	<ul style="list-style-type: none"> <li>- Monitor air and ground temperature to determine trends and variability in the climatic conditions of the Low Northern Rockcress population; compare findings with historical climate data</li> <li>- Correlate local climatic trends with population dynamics</li> </ul>	<ul style="list-style-type: none"> <li>- Ongoing record of climatic conditions of the Low Northern Rockcress population</li> <li>- Trends in climate dependant population dynamics</li> <li>- Bioclimatic indicators</li> </ul>
Necessary	VI	Knowledge gap	Taxonomic research	<ul style="list-style-type: none"> <li>- Improve knowledge of species definition and description</li> <li>- Describe the morphology, genetics, phenology, and ecology of our local disjunct population</li> </ul>	<ul style="list-style-type: none"> <li>- Preparation of keys and illustrations that compare the local population with other populations</li> <li>- Description of the taxonomy of the Low Northern Rockcress</li> </ul>
Necessary	II & III	Land Transfer	Site management & Stewardship	<ul style="list-style-type: none"> <li>- Should ownership of property be transferred, then the implications for species on the site should be identified</li> </ul>	<ul style="list-style-type: none"> <li>- Best management practices are transferred with the property</li> </ul>

#### **7.4. Effects on other species**

The Low Northern Rockcress is restricted to a specific habitat that supports a unique plant community that includes the Dwarf Arctic Ragwort (*Packera cymbalaria* (Pursh), Newfoundland Pussytoes (*Antennaria eucosma* Fernald & Wiegand), Hyssopleaf Fleabane (*Erigeron hyssopifolius* Michx.), and several willow species (*Salix ballii* Dorn, *Salix uva-ursi* Pursh, *Salix vestita* Pursh) (Meades *at al.*, 2000). The protection of this critical habitat will not only support the long-term persistence of the Low Northern Rockcress, but also the persistence of these other native plant species.

#### **7.5. Evaluation**

See “Key Performance Indicators” in section 7.3. (broad strategy to be taken to address threats).

### **8. Recommended Approach to Recovery**

Informed landowners will facilitate the protection of these vascular plant species, as well as support the importance of stewardship in the conservation process in Newfoundland and Labrador.

Recovery initiatives for the Low Northern Rockcress will be incorporated into the ongoing scientific and stewardship plans of the closely related Long’s Braya and Fernald’s Braya. The Limestone Barrens Species-at-Risk Recovery Team provides advice to support the management of these species.

### **9. Timeline for the Completion of Action Plans**

Plans to detail actions necessary to deliver on the goals and objectives of this strategy will be prepared within two years upon the release of this document, or as appropriate.

## References:

- Aiken, S., M.J. Dallwitz, L.L. Consaul, C.L. McJannet, L.J. Gillespie, R.L. Boles, G.W. Argus, J.M. Gillett, P.J. Scott, R. Elven, M.C. LeBlanc, A.K. Brysting and H. Solstad. 1999 onwards. *Flora of the Canadian Arctic Archipelago: descriptions, illustrations, identification, and information retrieval*. Version: 29th April 2003. <http://www.mun.ca/biology/delta/arctic/ca/www/babrhu.htm>. Accessed August 31, 2005.
- Bouchard, A., S. Hay, L. Brouillet, M. Jean and I. Saucier. 1991. *The Rare Vascular Plants of the Island of Newfoundland*, Syllogeus No. 65. Canadian Museum of Nature, Ottawa, ON.
- Canadian Environmental Assessment Act. 2004. Exclusion List Regulations Schedule 1 (Section 3): *Exclusion list for places other than national parks, national park reserves, national historic sites or canals*. Version: August 31, 2004. <http://laws.justice.gc.ca/en/C-15.2/SOR-94-639/66259.html>. Accessed December 11, 2005.
- Cody, W. J. 1996. *Flora of the Yukon Territory*. NRC Research Press, Ottawa, ON.
- Dickson, W.L. 2003. *Industrial-Mineral Studies, 2002*. Current Research, Newfoundland Department of Mines and Energy. Geological Survey, Report 03-1: 209-222. [http://www.nr.gov.nl.ca/mines&en/geosurvey/publications/pdf/Dickson\\_IM.pdf](http://www.nr.gov.nl.ca/mines&en/geosurvey/publications/pdf/Dickson_IM.pdf). Accessed December 9, 2005
- Directory of Federal Real Property, Treasury Board of Canada Secretariat. Version: 17<sup>th</sup> March 2005. <https://map-carte.tbs-sct.gc.ca/dfrp-rbif/mapcarte/mapcarte.aspx?Language=EN&env=www&PN=0085400>. Accessed November 22, 2005.
- Djan-Chékar, N. L. Hermanutz, D. Ballam, T. Bell, J. Brazil, H. Mann., J. Maunder, S.J. Meades, W. Nicholls, L. Soper, and G. Yetman. 2003. *Recovery strategy for the Barrens Willow (Salix jejuna Fernald)*. Inland Fish and Wildlife Division, Government of Newfoundland and Labrador, Corner Brook. v + 11 pp.
- Hermanutz, L., H. Mann, M.F.E. Anions, D. Ballam, T. Bell, J. Brazil, N. Djan-Chékar, G. Gibbons, J. Maunder, S.J. Meades, N. Smith and G. Yetman. 2002. *National recovery plan for Long's Braya (Braya longii Fernald) and Fernald's Braya (Braya fernaldii Abbe)*. National Recovery Plant No.23. Recovery of Nationally Endangered Wildlife (RENEW). Ottawa, Ontario. 33 pp.

- Hermanutz, L., S. Tilley, J. Kemp, T. Bell, P. Dixon, W. Nicholls, and E. Donato. 2004. *Risk assessment of insect pests and pathogens on endangered plants of the limestone barrens of Newfoundland*. Final report to ESRF- Dec 17/04. Memorial University of Newfoundland, St. John's.
- Knight, I. and W.D. Boyce. 2002. *Lower paleozoic carbonate rocks of the northern closure of the North Brook anticline and the Spruce Ponds klippe, Georges Lake (12B/16) and Harrys River (12B/9) map areas: collected thoughts on unconnected rocks*. Current Research, Newfoundland Department of Mines and Energy, Geological Survey, Report 02-1, pages 121-134.
- Meades, S.J., S.G. Hay, and L. Brouillet. 2000. *Annotated checklist of the vascular plants of Newfoundland and Labrador*. Version: 25<sup>th</sup> March, 2000. <http://www.nfmuseum.com/meades.htm>. Accessed November 1, 2005
- Palmer, S.E., J.W.F. Waldron, and D.M. Skilliter. 2002. Post-Taconian shortening, inversion and strike slip in the Stephenville area, western Newfoundland Appalachians <http://article.pubs.nrc-cnrc.gc.ca/ppv/RPViewDoc?handler=HandleInitialGet&journal=cjes&volume=39&calyLang=eng&articleFile=e02-041.pdf>. Accessed December 9, 2005
- Rafuse, G. 2005. *The impact of off-road vehicles on the limestone barrens habitat and resident plants endemic to the Great Northern Peninsula, Newfoundland, Canada*. Honours thesis, Department of Biology, Memorial University of Newfoundland. May 2005.
- Slater, J. 2005. *Statistical downscaling of temperature and precipitation for climate change impact assessment of rare plants on the limestone barrens of Northwestern Newfoundland*. Honours thesis, Department of Geography, Memorial University of Newfoundland. September 2005.
- Talekar, N.S. and A.M. Shelton. 1993. *Biology, ecology, and management of the diamondback moth*. Annual Reviews of Entomology 38: 275-301.
- The Species Status Advisory Committee Report No. 1. 2004. *The Status of Low Northern Rockcress (Neotorularia humilis) in Newfoundland and Labrador*.

## Appendix A

### Activities on the Pine Tree property that would not trigger an Environment Assessment (Canadian Environmental Assessment Act).

1. The proposed maintenance or repair of an existing physical work.
2. The proposed operation of an existing physical work that is the same as an operation for which an environmental assessment has been previously conducted and approved under either the *Canadian Environmental Assessment Act* or the *Environmental Assessment Review Process Guidelines Order*
3. The proposed continued operation of an existing physical work where the operation is the same as the existing operation and there is no interruption between the existing and proposed operations; the existing operation has been determined by a federal authority to be unlikely to cause significant adverse environmental effects.
4. The proposed construction or installation of a building with a footprint of less than 100 m<sup>2</sup> and a height of less than 5 m.
5. The proposed construction, installation, expansion or modification of a(n):
  - i) environmental scientific data collection instrument and its housing and enclosure;
  - ii) ramp, door or handrail to facilitate wheelchair access;
  - iii) temporary exhibition structure inside, or affixed to the exterior of, an existing building;
  - iv) sidewalk or boardwalk, or a parking lot with a parking capacity of 10 automobiles or fewer, where the construction would be contiguous to an existing building;
  - v) hydrant or hook-up, where the hydrant or hook-up would be or is part of an existing farm or municipal system of distribution;
  - vi) sign no surface of which would have or has an area of more than 25 m<sup>2</sup> and which would be or is situated at a distance of less than 15 m from an existing building;
  - vii) radiocommunication antenna and its supporting structure that would have one of the following characteristics: the antenna and supporting structure are affixed to an existing building, the antenna and supporting structure are situated at a distance of less than 15 m from an existing building, and neither the antenna nor its supporting structure nor any of its supporting lines have a footprint of more than 25 m<sup>2</sup>.
  - viii) temporary field camp used for scientific or technical research, or for reforestation, if the temporary field camp would be in use for fewer than 200 person-days, or) is a military field camp or a designated training area established under the authority of the Minister of National Defence before January 19, 1995.
  - ix) Canada-United States international boundary monuments.
  - x) physical work, not otherwise referred to in this Schedule, with a footprint of less than 25 m<sup>2</sup>.
6. The proposed expansion or modification of an existing:
  - i) building, including its fixed structures that would not increase the footprint or height of the building by more than 10 per cent.
  - ii) sidewalk, boardwalk or parking lot that would not increase the area of the sidewalk, boardwalk or parking lot by more than 10 per cent;
  - iii) fence that would not increase the length or height of the fence by more than 10 per cent.
  - iv) road that would be carried out on the existing road right of way and would not lengthen the road or widen the road by more than 15 per cent.
7. The proposed demolition of an existing building with a floor area of less than 1 000 m<sup>2</sup> that would not be carried out within 30 m of another building.