

**Management Plan
for
Fernald's Milk-vetch
(*Astragalus robbinsii* (Oakes) Gray var. *fernaldii* (Rydberg) Barneby) in
Newfoundland and Labrador
2006-2011**



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Prepared by:

Claudia Hanel and Brent Keeping, Wildlife Division, Newfoundland and Labrador
Department of Environment and Conservation

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Assessment Summary

Common Name (population): Fernald's Milk-vetch, Newfoundland and Labrador population

Scientific Name: *Astragalus robbinsii* (Oakes) Gray var. *fernaldii* (Rydberg) Barneby

Current status and most recent date of assessment: Vulnerable, November 2001

Reason for designation: Highly restricted endemic of limestone habitats found in only one small area in southeastern Québec and an adjacent site on the Great Northern Peninsula of Newfoundland. Populations in Québec have experienced some losses and are subject to on-going risks such as limestone extraction, trampling and ATV use.

Assessment Criteria: Met criterion for Threatened, D2, but is considered to be of Special Concern because of its resilience and its ability to colonize disturbed portions of its specialized habitat at the few Quebec sites and lack of anthropogenic risks at the single Newfoundland site.

Occurrence: QC, NL

Status history: Designated Special Concern by COSEWIC in April 1997. Status re-examined and confirmed in November 2001. Last assessment based on an existing (1997) status report.

Note: The above assessment summary represents COSEWIC's evaluation in 1997, but recent information suggests that this taxon may need to be re-assessed. At the time of assessment it was believed that a population in Labrador near the Québec/ Labrador border was located entirely within Québec.

Disclaimer

The Management Plan for Fernald's Milk-vetch (*Astragalus robbinsii* var. *fernaldii*) was prepared by the Wildlife Division, Department of Environment and Conservation to identify management strategies, based on sound ecological principles that will ensure the continued survival of this species. It does not necessarily represent official positions of agencies and/or the views of individuals involved in the document's preparation. The goals, objectives and management actions identified in the management document are subject to program priorities, policies and budgetary constraints of the participating agencies and organizations. Goals, objectives, and management approaches may be modified in the future to accommodate new objectives or findings.

Executive Summary

Fernald's Milk-vetch (*Astragalus robbinsii* var. *fernaldii*) is considered by COSEWIC (1997) to be a variety of Robbins' Milk-vetch that is endemic to the Strait of Belle Isle. Populations which have been ascribed to this variety are found in eastern Quebec, adjacent Labrador and on the Great Northern Peninsula of Newfoundland. The variety is listed as a species of Special Concern under the federal *Species at Risk Act* (SARA) and as Vulnerable under the provincial *Endangered Species Act*. In Québec it is listed as Threatened under the *Loi sur les espèces menacées ou vulnérables/Act Respecting Threatened or Vulnerable Species*.

Within the Province of Newfoundland and Labrador, COSEWIC (1997) identified two occurrences of Fernald's Milk-vetch, one in Labrador directly adjacent to the border with Québec, and the other in Newfoundland on the Highlands of St. John on the Great Northern Peninsula.

The genus *Astragalus* is large and complex, and closely related taxa are often difficult to distinguish. Since its original description Fernald's Milk-vetch has been considered to be a freestanding species, a subspecies of Elegant Milk-vetch (*Astragalus eucosmus*), and a subspecies of Robbins' Milk-vetch (*Astragalus robbinsii*). No one clear character separates Fernald's Milk-vetch from the closely related Robbins' Milk-vetch or Elegant Milk-vetch. Based upon morphological comparisons of the several *Astragalus* populations in Newfoundland and Labrador that are clearly part of this species complex, the validity of Fernald's Milk-vetch as a subspecies, as well as its association with Robbins' Milk-vetch, has been called into doubt. In addition, the identities of both the Newfoundland and Labrador populations, as Fernald's Milk-vetch, have been questioned. Preliminary genetics studies have been inconclusive and further systematic research is required to resolve these issues.

Of the two currently identified Fernald's Milk-vetch populations in the Province of Newfoundland and Labrador, the Labrador border population is considered to be under threat from illegal limestone rock quarrying. The Barr'd Harbour Hill population is not currently considered to be under threat due to the remoteness of the site and its location within the proposed Highlands of St. John Ecological Reserve. Climate change could potentially affect habitat quality at both locations in the future.

The goal of this management plan is to ensure the persistence of a healthy and viable population of Fernald's Milk-vetch throughout its natural range. To attain that goal, one of the most important management objectives is to resolve the several outstanding taxonomic questions. The management of the species will consist of two phases. During the first phase the taxonomic concept accepted by COSEWIC (1997) will be used, and taxonomic studies will be conducted. This phase will conclude when results from the study are available. Other objectives, such as population monitoring and habitat protection, will use the current species concept outlined in COSEWIC (1997) during Phase I, and the refined species concept afterward. An adaptive management approach

will allow the adjustment of this management plan based upon study results and any other new information.

The majority of the population in Labrador is currently protected in a Sensitive Wildlife Area designated by the Interdepartmental Land Use Committee of the Government of Newfoundland and Labrador, and this form of protection for this population needs to continue. Even if conclusive evidence is obtained that the milk-vetch population at this site is not Fernald's Milk-vetch, it still belongs to a rare species, since all large milk-vetches within the province are rare. A monitoring program will be established to measure potential changes in population size and health and to assess the urgency and severity of pending threats.

It is possible that even if Fernald's Milk-vetch is upheld as a valid variety several scenarios are possible. Perhaps one or both of the populations currently considered to be Fernald's Milk-vetch will be determined to belong to a different species, and/or one or more populations now considered to be a different species will be re-assigned to Fernald's Milk-vetch. It is also possible that the milk-vetches at some sites will be found to belong to several species, and that some will be identified as hybrids. The management plan will be updated to reflect new species concepts that may be produced and will extend to any locations where at least some plants are identified as Fernald's Milk-vetch according to the new concept.

If Fernald's Milk-vetch is upheld as a valid variety by the study, information on Fernald's Milk-vetch will be included in public education literature disseminated by the Province, such as fact sheets, posters, and displays. Current fact sheets, etc. will be updated. Local communities will be notified of the general location and special significance of the species. For the currently identified populations these communities would be L'Anse-au-Clair, L'Anse-Amour, Forteau and L'Anse-au-Loup in Labrador, and Hawke's Bay, Port Saunders, Eddies Cove West, and Castor's River South in Newfoundland.

An evaluation of the success of this management plan will be conducted in five years and measured against preset criteria. Expected outcomes of the management plan include; taxonomic test results that answer species identity questions, an established population monitoring program, maintenance of habitat quality and a population of Fernald's Milk-vetch equal to or greater than current levels.

Acknowledgements

Several people must be specially thanked for their contribution to this management plan. John Maunder's thorough examination of photographs and specimens of the large Milk-vetches within the province is especially appreciated as it suggests that the current concept of Fernald's Milk-vetch should be re-examined. Many thanks also to Guy Jolicoeur for providing detailed population data for the Labrador border population. The valuable comments of John Maunder, Joe Brazil, Luise Hermanutz and Doug Ballam are also gratefully acknowledged as they helped to greatly improve this management plan. John Maunder is also thanked for providing the cover photograph.

Table of Contents

Assessment Summary	ii
Disclaimer	ii
Executive Summary	iii
Acknowledgements	iv
Table of Contents	v
List of Figures.....	vi
Introduction.....	1
I Background.....	1
1. <i>Biology</i>	1
1.1 Description.....	1
1.2 Ecology and Life History.....	1
1.3 Habitat.....	2
1.4 Taxonomic Status.....	2
1.5 Distribution and Population	4
Québec and Labrador Border Populations.....	4
Barr'd Harbour Hill Population	6
Distribution of Related Taxa.....	6
2. <i>Legal Status</i>	7
3. <i>Threats</i>	7
4. <i>Monitoring History</i>	8
5. <i>Knowledge Gaps</i>	9
II Management.....	10
6. <i>Goals and Objectives</i>	10
6.1 Goals	10
6.2 Objectives	10
7. <i>Management Actions</i>	10
7.1 Habitat protection.....	11
Current Actions.....	11
Proposed actions	12
7.2 Research.....	12
7.3 Inventory, Monitoring and Assessment	13
7.4 Other Management Actions	14
7.5 Outreach and Communications.....	14
7.6 Evaluation	15

8. Summary Table	16
9. Implementation Schedule	18
10. Contact Information.....	19
11. References.....	19
Personal communications:	20

List of Figures

Figure 1. Newfoundland and Labrador locations for Fernald’s Milk-vetch (<i>Astragalus robbinsii</i> var. <i>fernaldii</i>) shown in the COSEWIC (1997) status report	5
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Introduction

Fernald's Milk-vetch (*Astragalus robbinsii* var. *fernaldii*) is an herbaceous perennial that is a member of the pea family (Fabaceae). It is restricted to the Strait of Belle Isle region and is found in Québec and the Province of Newfoundland and Labrador. The status report submitted to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 1997) identified six occurrences of this plant, two in Newfoundland and Labrador and four in the Blanc Sablon area of Québec. The combined total number of individuals within the Province of Newfoundland and Labrador is estimated to be less than 5000 individuals, or approximately 10% of the total world population.

I Background

1. Biology

The following three subsections (Description, Ecology and Life History, Habitat) pertain to Fernald's Milk-vetch as outlined in COSEWIC 1997.

1.1 Description

COSEWIC (1997) described Fernald's Milk-vetch as an herbaceous perennial that grows loosely erect and reaches an average height between 20 and 40 cm. The 2-8 stems (rarely only 1) arise from a single point on a short rhizome, giving the plant a tufted appearance. The leaves of the plant are alternate and comprised of 9 to 17 hairy leaflets. Each of the flowering stalks, which are found in the leaf axils on the stems of the plant, contains 10 to 20 small flowers. The petals of the flowers are purple to lilac and much less often, white. The pods are elongate and covered with stiff white to brownish hairs. The pod stands on a small stalk (stipe), which is shorter than the calyx tube. This description may eventually have to be modified in light of ongoing taxonomic studies.

Upper stems, leaves and flower clusters are shown on the cover photograph of this document.

1.2 Ecology and Life History

Fernald's Milk-vetch is shade intolerant and does not compete well with other species, especially shrubs over 50 cm in height (COSEWIC 1997). It can be a pioneer species that colonizes areas disturbed by frost heave or human activities, but once established, the plants can survive in a mat of low heath vegetation composed of creeping shrubs, such as black crowberry, tundra bilberry and dwarf willows (COSEWIC 1997). The plants do not reproduce vegetatively, but only by seed.

In the Blanc Sablon/Labrador border area the plant blooms throughout July and into August in sites with late lying snow. Seed maturation occurs towards the end of August. These phenological stages may occur earlier in Newfoundland, judging by the fact that individuals of *Astragalus robbinsii* var. *minor* from St. Paul's Inlet had already dispersed their seeds by July 28 (COSEWIC 1997). In some populations observed by Morisset in 1994 a number of flowers were aborted without setting seed (COSEWIC 1997). This seemed to occur mainly in plants found to receive competition from herbaceous vegetation 30-50 cm tall.

All of the populations surveyed by Morisset for the status report had some juvenile individuals that were not yet flowering (COSEWIC 1997). This number was 1 – 5% for most of the locations, including the Labrador border site, with higher proportions of juveniles observed only on Mount Bonenfant (10%) and the sides of an abandoned road on Mont Parent (30%), both in the Blanc Sablon area of Québec.

1.3 Habitat

Fernald's Milk-vetch is an obligate calciphile (COSEWIC 1997). It grows only in exposed, frost-heaved, limestone-derived soils that are inhabited by arctic/alpine plant communities. In particular, it seems to prefer slightly elevated, drier calcareous mounds and low ridges; generally within areas of low heathy vegetation (John Maunder, pers. comm. May 2006). The Québec and Labrador populations are all found on the limestones of the Forteau Formation, which caps the hills in this area; the plant is absent from the underlying sandstones of the Bradore Formation (COSEWIC 1997). The putative Newfoundland population is also located on limestone of the Forteau Formation, which extends across the Straight of Belle Isle and is exposed on the western slopes of the Highlands of St. John (Knight, 1991). At this location the plants are found on small limestone outcrops and ledges among larger cliffs.

This type of limestone barren habitat is relatively rare in Newfoundland and Labrador, and the plant only occupies a small fraction of the seemingly suitable habitat. For example, it is not found in the coastal limestone barrens of the northern tip of the Great Northern Peninsula in Newfoundland, which belong a different geological Formation and thus may have subtle physical and chemical differences. Some seemingly suitable habitat is occupied by other milk-vetch species. For example, all populations of large milk-vetches from the northern tip of the Great Northern Peninsula are currently identified as Elegant Milk-vetch (*Astragalus eucosmus*).

1.4 Taxonomic Status

Originally, Fernald's Milk-vetch had been described at the rank of a species (Rydberg 1928). Subsequently Barneby (1964), whose book represented the state of the knowledge about the genus *Astragalus* at that time, considered a number of milk-vetches, including Fernald's Milk-vetch, to be varieties of the Robbins' Milk-vetch (*Astragalus robbinsii*).

However, Boivin (1967) felt that Fernald's Milk-vetch should be considered a variety of Elegant Milk-vetch (*Astragalus eucosmus*). In the status report (COSEWIC 1997), Pierre Morisset of l'Université Laval generally accepted the treatment of Barneby (1964). He was somewhat unsure, but considered Barneby's taxonomy to be the best available until further studies had been conducted.

Barneby (1964) and later Morisset (COSEWIC 1997) mentioned the similarity between Fernald's Milk-vetch, Robbins' Milk-vetch and Elegant Milk-vetch, with Fernald's Milk-vetch appearing to be intermediate between the other two species. Several populations of Milk-vetch have been re-identified several times. For example, the number of milk-vetch populations on the island of Newfoundland considered to be Fernald's Milk-vetch was as high as three at one time (Bouchard et al. 1991). One of these populations was later re-identified as Robbins' Milk-vetch by Barneby, another one was later revised to Elegant Milk-vetch by Morisset (COSEWIC 1997), and the third was still considered to be Fernald's Milk-vetch in COSEWIC (1997).

Recent unpublished preliminary genetic studies have been inconclusive in distinguishing Fernald's Milk-vetch from Robbins' Milk-vetch or even from Elegant Milk-vetch, and further study is warranted (Lynn Gillespie, Canadian Museum of Nature, pers. comm. 2005).

In the status report (COSEWIC 1997) Morisset distinguished Fernald's Milk-vetch from Elegant Milk-vetch (*Astragalus eucosmus*) by a single character, a stalk (stipe) of its seed pod over 0.4 mm long. However, he used a combination of two characters to distinguish Fernald's Milk-vetch from Robbins' Milk-vetch (*Astragalus robbinsii* var. *minor*). He classified a specimen as Fernald's Milk-vetch if it either had a stipe less than 3 mm long and a hairy upper side of the leaflets, or as Robbins' Milk-vetch if the stipe was over 3 mm long, the tops of the leaves were hairless, or both. He was not firmly convinced that this was the best treatment, but believed it to be the best possible at the time (COSEWIC 1997).

John Maunder, Curator Emeritus of Natural History, Provincial Museum of Newfoundland and Labrador, recently examined dried milk-vetch specimens from each of the populations in the Blanc Sablon area of Québec, Newfoundland, and Labrador that were deposited at the Herbarium of the Provincial Museum of Newfoundland and Labrador (NFM) or the Herbier Marie-Victorin at the Université de Montréal (MT). He measured the stipe, pod and flower length, and assessed pod shape, and the hairiness of both the pods and upper leaf surfaces. In addition, he examined the morphology and colour of fresh flowers of many of the same populations in the field and from digital photographs.

For populations considered to be Fernald's Milk-vetch and its closely related taxa John Maunder (pers. comm., 2006) noticed considerable variety, both within single localities and between different populations currently ascribed to the same species. This work suggests that it would be of great value to re-examine the taxonomic concepts of

Fernald's Milk-vetch, Robbins' Milk-vetch and Elegant Milk-vetch. Taxonomic issues pertaining to specific populations are discussed in the following section.

1.5 Distribution and Population

Astragalus robbinsii, as a species, is primarily western North American Cordilleran, occurring widely in Alaska, British Columbia, Alberta, Washington, Oregon, Idaho, Montana, Colorado and Wyoming. Over most of the range of the species it is represented by *Astragalus robbinsii* var. *minor*, the most common variety in the west. However, it is also sparsely represented in eastern North America by very scattered, disjunct populations. These eastern populations have been recognized as four distinct varieties: var. *robbinsii* (Vermont - probably now extinct), var. *jesupi* (New Hampshire, Vermont), var. *minor* (Vermont, Maine, and Nova Scotia), and var. *fernaldii* (Québec, Labrador, Newfoundland) (Barneby 1964).

According to the status report (COSEWIC 1997) Fernald's Milk-vetch (*Astragalus robbinsii* var. *fernaldii*) is only found in Canada, where it is endemic to the Strait of Belle Isle region of the Gulf of St. Lawrence (Figure 1).

Québec and Labrador Border Populations

The bulk of the population is found in the Blanc Sablon area of Québec with an original population estimate of 18,000 individuals at four sites (COSEWIC 1997). The nearby Labrador border population falls just on the Labrador side of the Québec/Labrador border, mostly on the southern side of the highway. This population was estimated at 1000 individuals (COSEWIC 1997). However, during a much more intensive survey in 2004 by Guy Jolicoeur (Recovery Coordinator, Biodiversity Division, Ecosystems and Biodiversity Service, Natural Heritage and Parks Directorate, Ministère du Développement Durable, de l'Environnement et des Parcs, pers. comm., 2004) approximately 45,800 plants were found in Québec and 4600 in Labrador. Most of the Labrador population occupies an area of 300 x 300 m. During this intensive survey a few small and isolated patches, with a total of approximately 70 plants, have been recorded at location coordinates 1 km to the north of the main population.

At each site in Québec, and also at the Labrador border site, John Maunder (pers. comm., 2006) observed considerable variability in stipe length and hairiness characteristics of the pods and upper leaf surfaces among the milk-vetch plants. Many of the plants at Cap Crow (the westernmost population in Québec), which is thought to be (John Maunder, pers. comm. 2006) the type location for Fernald's Milk-vetch, seemed to match the official description of the variety. However, some individuals from the Blanc Sablon area localities, and especially from Île au Bois and the Labrador border site, seemed to be indistinguishable from Elegant Milk-vetch and intermediate individuals were also observed (John Maunder, pers. comm., 2006). The similarity of the milk-vetches from Île au Bois and some individuals from Mt. Parent to Elegant Milk-vetch was already noted by Morisset (COSEWIC 1997) who hypothesized that these populations could have

originated by hybridization. However, he did not consider that perhaps both taxa, and hybrids between them, could currently coexist at these sites.

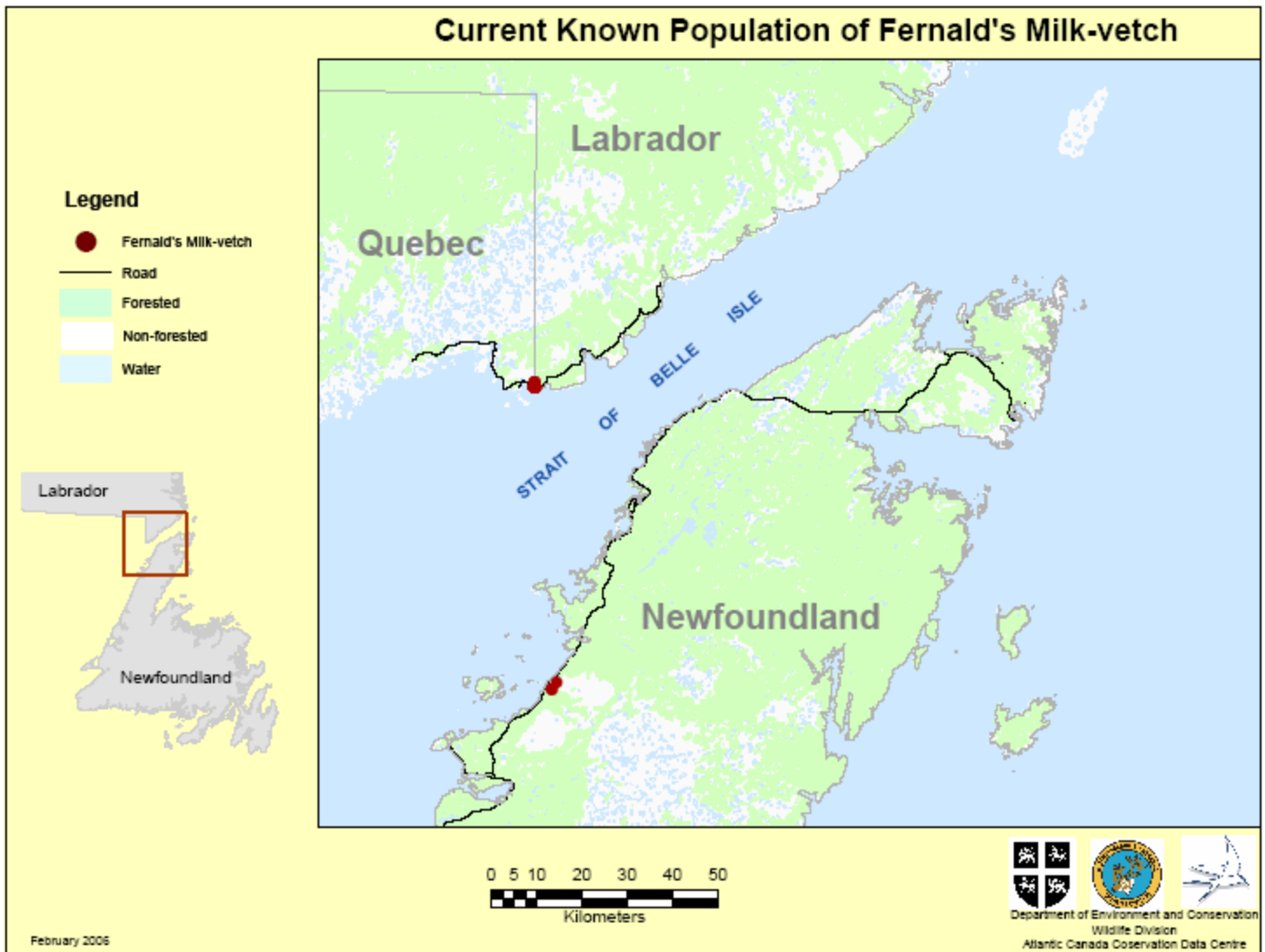


Figure 1. Newfoundland and Labrador locations for Fernald's Milk-vetch (*Astragalus robbinsii* var. *fernaldii*) shown in the COSEWIC (1997) status report

Barr'd Harbour Hill Population

Another population considered to be Fernald's Milk-vetch in the status report (COSEWIC 1997) is located on Barr'd Harbour Hill on the Great Northern Peninsula of Newfoundland. One of the original specimens collected on Barr'd Harbour Hill in 1925 by Wiegand, Gilbert and Hotchkiss is kept at the Université de Montréal (MT). An examination of this specimen revealed that it was originally identified by Wiegand as "*Astragalus Blakei*", which is now considered a synonym of *A. robbinsii* var. *minor* (Meades et al. 2000). In 1962, Boivin re-determined Wiegand's specimen as "*Astragalus euocosmus* var. *fernaldii*". Since then, *Astragalus euocosmus* var. *fernaldii* has been synonymized with *Astragalus robbinsii* var. *fernaldii* (Meades et al. 2000).

At the time of the preparation of the status report (COSEWIC 1997) the Barr'd Harbour Hill population had not been seen for 72 years. However, in 2002, it was relocated as part of the Newfoundland Rare Plant Project (Fitzgerald, 2002). The size of this population was estimated at several hundred individuals.

Based upon an analysis of the colour and morphology of fresh flowers, the shape of the pods, and the length of the stipe, John Maunder (pers. comm., May 2006) noticed the similarity of the Barr'd Harbour Hill plants relocated in 2002 to some plants at L'Anse Amour in southern Labrador which were determined to be *Astragalus robbinsii* var. *minor* by Morisset (COSEWIC 1997), as well as their dissimilarity to the Blanc Sablon var. *fernaldii* plants. Maunder strongly believes that the Barr'd Harbour Hill plants sampled in 2002 belong to the same population as those seen in 1925 and that this population is *Astragalus robbinsii* var. *minor* (pers. comm. May 2006).

Recently two fruiting milk-vetch plants were observed at the base of Doctor Hill, the southern plateau of the Highlands of St. John, approximately 8 km from Barr'd Harbour Hill. The tops of the leaves were slightly hairy, but these plants were identified as Robbins' Milk-vetch based upon pod shape, and stipe length which in some cases exceeded 3 mm.

Distribution of Related Taxa

The two other milk-vetch taxa closely related to Fernald's Milk-vetch - Robbins' Milk-vetch (*Astragalus robbinsii* var. *minor*) and Elegant Milk-vetch (*Astragalus euocosmus*) - are also found in Newfoundland and Labrador, and are both considered to be rare in the Province.

Populations presently considered to be Robbins' Milk-vetch are found in Newfoundland at St. Paul's Inlet, on Fang Mountain in Gros Morne National Park, at Doctor Hill and in Labrador at L'Anse-Amour and on the Red Cliffs near L'Anse-au-Loup.

Populations currently identified as Elegant Milk-vetch occur near Corner Brook, along Indian Brook, along the Exploits River near both Grand Falls and Bishops Falls, on Big Hill in Gros Morne National Park, on Portland Head, and at several different sites near

the northern tip of the Great Northern Peninsula between Quirpon Island and Cooks Harbour. There are also several historic populations (not relocated for at least 48 years) at Middle Arm of the Bay of Islands, Deer Lake, and Hare Bay (northeastern Great Northern Peninsula). Elegant Milk-vetch is also reported from northern Labrador (Meades et al. 2000), and according to Maunder (pers. comm., 2006) some plants collected at Fox Cove near L'Anse Amour, Labrador, also appear to be Elegant Milk-vetch.

At several of these Elegant Milk-vetch populations the stipes have been observed to be somewhat longer than the 0.4 mm used by Morisset (COSEWIC 1997) to distinguish this species. In particular, the populations at Indian River and Corner Brook appeared to be intermediate between Elegant Milk-vetch and Robbins' Milk-vetch with respect to both stipe length and pod shape. The Corner Brook population was even considered to be Robbins' Milk-vetch by Morisset (COSEWIC 1997). However, the plants from these two sites do not resemble Fernald's Milk-vetch in other characteristics, such as hairiness of the top of the leaflets.

At this point it is not known how much of the variation between populations can be attributed to habitat differences. Until the taxonomic status of Fernald's Milk-vetch has been clarified and the identity of the two populations identified as belonging to this variety in the status report (COSEWIC 1997) has been conclusively resolved by taxonomic analysis, this management plan will consider the taxonomic concept of Fernald's Milk-vetch and the populations identified as this taxon, to be those outlined in the 1997 COSEWIC report.

2. Legal Status

In 2001, Fernald's Milk-vetch was listed as a species of Special Concern under the federal *Species at Risk Act* (SARA) and listed as Vulnerable in Newfoundland and Labrador under the provincial *Endangered Species Act*. In Québec it is listed as Threatened under the *Loi sur les espèces menacées ou vulnérables/Act Respecting Threatened or Vulnerable Species*. It is ranked globally as G5T1, nationally as N1 and provincially as S1.

3. Threats

While the main threats to the Québec populations of Fernald's Milk-vetch are off-road vehicles, trampling and snow fences, the largest population of Fernald's Milk-vetch in the Province of Newfoundland and Labrador, the Labrador border population, is under threat from illegal rock quarrying activities. The Quarry Materials Division, Mines Branch, Department of Natural Resources is aware of quarry activity that is illegal under the *Quarry Materials Act* that had occurred in the area (Fred Kirby, Project Geologist, Quarry Materials Management, Mineral Lands Division, Mines Branch, Department of

Natural Resources, Government of Newfoundland and Labrador, pers. comm. 2006) and is pursuing this issue through enforcement measures.

The site is close to the main highway linking southeastern Labrador with the Blanc Sablon Ferry and is located within a few kilometers of several communities. At least part of the site is relatively level, and there is potential for off-road vehicle travel to occur in areas occupied by the plants. However, it has not been determined whether off-road vehicle use occurs to an extent to cause concern.

No current threats have yet been identified for the small outliers of the Labrador populations that occur approximately 1 km to the north of the main population.

Potential biological threats to Fernald's Milk-vetch could include disease and pest infestation. Some plants at the Labrador border site were observed to be infected with a rust fungus, possibly of the genus *Uromyces* (John Maunder, pers. comm. 2006). Similar fungus infection of milk-vetches and Alpine Sweet-vetches (*Hedysarum alpinum*) was also observed nearby at Point Amour in 2004. There are no data about the severity of the fungus infection. Its potential to reduce the milk-vetch population should be further investigated.

The Barr'd Harbour Hill population in Newfoundland is in a remote area and not under any obvious or immediate threat. The plants are located on ledges on a steep slope below the summit of a mountain plateau and are protected to some extent by the inaccessibility of the site. There is no road access to the area and it can only be reached by hiking or by helicopter.

Climate change is a potential threat that could conceivably affect both populations. Climatic warming could result in a denser cover of taller vegetation, which would likely result in increased competition, making the habitat less suitable for Fernald's Milk-vetch. Any changes affecting snow depth and the availability of moisture throughout the year may also potentially reduce habitat quality. The effects of climate change would likely be slow-acting, but could result in a population decline over several decades.

4. Monitoring History

In 1994 Morisset inventoried the Québec populations, and also the Labrador border population, which he thought was in the Province of Québec (COSEWIC 1997). He estimated the size of the border population at 1000 individuals (COSEWIC 1997). Specimens were collected from this population in 1999 and again in 2002 as part of the Newfoundland Rare Plant Project, but no population count was done. In 2002 some samples for a preliminary genetic analysis were taken. John Maunder (pers. comm. 2004) recorded location coordinates for seven patches. He collected some voucher specimens, now deposited at the herbarium of the Provincial Museum of Newfoundland and Labrador, and also took digital photographs of some of the plants, which can be found on the "A Digital Flora of Newfoundland and Labrador Vascular Plants" website at

http://www.digitalnaturalhistory.com/genus_astragalus_index.htm. Subsequent surveys by the Quebec Ministry of Environment (Natural Heritage and Sustainable Development Directorate) were conducted in Labrador and adjacent Québec in 2002 and 2004. The 2004 survey was especially thorough, with approximately 4600 individuals being located during 4 survey days (Guy Jolicoeur, pers. comm. 2004). Although no permanent monitoring plots were established, this survey provides a good baseline against which to judge any population trends.

Since its discovery in 1925 the Barr'd Harbour Hill population was not relocated until 2002 as part of the Newfoundland Rare Plant Project. In 2002 the population was estimated as several hundred individuals, but a count was not done. Due to the remoteness of the site and difficulty of the terrain limited exploration of the potential habitat area. The site was revisited in 2003 by Nathalie Djan-Chékar, but no attempt to count the plants was made. Therefore, the full extent and size of the population are currently unknown. It may only be possible to perform a partial population census to avoid placing the observers into dangerous situations inherent in the steepness of the mountain slope.

5. Knowledge Gaps

An indication of the taxonomic difficulties of the genus *Astragalus* in Newfoundland and Labrador has been presented above. In the light of the great within-and-between population variability of several morphological characters, such as stipe length, pod length and shape, flower colour and shape, and pod and leaf hairiness, it is necessary to investigate how many taxonomic entities are worthy of recognition as species or varieties, their relationships to each other, and which populations can be ascribed to each taxon.

Although the Newfoundland Rare Plant Project (1999-2002) and other recent rare plant surveys included efforts to locate additional populations of any rare plants, including milk-vetches, none of the milk-vetches found were determined to be Fernald's Milk-vetch. However, it is possible that some populations matching the COSEWIC (1997) species concept of Fernald's Milk-vetch remain undiscovered, especially in as yet unexamined areas of potentially suitable habitat between L'Anse-au-Clair and Forteau in southeastern Labrador.

Population trends are not known for either of the two locations in Newfoundland and Labrador identified as Fernald's Milk-vetch by COSEWIC (1997). Also, many important parameters of the life history and reproductive biology of the variety have not been documented. These include the maximum and average age of the plants, age at first reproduction, pollination requirements, rate of seed set, average and maximum seed dispersal distance, germination requirements, and seedling and adult survival.

The rust fungus observed on Fernald's Milk-vetch at the Labrador border has not been identified to species and it is not known to what extent it kills plants or represses reproduction and whether it represents a threat to the population.

II Management

6. Goals and Objectives

6.1 Goals

The management goal is to maintain (or enhance where feasible) the current population and distribution of Fernald's Milk-vetch within the Province of Newfoundland and Labrador, using the most current scientific species-concept available.

6.2 Objectives

To reach the stated goal, six objectives have been identified. They are:

- I. **Habitat Protection.** Protect the critical habitat of the populations currently identified as Fernald's Milk-vetch or which are determined to be Fernald's Milk-vetch in the future.
- II. **Taxonomic Studies.** Determine whether Fernald's Milk-vetch should be recognized as a separate taxon or just a minor variation. If the taxon is considered to be valid, determine which milk-vetch populations in the province belong to this taxon.
- III. **Threat Assessment and Mitigation.** Assess which agents or activities represent current or potential threats, and propose mitigation measures for each threat.
- IV. **Inventory and Monitoring Program.** Establish a monitoring program for populations determined to be Fernald's Milk-vetch.
- V. **Status Re-evaluation.** Re-assess the taxon, which may result in re-designation of its status.
- VI. **Outreach and Education.** Include the description and status of Fernald's Milk-vetch in public education literature and establish links with nearby communities.

7. Management Actions

An adaptive management approach will be followed to ensure that new information is included in the protection of the species. As information becomes available that can affect the management of the species, it will be incorporated as soon as it is practical to

do so. Due to the taxonomic uncertainties about this milk-vetch variety, the management program will have to be exceptionally flexible. It is possible that the taxonomic study will change the scientific concept of Fernald's Milk-vetch to a significant degree so that the management program has to be substantially modified.

The approach outlined in this section will consist of two distinct phases. The first phase will use the species concept of Fernald's Milk-vetch as outlined in the status report (COSEWIC 1997). The aim of this phase is to re-evaluate this species concept, and to protect and monitor populations currently identified as Fernald's Milk-vetch in the interim.

The management actions taken in the second phase of the project will depend to a large degree on the outcome of the taxonomic study. Several scenarios are possible, and each will require a different management approach. It is possible that Fernald's Milk-vetch will be confirmed as a valid taxon, and that the new species concept will apply to either one or both of the populations currently identified as Fernald's Milk-vetch. It is also possible that neither of the two Newfoundland and Labrador populations will match the new species concept or that some populations currently identified as Elegant Milk-vetch or Robbins' Milk-vetch may be included in the new concept of Fernald's Milk-vetch. Furthermore it is also possible that Fernald's Milk-vetch will be determined to be a minor variation of one of the other species or a hybrid, and will not be recognized as a taxon eligible for status assessment.

Any other management actions will be delayed until the results of the taxonomic study become available. The actions proposed for the second phase will be using the new species concept produced during the taxonomic study. The management actions proposed for this phase will only apply if Fernald's Milk-vetch is upheld as a valid variety and at least one milk-vetch population within the province of Newfoundland and Labrador is found to belong to this variety.

7.1 Habitat protection

Until the taxonomic issues are resolved, efforts will be made to protect habitat quality in the areas inhabited by the populations currently identified as Fernald's Milk-vetch.

Current Actions

At the Labrador border location clusters of individual plants have been delineated, mapped and incorporated into a computer-based Geographic Information System. For the locations in Québec, and also the Labrador Border population, critical habitat has been mapped and will soon be gazetted by the Québec government. (Line Couillard, pers. comm. 2006).

The area around the main Labrador border population has been designated a Sensitive Wildlife Area by the Interdepartmental Land Use Committee (ILUC) in 2003, with the Mineral Lands Division of the Department of Natural resources agreeing to a moratorium

on rock quarry operations. No new quarry permits have been issued for the area, but mineral exploration may continue if no major ground disturbance is involved.

Some illegal quarrying has been observed in the area, and the Department of Natural Resources has erected signs stating that quarrying in the area is prohibited and outlining the minimum fine if convicted. In addition, the Department of Natural Resources has recently installed signs produced by the Wildlife Division that inform visitors to the site about the presence of Fernald's Milk-vetch, its status as a Vulnerable plant, and about which activities can damage the plants.

Proposed actions

Even if the plants at the Labrador Border site are determined to be something other than Fernald's Milk-vetch it is not recommended that the moratorium on quarrying in the area be lifted. Even if all of the populations of large milk-vetches in the province were determined to be a single species, this species would likely still be considered rare.

The Barr'd Harbour Hill population is located in a remote area within a proposed ecological reserve. If the proposal to establish an ecological reserve in the area is unsuccessful, other avenues of habitat protection, including designating the site as a sensitive wildlife area, will be explored.

Protection as Sensitive Wildlife Areas will also be considered if additional Fernald's Milk-vetch populations are located on crown land or if any populations of milk-vetch on crown land currently identified as a different species are re-identified as Fernald's Milk-vetch by the taxonomic study.

The possibility of stewardship agreements will be examined if any populations of milk-vetch on private land are identified as Fernald's Milk-vetch.

7.2 Research

Due to the uncertainty about the validity of Fernald's Milk-vetch as a valid taxon, and about the identity of specific populations (John Maunder, pers. comm. 2006), a taxonomic study will be conducted. Morphological and genetic analyses will be conducted on all populations currently identified as Fernald's Milk-vetch, as well as populations of the closely related Robbins' Milk-vetch and Elegant Milk-vetch, to investigate the taxonomy of this section of the genus *Astragalus* and resolve the identities of individual populations.

Given the known range of morphological diversity within *Astragalus*, it is likely that these studies will prove more definitive in species identification. Sampling milk-vetches belonging to this species complex throughout their North American range would clarify how many distinct species and/or varieties exist within the complex and whether any of the Newfoundland and Labrador populations fall within taxa that are restricted or highly disjunct in distribution, or perhaps even endemic to the province.

Research is also required to determine the identity of the rust fungus which has been observed to infect individuals in the Labrador border population. During population monitoring efforts, the prevalence of this fungus should be assessed, and a determination should be made on whether this fungus may be a threat to the survival of the milk-vetches and related plants.

7.3 Inventory, Monitoring and Assessment

A monitoring program will be established to document population trends and to determine whether any threats have intensified and/or whether mitigation measures have been successful. During the monitoring surveys information regarding distribution, population size, population health and health of adjacent vegetation communities, as well as any indications of threats to the populations, will be recorded.

Since complete population counts would be very time consuming, monitoring will be done on a subsample of the populations. Permanent monitoring plots will be established to facilitate the survey. Also, the known extent of the populations will be mapped during each re-survey to determine whether the area occupied by Fernald's Milk-vetch is increasing or decreasing.

The Labrador border site will be given priority for monitoring efforts as it is more accessible and is known to be under threat. It will be surveyed every three years, with more frequent monitoring if new threats, significant population declines, or damage to the habitat are identified.

The Barr'd Harbour Hills site is very inaccessible and is not currently known to be under threat, except perhaps by climate change. This site will not be the target of a detailed monitoring program unless the milk-vetch population there is confirmed to be Fernald's Milk-vetch. However, if it is necessary to visit the site to collect material for the taxonomic study, survey efforts will include an investigation of the extent of the suitable habitat and population size. It is likely that some potential habitat patches cannot be visited due to their location on and around dangerous cliffs.

When the results from the taxonomic study have been obtained, an initial survey and subsequent monitoring will be extended to all sites identified as harbouring Fernald's Milk-vetch according to the revised species concept. In the unlikely event that the number of known Fernald's Milk-vetch locations increases to the point where it is no longer feasible to monitor all sites, representative sites will be used.

If during the taxonomic investigation it becomes clear that some taxa of milk-vetch other than Fernald's Milk-vetch are determined to be very rare in Newfoundland and Labrador, the populations belonging to these taxa will be surveyed in anticipation of future status assessment.

7.4 Other Management Actions

The provincial status designation as Vulnerable followed a similar designation as Special Concern by COSEWIC. However, the bulk of the Fernald's Milk-vetch population is located in Québec, and only two sites are found in the Province of Newfoundland and Labrador. One of these sites is very accessible and is currently under threat from illegal quarrying. If only these two populations were to be considered in a status assessment, it is likely that the taxon would qualify to be up-listed to Endangered or Threatened provincially according to the criteria set out in the Annual Report of the Species Status Advisory Committee (SSAC 2004-2005).

If as a result of the taxonomic study the species concept of Fernald's Milk-vetch is substantially altered, it is likely that the populations assigned to this taxon will change also. It is also possible that some sites, where all plants are currently identified as Fernald's Milk-vetch, will be found to harbour several different taxa, and perhaps hybrids. These potential outcomes of the taxonomic study indicate a need for status re-assessment but it would be prudent to delay this re-assessment until completion of the study.

7.5 Outreach and Communications

Further incorporation of information about Fernald's Milk-vetch into documents produced by the Wildlife Division will be delayed until the results from the proposed taxonomic study have been obtained.

If this study upholds Fernald's Milk-vetch as a valid variety, and some populations within the province are confirmed to belong to this variety, Fernald's Milk-vetch will be included in the general provincial awareness campaign on rare and endangered species. This would include the provincial Department of Environment and Conservation's Wildlife at Risk website, posters and brochures. Existing fact sheets will be updated.

Councils, schools and non-government organizations in adjacent communities will be specifically targeted in outreach efforts. For the currently identified populations these communities would be L'Anse-au-Clair, L'Anse-Amour hamlet, Forteau and L'Anse-au-Loup in Labrador, and Hawke's Bay, Port Saunders, Eddies Cove West, and Castor's River South in Newfoundland.

7.6 Evaluation

The near-term objectives (5 years) of this management plan will be considered successfully completed if:

1. The size and health of populations identified as Fernald's Milk-vetch in the status report (COSEWIC 1997) are maintained at, or exceed, current levels.
2. Any threats to these populations have been halted or mitigated to the best extent possible.
3. A taxonomic study has been conducted on the Newfoundland and Labrador milk-vetches and it has been determined whether Fernald's Milk-vetch should be recognized as a valid taxon, and if yes, it has been determined which populations within the province belong to this taxon.
4. If Fernald's Milk-vetch has been upheld as a valid taxon by the scientific studies, and the number of known locations within the province has not increased enough to de-list the taxon, Fernald's Milk-vetch has been re-assessed by the Species Status Advisory Committee and has been listed appropriately within the province.
5. If Fernald's Milk-vetch has been upheld as a valid taxon, a monitoring program that provides regular quantitative data on the trends of, and threats to, each of the populations has been established.

8. Summary Table

Priority	Objective	Broad Approach	Threat addressed	Specific Steps/Actions	Outcomes or Deliverables
Phase I					
Urgent	II	Morphological and Genetics Studies	n/a	<ul style="list-style-type: none"> Determination and description of distinct taxonomic entities using DNA and morphological characters. Comparison of morphology and DNA from all Fernald's Milk-vetch and Newfoundland and Labrador populations of closely related milk-vetches. 	<ul style="list-style-type: none"> Updated definitions of taxonomic entities (species and varieties) and a key to distinguish among these taxa. Confirmation or rejection of Fernald's Milk-vetch as a valid taxon. Confirmation or rejection of individual populations as Fernald's Milk-vetch.
Necessary	IV	Population Monitoring	n/a	<ul style="list-style-type: none"> Establishment of permanent sampling plots Periodic re-surveys of these plots 	<ul style="list-style-type: none"> Quantification of future population trends.
Necessary	III	Threat Assessment	off-road vehicle traffic	<ul style="list-style-type: none"> Visually inspect the area for tracks produced by motor vehicles, especially in Fernald's Milk-vetch habitat 	<ul style="list-style-type: none"> Knowledge of whether the area is used for driving motor vehicles and if yes, whether this activity has caused plant damage
Necessary	IV	Inventory	n/a	<ul style="list-style-type: none"> Search of a roadless coastal area in Labrador near L'Anse-au-Clair for Fernald's Milk-vetch 	<ul style="list-style-type: none"> It has been determined by a survey if the area contains any milk-vetches.
Necessary	III	Threat Assessment	Fungus infection	<ul style="list-style-type: none"> Determination of the identity of rust fungus infecting the Labrador border population Assessment of whether the rust fungus poses a threat 	<ul style="list-style-type: none"> The rust fungus is identified to species and it is known whether it is introduced or native Infection rates have been quantified

Priority	Objective	Broad Approach	Threat addressed	Specific Steps/Actions	Outcomes or Deliverables
Phase II (These actions may be modified based on the outcome of the taxonomic study)					
Urgent	I	Habitat Protection	unknown	<ul style="list-style-type: none"> Recommendation to designate the habitat of newly identified Fernald's Milk-vetch populations as Sensitive Wildlife Areas 	<ul style="list-style-type: none"> Newly identified Fernald's Milk-vetch populations are protected by ILUC as Sensitive Wildlife Areas.
Urgent	III	Threat Assessment	all	<ul style="list-style-type: none"> Survey of newly identified Fernald's Milk-vetch populations to assess threats 	<ul style="list-style-type: none"> The severity of threats to newly identified Fernald's Milk-vetch populations is known.
Urgent	IV	Population Monitoring		<ul style="list-style-type: none"> Establishment of permanent sampling plots newly identified Fernald's Milk-vetch populations using the same protocol as in Phase I. Periodic re-surveys of these plots 	Quantification of population trends of newly identified Fernald's Milk-vetch populations.
Necessary	V	Status Re-assessment	n/a	<ul style="list-style-type: none"> Determination of whether the current designation is appropriate to the status of the population. 	<ul style="list-style-type: none"> A new designation that is appropriate to the status of the taxon.
Beneficial	VI	Public Outreach	n/a	<ul style="list-style-type: none"> Publication of literature on Fernald's Milk-vetch. 	<ul style="list-style-type: none"> Increase in public awareness of issues regarding Fernald's Milk-vetch and its protection.

9. Implementation Schedule

Action	Objective	Lead	Other	Year				
				1 2006	2 2007	3 2008	4 2009	5 2010
Taxonomic study	II	Lynn Gillespie, Canadian Museum of Nature, Ottawa	M.Sc. student, Wildlife Division, Department of Environment and Conservation		x	x	x	
Threat assessment of Labrador Border site	III	Wildlife Division, Department of Environment and Conservation		x				
Establishment and Implementation of a monitoring program	IV	Wildlife Division, Department of Environment and Conservation		x	x	x	x	x
Search of potential habitat for milk-vetches in SE Labrador	IV	Wildlife Division, Department of Environment and Conservation		x				
Development of educational materials	VI	Wildlife Division, Department of Environment and Conservation						x
Status re-assessment	V	COSEWIC				?		

10. Contact Information

Ecosystem Management Ecologist (Botany), Endangered Species and Biodiversity Section, Wildlife Division, Department of Environment and Conservation, Government of Newfoundland and Labrador. P.O. Box 2007, Corner Brook NL. A2H 7S1. Telephone: (709) 637-2019. Facsimile: (709) 637-2004.

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