

RECOVERY PLAN FOR THE EASTERN MOUNTAIN AVENS (*GEUM PECKII*) IN NOVA SCOTIA



**A recovery plan adopted by the Nova Scotia Department of Lands and
Forestry**

2021 - 2026



Recommended citation:

Nova Scotia Department of Lands and Forestry. 2021. Recovery Plan for the Eastern mountain avens (*Geum peckii*) in Nova Scotia [Final]. *Nova Scotia Endangered Species Act Recovery Plan Series*.

Cover illustration: Eastern mountain avens (*Geum peckii*).

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Adoption of a Recovery Plan per Section 15(9) of the Endangered Species Act

Species:

Eastern mountain avens (*Geum peckii*)

Reference:

Environment Canada. 2010. Recovery Strategy for the Eastern Mountain Avens (*Geum peckii*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 17 pp. + Appendices.

Environment and Climate Change Canada. 2018. Action Plan for the Eastern Mountain Avens (*Geum peckii*) in Canada. Species at Risk Act Action Plan Series. Environment and Climate Change Canada, Ottawa. v + 23 pp.

Whereas a Species at Risk Act Recovery Strategy has been prepared for this species by Environment Canada, and that plan has been reviewed by members of the applicable Nova Scotia Recovery Team and determined to fulfil the requirements of Section 15(4) of the Endangered Species Act as they pertain to Nova Scotia, the above-named recovery plan and action plan shall be adopted in lieu of a Nova Scotia Recovery Plan subject to the following:

Date of Adoption: 13 February 2021

Expiry/renewal Date: 13 February 2026

Conditions:

1. Adoption of this recovery plan will be reviewed 5 years from the Date of Adoption.
2. Only elements of this plan that are relevant to Nova Scotia and are in accordance with the Endangered Species Act (Nova Scotia) shall be used. This includes the following sections of the reports:

Environment Canada (EC 2010): 1. Background, 2. Recovery, 3. References, Appendix A, B, C.

Environment and Climate Change Canada (ECCC 2018): 1. Recovery Actions, 4.

References, Appendix A.

3. The Nova Scotia Plants Recovery Team explicitly endorsed the adoption of critical habitat as described in this Recovery strategy and Action plan in lieu of core habitat and that core habitat be described as laid out in Section 2.6 (EC 2010) and Section 1.3 (ECCC 2018).
4. Should any additional requirements be identified, the Nova Scotia Department of Lands and Forestry may prepare an addendum to this plan under the Endangered Species Act.

Approved:

A handwritten signature in black ink that reads "D. Hurlburt".

Donna Hurlburt, Manager of Biodiversity

Date:

13 February 2021

Appendix A:

Environment Canada. 2010. Recovery Strategy for the Eastern Mountain Avens (*Geum peckii*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 17 pp. + Appendices.

Recovery Strategy for the Eastern Mountain Avens (*Geum peckii*) in Canada

Eastern Mountain Avens



2010



Environment
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About the *Species at Risk Act* Recovery Strategy Series

What is the *Species at Risk Act* (SARA)?

SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is “*to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity.*”

What is recovery?

In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed and threats are removed or reduced to improve the likelihood of the species’ persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

What is a recovery strategy?

A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies — Environment Canada, Parks Canada Agency, and Fisheries and Oceans Canada — under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA (www.sararegistry.gc.ca/approach/act/default_e.cfm) outline both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. A period of three to four years is allowed for those species that were automatically listed when SARA came into force.

What’s next?

In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

The series

This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

**Recovery Strategy for the Eastern Mountain Avens (*Geum peckii*) in
Canada**

2010

Recommended citation:

Environment Canada. 2010. Recovery Strategy for the Eastern Mountain Avens (*Geum peckii*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vii + 17 pp. + Appendices

Additional copies:

Additional copies can be downloaded from the SAR Public Registry (www.sararegistry.gc.ca/)

Cover illustration: Eastern Mountain Avens on Brier Island, NS. Photo by June Swift

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DECLARATION

This recovery strategy has been prepared in cooperation with the jurisdictions responsible for the Eastern Mountain Avens. Environment Canada has reviewed and accepts this document as its recovery strategy for the Eastern Mountain Avens, as required under the *Species at Risk Act* (SARA). This recovery strategy also constitutes advice to other jurisdictions and organizations that may be involved in recovering the species.

The goals, objectives, and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives.

This recovery strategy will be the basis for one or more action plans that will provide details on specific recovery measures to be taken to support conservation and recovery of the species. The Minister of the Environment will report on progress within five years, as required under SARA.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada or any other jurisdiction alone. In the spirit of the Accord for the Protection of Species at Risk, the Minister of the Environment invites all responsible jurisdictions and Canadians to join Environment Canada in supporting and implementing this strategy for the benefit of the Eastern Mountain Avens and Canadian society as a whole.

RESPONSIBLE JURISDICTIONS

Environment Canada

Nova Scotia Department of Natural Resources

CONTRIBUTORS

This recovery strategy was prepared by Laurel Bernard, Sherman Boates, Crystal Doggett, Samara Eaton, Mark Elderkin, Julie McKnight, Ruth Newell, Gini Proulx, June Swift, and the Atlantic Coastal Plain Flora Recovery Team. Although Eastern Mountain Avens is not one of the group of species classified as Coastal Plain Flora, the relevant expertise of the Recovery Team members make it appropriate for them to act on behalf of this species.

STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of the Eastern Mountain Avens. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: description of the species, description of the biological needs of the species, examples of activities that are likely to result in the destruction of the critical habitat and effects on other species.

RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* [Subsection 2(1)].

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SAR Public Registry:
www.sararegistry.gc.ca/sar/recovery/residence_e.cfm.

PREFACE

The *Species at Risk Act* (SARA, Section 37) requires the competent minister to prepare recovery strategies for listed extirpated, endangered or threatened species. The Eastern Mountain Avens was listed as Endangered under SARA in June 2003 and under the Nova Scotia Endangered Species Act in 2000. Canadian Wildlife Service - Atlantic Region (Environment Canada) and the Nova Scotia Department of Natural Resources led the development of this Recovery Strategy. This is a five-year recovery strategy spanning 2010-2015. This recovery strategy meets SARA requirements and it also meets the particular requirements of recovery plans under the Nova Scotia Endangered Species Act (1998).

Although Eastern Mountain Avens is not one of the group of species classified as Coastal Plain Flora, the relevant expertise of the Recovery Team members makes it appropriate for them to act on behalf of this species.

The Recovery Strategy was developed in cooperation or consultation with numerous individuals and agencies: the Atlantic Coastal Plain Flora Recovery Team, Province of Nova Scotia (NS), Environment Canada, aboriginal groups; environmental non-government organizations; industry stakeholders; and private landowners.

An initial Recovery Strategy was developed by the Nova Scotia Department of Natural Resources in 2001. This 2010 Recovery Strategy builds on the earlier Strategy, retaining much of the content but including additional information as required under SARA.

EXECUTIVE SUMMARY

Eastern Mountain Avens (*Geum peckii*) is an endangered perennial herb producing small yellow flowers from June to September. The listing of this species is based on its very restricted and disjunct distribution and the considerable threat of destruction to its habitat. The Canadian population is one of only two global populations. The second population occurs in the United States in New Hampshire where the Eastern Mountain Avens appears in the New Hampshire Natural Heritage Inventory (New Hampshire Natural Heritage Bureau, 2006) as a state listed threatened plant species. The goal of this recovery strategy is to protect and maintain extant populations at current or greater levels of abundance with no reduction in the current range.

In Canada, the Eastern Mountain Avens is found in only eight sites; all in Nova Scotia. One site is on Digby Neck and the remainder are on Brier Island. Populations are usually found in boggy habitats where moisture levels can vary considerably. Populations within some sites have declined or disappeared entirely due to habitat loss and degradation.

The recovery activities described in this Recovery Strategy will be carried out in part or in whole within the next five years (2010-2015). The objectives for Eastern Mountain Avens are to:

1. Maintain Eastern Mountain Avens populations at occupied sites; 2. Improve conditions and enhance Eastern Mountain Avens populations at occupied sites; and 3. Improve conditions at previously occupied sites.

These objectives will be achieved through research, monitoring, management, education, and stewardship. Specific recovery approaches include:

- Research
 - Assess how to raise water-table level;
 - Continue genetic studies;
 - Explore methods of population and habitat enhancement;
 - Clarify habitat needs and characteristics;
 - Determine extent to which habitat alteration surrounding wetlands may threaten the species
- Monitoring
 - Monitor known occupied sites;
 - Monitor threats;
 - Confirm distribution data;
 - If bog restoration proceeds, monitor habitat characteristics at unoccupied suitable habitat;
- Management
 - Protect habitat at all sites;
 - Reduce off-highway vehicle traffic through habitat;
 - Restore pre-drainage water-table levels;
 - Reduce numbers of nesting gulls in the immediate vicinity of Big Meadow Bog;
 - Restore historic species composition to bog;

- Education
 - Provide quality educational materials and opportunities to raise the awareness of Eastern Mountain Avens;
- Stewardship
 - Foster cooperative relationships for Eastern Mountain Avens recovery with landowners, community, off-highway vehicle operators, volunteers (local naturalists, Nature Conservancy of Canada members) and ecotourists.

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1. BACKGROUND

1.1 Species Assessment Information from COSEWIC

Date of Assessment: May 2000

Common Name: Eastern Mountain Avens

Scientific Name: *Geum peckii*

COSEWIC Status: Endangered

Reason for Designation: A highly disjunct species occurring in a few sites at the northern edge of its range in North America. Some populations have undergone substantial declines due to habitat drainage and successional changes.

Canadian Occurrence: NS

COSEWIC Status History: Designated Endangered in April 1986. Status re-examined and confirmed Endangered in April 1999 and May 2000.

1.2 Description of the Species



The Eastern Mountain Avens (*Geum peckii*) is a rhizomatous perennial herb that produces attractive sunny yellow flowers from June to September. The shiny leaves are compound and consist of one large, rounded, terminal leaflet and several smaller lateral leaflets. The leaves are clustered around the plant's base while a separate flowering stalk (20 – 40 cm tall) carries one to five small (1-3 cm across), five-petaled yellow blooms.

Figure 1. *Geum peckii* illustration from Holmgren, 1998.

1.3 Populations and Distribution

Global and National Status

Global Status: G2 Imperiled (NatureServe, 2006)

Canada: National Status: N1 Critically Imperiled (NatureServe, 2006)

United States: National Status: N2 Imperiled (NatureServe, 2006)

Provincial and State Status

Nova Scotia, Canada: S1 Critically Imperiled (NatureServe, 2006)

New Hampshire, United States: S2 Imperiled (NatureServe, 2006)

Eastern Mountain Avens occurs only in eastern North America. It is known from two disjunct locations: Digby County, in Nova Scotia (NS), Canada and Mount Washington, in the Presidential Range of the White Mountains of New Hampshire, USA (Figure 2). These locations are the only two known in the world. The species was reported in Maine (Gleason and Cronquist, 1991); however, there are no records to substantiate this report.



Figure 2. Global distribution of the Eastern Mountain Avens (*Geum peckii*)

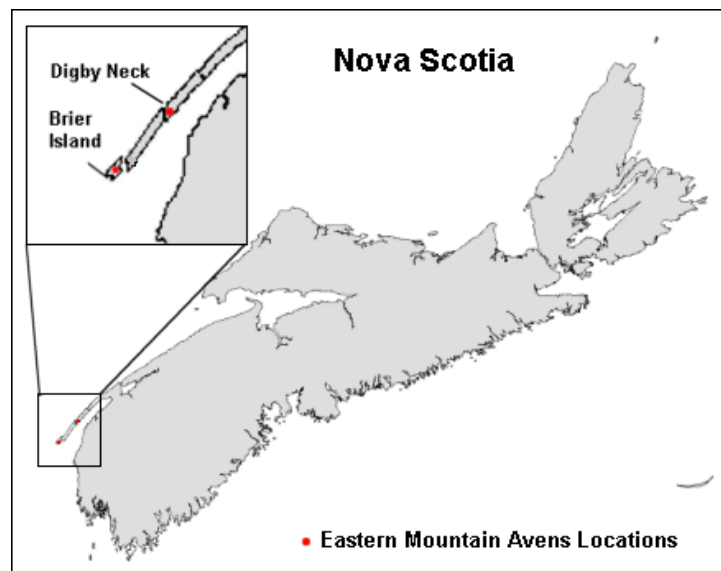


Figure 3. Distribution of Eastern Mountain Avens (*Geum peckii*) in Nova Scotia, Canada

As of 2006, there are 24 known sites with Eastern Mountain Avens in New Hampshire (New Hampshire Natural History Bureau, 2006). Surveys in 2008 identified nine sites with Eastern Mountain Avens in NS. However, the avens species found at Gooseberry Cove was later determined to be Water Avens (*G. rivale*) (S. Blaney, personal communication). These sites were found on Brier Island and in the East Ferry area of Digby Neck in Digby County, south-western NS (Figure 3).

On Brier Island, Eastern Mountain Avens occurs: at Green Head, along Gull Rock Road, in Big Meadow Bog, at Central Brier, at Little Pond, along the Camp Road, and at Western Light. The site at Digby Neck was discovered in 1997 and is situated in a bog south of Harris Lake on the outskirts of East Ferry (Newell and Proulx, 1998).

Population sizes and trends

Within the eight known sites in NS, there are approximately 18 stands of Eastern Mountain Avens. The largest stand contained 1327 plants, but most stands had less than 300 plants and many had less than 65 plants. Based on 2008 survey data, the total population of Eastern Mountain Avens in NS is estimated to be 2424 plants (NS DNR unpublished data). Keddy (1986) estimated the Canadian population to be a minimum of 5450 plants in 1986.

Table 1: Population data at sites and stands (1986-2008).

Site	Stand	Keddy (1986)	Newell & Proulx (1998) ^a	Brown (2003) ^a	Swift (2005)	Proulx (2006), Swift (2006)	Porter & Noel (2007)	NSDNR & ACCDC (2008)
Green Head	GH1	1,000+	-	-	-	-	-	112
	GH2	<1,000	-	-	-	-	-	37
	GH3	<1,000	-	-	-	-	-	0
	GH4	<1,000	-	-	-	-	-	113
	GH5	<1,000	-	-	-	-	-	61
Gull Rock Road	GR1	<1,000 (x4) ^b	-	2,026	134	113	-	274
	GR2	<1,000	-	-	-	-	-	0
Big Meadow	BM1	0	-	1,200	-	-	-	1,327
	BM2	1,000+	-	252	-	-	-	-
	BM3	1,000+	-	186	-	-	-	0
	BM4	1,000+	-	800	-	-	-	21
	BM5	1,000+	-	-	-	-	102 ^c	242 ^c
Central Brier	CB1	-	-	-	-	-	-	8
	CB2	-	-	-	-	-	-	13
Little Pond	LP	<1,000	-	-	-	-	-	-
Camp Road	CR	-	-	1,789	“significant decline”	190	-	166
Western Light	WL	<1,000	-	-	-	-	6	6 ^d

Site	Stand	Keddy (1986)	Newell & Proulx (1998) ^a	Brown (2003) ^a	Swift (2005)	Proulx (2006), Swift (2006)	Porter & Noel (2007)	NSDNR & ACCDC (2008)
Harris Lake	HL	-	300	-	-	“same area of occupancy”	-	44
TOTAL		5450 (min)						2,424

^a These surveys counted individual rosettes, rather than clumps and flowering stems as were counted in 2008.

^b Keddy (1986) mapped four separate populations of under 1000 plants within this site

^c Porter and Noel (2007) found their 102 plants within a slightly different area than was covered in 2008. Their numbers are added to the 140 plants observed in 2008 to get the overall total of 242.

^d Not checked in 2008, number based on Porter and Noel (2007) survey.

1.4 Needs of the Eastern Mountain Avens

1.4.1 Habitat needs

Eastern Mountain Avens habitat in NS appears to differ greatly from the New Hampshire populations. In New Hampshire, it occurs in alpine meadows and streamsides (Newell, 2002). In NS, it is found at sea level near the coast in boggy terrain and can occur under a variety of moisture regimes, from sphagnum bogs with small channels of open water to sphagnum depressions and even occasionally in dry depressions on mineral soil (Keddy 1986). Eastern Mountain Avens requires relatively undisturbed soil; any alteration to surface soils can negatively impact the plant’s survival.

1.4.2 Pollination

Small flies are considered to be the pollinator of Eastern Mountain Avens, with each flower producing approximately 50 seeds. Zinck (1996) determined the flowers to be protogynous (prior to pollen ripening, the female’s stigma becomes receptive) and herkogamous (spatial separation of male and female organs). Self-pollination has been experimentally shown to produce seeds but the number of seed yielded in this manner is fewer than yielded by cross-pollination (Zinck 1996).

1.4.3 Ecological role

Eastern Mountain Avens is part of a community of bog vegetation that is unique in Canada, and is found only in NS. Big Meadow Bog, the largest habitat location for Eastern Mountain Avens is also home to other rare plant species including various orchids, curly grass fern (*Schizea pussilla*) and northern dwarf birch (*Betula michauxii*) (Brown, 2003). The occurrence of both shrubby cinquefoil (*Potentilla fruticosa*) and deergrass (*Scirpus caespitosus*) has been noted wherever Eastern Mountain Avens occurs (Zinc 1996). There is limited research on Eastern Mountain Avens and, therefore, its specific ecological role is not well known.

1.4.4 Limiting factors

In NS, Eastern Mountain Avens is biologically limited by the following factors:

- small population size and globally limited distribution;
- requirement for specific hydrologic conditions in bogs;
- inability to compete for habitat.

1.5 Threats

Appendix C summarizes the historic and current threats to Eastern Mountain Avens. The threat information presented is based on documented research or expert opinions from members of the Recovery Team.

It is important to note that several of the threats are interrelated and the stresses on the species are likely a result of complex interactions of more than one threat. The additive or cumulative effects of the threats are difficult to assess and address; however, they must be considered wherever possible. The current threats identified may also be compounded by climate change; though there is uncertainty regarding how it may impact the species and its habitat. Specific detail is provided in the following section on six key threats.

1.5.1 Drainage ditches

In 1953, two drainage ditches were dug in Big Meadow Bog in an attempt to convert the land to agriculture use (Brown, 2003; Newell, 2002). The farming initiatives were abandoned, however the drainage ditches remain functional today (Brown, 2003). This has resulted in significant changes to the hydrological conditions of the bog and lowering of the water-table. These changes have impacted the habitat in Big Meadow Bog by direct destruction of habitat where ditches were created and dredged material was dumped, and by drying the bog, which appears to have reduced the amount of suitable habitat and limited the species' extent of occurrence. The lower water table has likely contributed to increased shrub encroachment and perhaps also increased suitability of the bog for gull nesting (S. Blaney, personal communication).

1.5.2 Gull nesting

A large population of Herring (*Larus argentatus*) and Great Black-backed Gulls (*Larus marinus*) has increased the amount of nutrients in the soil. Where gulls enrich the substrate, bog vegetation, including Eastern Mountain Avens, is completely eliminated and replaced with exotic weeds and ruderal native species such as Fireweed (*Chamerion angustifolium*) and Canada Goldenrod (*Solidago canadensis*) (S. Blaney, personal communication). With respect to the gull nesting in Big Meadow Bog, it is speculated that the ditching of the bog led to drier conditions which in turn provided the opportunity for a gull colony to establish, however this link is not well documented (S. Blaney, personal communication).

1.5.3 Tree and shrub encroachment

Many of the Brier Island sites are threatened by increasing cover from trees and shrubs. Several of the sites are only small openings within densely shrubby or semi-treed habitat where ingrowth has been observed in the past decade (S. Blaney, personal communication). Within the Green Head and Gull Rock Road sites tree and shrub encroachment may be a return to more natural conditions in areas which had been kept open in the past by livestock grazing. In Big Meadow Bog the encroachment is likely associated with the construction of the drainage ditches in the 1950's which lowered the water table and likely has promoted tree and shrub growth.

1.5.4 Development and road maintenance

There is the possibility of future housing and cottage development on Brier Island. Some current sites occur as little as 100 m away from existing roads and thus it is possible that future developments could fall within the areas where these stands exist (S. Blaney, personal communication). Road maintenance, ditching, or expansion can result in the alteration of surface soils and impact stands of Eastern Mountain Avens, particularly at Western Light, Green Head, and Gull Rock Road sites. In 1988 a stand was destroyed during the construction of a roadside ditch (Newell 2003).

1.5.5 Off-highway vehicle use

Off-Highway vehicles (OHVs) are widely used on Brier Island and have the potential to significantly damage or even eliminate small stands. However, some OHV activity in habitat surrounding Eastern Mountain Avens may actually afford short-term benefits through limiting competition from shrubs and allowing for establishment of Eastern Mountain Avens. A survey in 2005 recorded that Eastern Mountain Avens were growing heavily in a once used OHV path where a fallen tree prevented access to the stand (Swift 2005).

1.5.6 Lakeshore habitat alteration

This threat applies to the Digby Neck, Harris Lake site only and is the primary threat at this site. Any alteration to the lakeshore habitat associated with this wetland could impact the hydrology, altering the lakeshore water level, and thus habitat conditions of the site.

1.6. Actions Already Completed or Underway

NSDNR and the Nature Conservancy of Canada (NCC) have been actively involved in recovery efforts for Eastern Mountain Avens. NSDNR maintains a Geographic Information System (GIS) database of survey data. This data is provided by NSDNR staff and dedicated volunteers.

In 1998, the NCC purchased lands on Brier Island to protect Eastern Mountain Avens. The NCC has been conducting some stewardship activities on their lands and educating the public since 2001. The Brier Island Management Committee (BIMC) was formed in 2001. This group may offer advice on general management issues within the NCC Brier Island property. NCC has developed education plans on local flora and fauna for the local school, and fenced off OHV

trails from use with the assistance of OHV users. Their 2003 report 'Big Meadow Bog and *Geum peckii*: Preliminary Restoration Plan' outlines strategies for the conservation and recovery of Eastern Mountain Avens at the Big Meadow Bog site, some of which are incorporated into this recovery strategy. In this report, the collection of baseline habitat data for Big Meadow Bog was suggested and in 2003, the following parameters were recorded: peat depth, detailed hydrology, and species composition.

1.7. Knowledge Gaps

Monitoring requirements

Regular surveys of known sites as part of a long-term monitoring program to determine accurate population abundance and distribution, population trends, and habitat conditions

Biological / ecological research requirements

A genetic study (Paterson & Snyder 1999) found that Eastern Mountain Avens and *Geum radiatum* (a morphologically similar species) are separate species and recommended a population-level genetic analysis. The relatedness of the two disjunct populations of Eastern Mountain Avens in New Hampshire and NS is unknown at present and may prove useful knowledge to restore the population in NS.

Little is known about reproductive strategies of Eastern Mountain Avens in Nova Scotia and this too, is a conspicuous void in recovery knowledge.

Habitat restoration and enhancement feasibility

Research and experimental trials are required to ensure the appropriate decisions are made to restore the habitat for Eastern Mountain Avens in Big Meadow Bog.

2. RECOVERY

2.1. Recovery Feasibility

Ecological and technical feasibility of species recovery

Recovery of Eastern Mountain Avens is technically and biologically feasible as determined by the criteria for assessing the feasibility of recovery.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance. YES

Experimental crosses revealed healthy reproduction through both cross-pollination and self-pollination.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration. YES

Habitat is available in Nova Scotia and approximately 20% of the known Canadian stands are on land owned by the NCC, which means that a significant portion of habitat is potentially accessible for conservation and habitat management.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated. YES

Most of the threats have the potential to be eliminated or minimized.

4. Recovery techniques exist or can reasonably be expected to be developed to achieve the recovery goal. YES

Recovery techniques exist, such as habitat restoration and transplantation, which have been successfully carried out in other situations (although not with Eastern Mountain Avens in particular).

2.2. Recovery Goal

The goal of this recovery strategy is to protect and maintain extant populations at current or greater levels of abundance with no reduction in the current range.

2.3. Recovery Objectives

- 1) Maintain populations at occupied sites

Rationale: Current sites must be protected as a strong population base for recovery efforts.

- 2) Improve conditions and enhance populations at occupied sites

Rationale: Improve habitat where Eastern Mountain Avens is known to occur to help stands flourish. Techniques such as active vegetation management, seed banking, and transplantation may be considered if deemed feasible.

- 3) Improve conditions at previously occupied sites

Rationale: At least three stands of Eastern Mountain Avens have been lost due to ditching, trampling, habitat disturbance, and encroaching vegetation. Once recovery efforts are undertaken to restore habitat or remove disturbance, nearby populations may repopulate the area.

2.4. Approaches Recommended to Meet Recovery Objectives

2.4.1 Recovery planning

The recovery strategies outlined in this section will facilitate the achievement of the recovery objectives. Recovery approaches are identified as research, monitoring, management, education,

and stewardship. The Action Plan associated with this Recovery Strategy will include a detailed and prioritized schedule for these activities.

Table 2. Recovery planning table: recovery approaches for Eastern Mountain Avens in Canada. Priorities are defined as: Urgent = top priority action, without which population will decline; Necessary = needed to evaluate and guide recovery actions; Beneficial = beneficial if urgent actions are already underway.

Priority	Broad Approach/ Strategy	Objective Addressed	General Steps	Effect
RESEARCH				
Urgent	● Assess how to raise water-table level	All	~ Gather information and design experimental trials to assess how to restore the pre-drainage water-table level	May provide protection from some threats
Beneficial	● Continue genetic studies	All	~ Sample plants in NS and in New Hampshire	Clarifies the possibility of human-assisted rescue from New Hampshire
Beneficial	● Explore methods of population and habitat enhancement	All	~ Determine feasibility for seed banking and transplanting within the Atlantic population ~ Identify other possibilities for enhancement	Guides management and recovery efforts Determines potential for population augmentation/expansion
Beneficial	● Clarify habitat needs and characteristics	2	~ Map and atlas habitat characteristics and floristic associations for all sites with Eastern Mountain Avens	Habitat needs of the species are better understood
Beneficial	● Determine extent to which habitat alteration surrounding wetlands may threaten the species	All	~ Assess distance needed to protect the hydrology and the native vegetation community of the site	Guides management of recovery efforts
MONITORING				
Necessary	● Monitor known occupied sites	All	~ Develop reliable, repeatable, long-term monitoring tools and techniques to locate, monitor and assess	Enables determination of population trends, evaluation of recovery efforts and guides recovery efforts
Necessary	● Monitor threats	All	~ Document presence, severity, and effects of threats	Assesses success of efforts to eliminate and reduce threats
Beneficial	● If bog restoration proceeds, monitor habitat characteristics at unoccupied suitable habitat	3	~ Track changes in hydrology and species composition	Increases capacity to foster population enhancement
MANAGEMENT				
Necessary	● Protect Habitat at all sites	All	~ Secure relevant habitat through a variety of approaches	Allows for easier implementation of recovery actions

Priority	Broad Approach/ Strategy	Objective Addressed	General Steps	Effect
Necessary	<ul style="list-style-type: none"> Reduce off-highway vehicle traffic through habitat 	All	<ul style="list-style-type: none"> Map main trails with OHV riders, highlight any areas that may cause significant threat Work with riders to re-route trails to less vulnerable area and discourage off-trail riding. 	<p>Gives drivers ownership in recovery solutions</p> <p>Reduces threat to Eastern Mountain Avens habitat</p>
Urgent	<ul style="list-style-type: none"> Restore pre-drainage water-table levels 	All	<ul style="list-style-type: none"> Take action based on the results of research. 	<p>Enhances habitat and helps maintain current distribution, higher water-table may discourage gulls</p>
Necessary	<ul style="list-style-type: none"> Reduce numbers of nesting gulls in the immediate vicinity of Big Meadow Bog 	All	<ul style="list-style-type: none"> Observe effects of raising water level by above action. If necessary, undertake further discouragement measures 	<p>Helps maintain existing sites and potential future sites and may make habitat less suitable for encroaching vegetation</p>
Necessary	<ul style="list-style-type: none"> Restore historic species composition to bog 	All	<ul style="list-style-type: none"> Observe effects of raising water level, if that occurs If necessary, use active vegetation management to re-instate sphagnum-dominated cover. 	<p>Restores habitat conditions and interactions</p>
EDUCATION				
Necessary	<ul style="list-style-type: none"> Provide quality educational materials and opportunities to raise the awareness of Eastern Mountain Avens 	All	<ul style="list-style-type: none"> Create educational materials to support recovery efforts and solicit support for Eastern Mountain Avens and/or restoration of its habitat 	<p>Raises the public profile of Eastern Mountain Avens</p>
STEWARDSHIP				
Necessary	<ul style="list-style-type: none"> Foster cooperative relationships for Eastern Mountain Avens recovery with landowners, community, OHV riders, volunteers and ecotourists 	All	<ul style="list-style-type: none"> Engage groups and individuals in the recovery process Search for local and historical information and resources to assist in bog restoration Encourage voluntary stewardship agreements 	<p>Increases capacity of recovery efforts beyond researchers</p>

2.4.2 Narrative to support recovery planning table

Research

Assess how to raise water table level

Raising the water-table in Big Meadow Bog to the height before construction of the drainage ditches may reverse the negative impacts on Eastern Mountain Avens habitat. However, more information and experimental trials will be necessary before a decision to do so is reached.

Research should be designed and carried out at Big Meadow Bog to assess how to restore the pre-drainage water-table level and to understand whether doing so will restore habitat for Eastern Mountain Avens. Based on the results of this research, management actions will be recommended.

Continue genetic studies

When Paterson and Snyder (1999) studied whether *Geum peckii* and *Geum radiatum* were separate species, genetic sampling proved the species to be distinct. They recommended population level genetic analysis to identify genetic variation and conservation importance. Understanding the relatedness of the NS and New Hampshire populations would clarify the rescue potential from the New Hampshire population and may therefore guide management actions.

Explore methods of population and habitat enhancement

More information is required before decisions can be made regarding transplanting Eastern Mountain Avens. Possible habitat enhancement methods may also be explored with the intent that such strategies could play a greater role in recovery efforts when the Recovery Strategy is reviewed in 2015.

Clarify habitat needs and characteristics

In order to further the understanding of habitat needs and characteristics it is important to map habitat characteristics and floristic associations for all sites. Producing an atlas of Eastern Mountain Avens sites and habitats will facilitate habitat protection as well as education and stewardship initiatives.

Determine extent to which habitat alteration surrounding wetlands may threaten the species

It is possible that alteration of areas surrounding wetlands may impact the hydrology or vegetation community within the sites. In order to ensure that management efforts are appropriately targeted it is important to refine our understanding of the extent to which distance from the wetland impacts the species.

Monitoring

Monitor known occupied sites

A set of reliable, repeatable, long-term monitoring tools and techniques should be developed to assess the status of Eastern Mountain Avens and the success of recovery efforts.

Monitor threats

As part of site monitoring, observations of threats should also be recorded including presence and count of gulls, encroachment of competing plants, etc.

If bog restoration proceeds, monitor habitat characteristics at historical and unoccupied suitable habitat

The NCC Big Meadow Bog and *Geum peckii*: Preliminary Restoration Plan (2003) recorded baseline information on water level conditions in Big Meadow Bog. These conditions should continue to be measured at prescribed times. These data will be necessary to evaluate

enhancement of habitat if action is taken to raise the water-table. In addition to tracking changes in hydrology, species composition should also be tracked.

Management

Protect habitat at all sites

Wherever possible, Eastern Mountain Avens habitat (extant and historical) should be secured. This could be achieved through a variety of approaches, such as; purchasing, acquiring through a donation, or establishing a conservation easement. Protection of habitat would also be enhanced by ensuring that all laws and regulations are enforced. Education and stewardship are also important steps towards achieving protection of habitat and is thus linked directly to the education and stewardship approaches/strategies.

Reduce off-highway vehicle traffic through habitat

The Recovery Team and other conservation partners should work with OHV operators to establish mutually acceptable re-routing of trails away from Eastern Mountain Avens stands. Educational materials should also be provided so the local riders may inform visiting riders why off-trail riding is a threat to Eastern Mountain Avens.

Restore pre-drainage water-table levels

If research indicates that raising the water-table in Big Meadow Bog will be beneficial to Eastern Mountain Avens, the management actions implicated as most likely to succeed in restoring pre-drainage water-table levels should be implemented.

Reduce numbers of nesting gulls in the immediate vicinity of Big Meadow Bog

Gulls have appeared in Big Meadow Bog as a result of the drainage ditches lowering the water-table, making the habitat suitable for nesting. Gulls have nutrified the soil, making it suitable for species that compete with Eastern Mountain Avens. It is possible that if a suitable action to raise the water-table is undertaken, the gulls may leave or be reduced. Counts should be taken to monitor the impact of the suitable action on the gulls. If an action is not chosen or that action does not result in a reduction of the gulls, further discouragement measures may be explored.

Restore historic species composition to bog

Research will dictate if action should be taken to raise the water-table and by what means. If the water-table does rise, the effects of raising the water level on species that were not historically present in the bog should be monitored. It may be necessary to explore using active vegetation management to re-instate sphagnum-dominated cover.

Education

Provide quality educational materials and opportunities to raise the awareness of Eastern Mountain Avens

The target audience for education should be easy to identify for Eastern Mountain Avens because the known distribution area in NS is relatively small. Educational materials should be created to support recovery efforts and solicit stewards for Eastern Mountain Avens and/or restoration of its habitat.

Stewardship

Foster cooperative relationships for Eastern Mountain Avens recovery with landowners, community, OHV riders, volunteers and ecotourists

To date, an active role has been taken by naturalists, local residents, OHV operators, and organizations such as NCC. The resulting activities have led to the discovery of Eastern Mountain Avens stands, re-routing of OHV trails to protect the plant, as well as purchase of land to conserve habitat. The information and input that local residents can provide may prove invaluable to decisions that must be made regarding habitat restoration and conservation. In addition, voluntary stewardship agreements should be developed with private landowners to protect Eastern Mountain Avens stands occurring on their land.

2.5 Evaluation

Section 46 of SARA requires that the competent minister report on the progress towards meeting the objectives of the recovery strategy every five years. Table 3 highlights those performance measures that will be evaluated within five years of the final recovery strategy being posted on the SAR Public Registry.

Table 3. A summary of the performance measures for evaluating the success of each strategy / approach.

Strategy / Approach	Performance Measures for Evaluation
RESEARCH	
<ul style="list-style-type: none"> • Assess how to raise water-table level • Genetic studies • Explore methods of population and habitat enhancement • Clarify habitat needs and characteristics • Determine extent to which habitat alteration surrounding wetlands may threaten the species 	<ul style="list-style-type: none"> • Appropriate approach identified • Increased understanding of genetics • Enhancement methods are identified • Habitat characteristics and requirements documented • Map and atlas of all sites produced • Assessment of distance from wetland needed to protect hydrology conducted
MONITORING	
<ul style="list-style-type: none"> • Monitor known occupied sites • Monitor threats • If bog restoration proceeds, monitor habitat characteristics at historical and unoccupied suitable habitat 	<ul style="list-style-type: none"> • Effective long-term monitoring process developed • Changes in threats are monitored • Monitoring program in place for physical characteristics
MANAGEMENT	
<ul style="list-style-type: none"> • Protect habitat at all sites 	<ul style="list-style-type: none"> • Number of conservation easements established • Number of sites purchased or donated • Proportion of populations and habitat protected

<ul style="list-style-type: none"> • Reduce off-highway vehicle traffic through habitat • Restore pre-drainage water-table levels 	<ul style="list-style-type: none"> • Re-routing of OHV trails away from Eastern Mountain Avens habitat • Suitable habitat conditions restored
<ul style="list-style-type: none"> • Reduce numbers of nesting gulls in the immediate vicinity of Big Meadow Bog • Restore historic species composition to bog 	<ul style="list-style-type: none"> • Reduce number of nesting gulls at targeted sites • Data records of native and non-native vegetation
EDUCATION	
<ul style="list-style-type: none"> • Provide quality educational materials and opportunities to raise the awareness of Eastern Mountain Avens 	<ul style="list-style-type: none"> • Eastern Mountain Avens material is presented • Stewardship communication pieces (website, identification card or brochure) are available
STEWARDSHIP	
<ul style="list-style-type: none"> • Foster cooperative relationships with landowners, community, OHV riders, volunteers, and ecotourists 	<ul style="list-style-type: none"> • Number of volunteers • Voluntary involvement in recovery activities and planning

2.6 Critical Habitat

2.6.1 Identification of the species' critical habitat

Eastern Mountain Avens is a unique species known to occur in two disjunct locations with distinctly different habitats; an alpine location in the United States and boggy terrain in NS. Eastern Mountain Avens populations in NS have been the subject of survey effort since 1985 and it is unlikely that more populations will be discovered.

Sufficient information is available on the species' habitat requirements and distribution, thus critical habitat is fully identified in this recovery strategy. It is important to note that if new information becomes available or additional sites or stands are found, then critical habitat would be updated accordingly in a Recovery Strategy or Action Plan.

Critical habitat is identified as the eight known sites with Eastern Mountain Avens. In general terms, Eastern Mountain Avens in NS occurs near the coast in bogs, sphagnum depressions, and occasionally in dry depressions on mineral soil and regularly co-occurs with shrubby cinquefoil (*Potentilla fruticosa*) and deergrass (*Scirpus caespitosus*) (Newell 2002). Alterations of hydrology and/or the native vegetation community by mechanical, chemical or other means are documented as causing decline to Eastern Mountain Avens. Thus, as a precautionary measure, Critical Habitat is identified as: the wetlands where the species currently occurs and a 100 m zone landward of the edge of these wetlands. The purpose for including the 100 m zone is to maintain and protect the hydrology of the site for Eastern Mountain Avens and to protect the native vegetation community.

Appendix A indicates the general location of known occupied sites of Eastern Mountain Avens. Appendix B, giving the coordinates and directions to the Eastern Mountain Avens sites and stands, has been removed from the public document to protect the species and its habitat.

2.6.2 Examples of activities likely to result in destruction of critical habitat

An activity is detrimental to Critical Habitat when it alters conditions such that the capacity of that Critical Habitat to contribute to the survival or recovery of the species would be compromised.

Some examples of activities that may result in the destruction of Critical Habitat include, but are not limited to:

- alteration of surficial soil through activities such as ditching, bulldozing, excavation, raking, shovelling, trampling, indiscriminate use of herbicides;
- deliberate setting of fires;
- alteration of surficial or ground hydrology through activities including channelization, alteration to natural drainages.

2.7 Existing Habitat Protection

Under the Nova Scotia Endangered Species Act (NSESA), the province of NS may designate “core habitat”, which is defined in the act as “*specific areas of habitat essential for the long-term survival and recovery of endangered or threatened species*”. The process for designating core habitat is not yet developed as the emphasis has been on other existing and tested tools for habitat protection. The relationship between the identification of “Critical Habitat” under SARA and the designation of “core habitat” under the NSESA, and the implications for protection are yet to be determined.

Eastern Mountain Avens core habitat, if designated under the Nova Scotia Endangered Species Act, can be protected by some specific regulations. In 1988 the NCC purchased a Brier Island property encompassing roughly 20% of known Eastern Mountain Avens stands (NSDNR unpublished data).

In 2003, the NCC prepared a report entitled, ‘Big Meadow Bog and *Geum peckii*: Preliminary Restoration Plan’, and has been actively monitoring the site and communicating with the landowners of other sites. All of the sites not within the NCC owned parcel of land occur on privately owned land. In 2003, owners of the private Brier Island properties were supportive of bog restoration and allowed NCC access to their properties to conduct research (Brown 2003). The NCC may pursue acquisition of more land on Brier Island or at the Digby Neck – East Ferry site if the appropriate conditions or opportunities arise (Bernard, per. comm. 2006).

2.8 Effects on Other Species

Species that have become established in Big Meadow Bog due to the habitat conditions provided by the drainage ditch (such as gulls) may be displaced due to the efforts to restore habitat by raising the water-table. The displacement of gulls at sites is beneficial to Eastern Mountain

Avens and will not be harmful to gull populations overall. Species with similar habitat needs to Eastern Mountain Avens that have been pushed to the marginal edges of the bog should benefit from habitat restoration efforts. Research and monitoring efforts will be minimally invasive and should have no significant negative effects on other species. Educational, stewardship and threat mitigation efforts are expected to benefit the majority of native species in the area.

2.9 Recommended Approach for Recovery Implementation

A single species approach is recommended because Eastern Mountain Avens is distinct with respect to habitat requirements and threats in this area of NS.

2.10 Statement on Action Plan

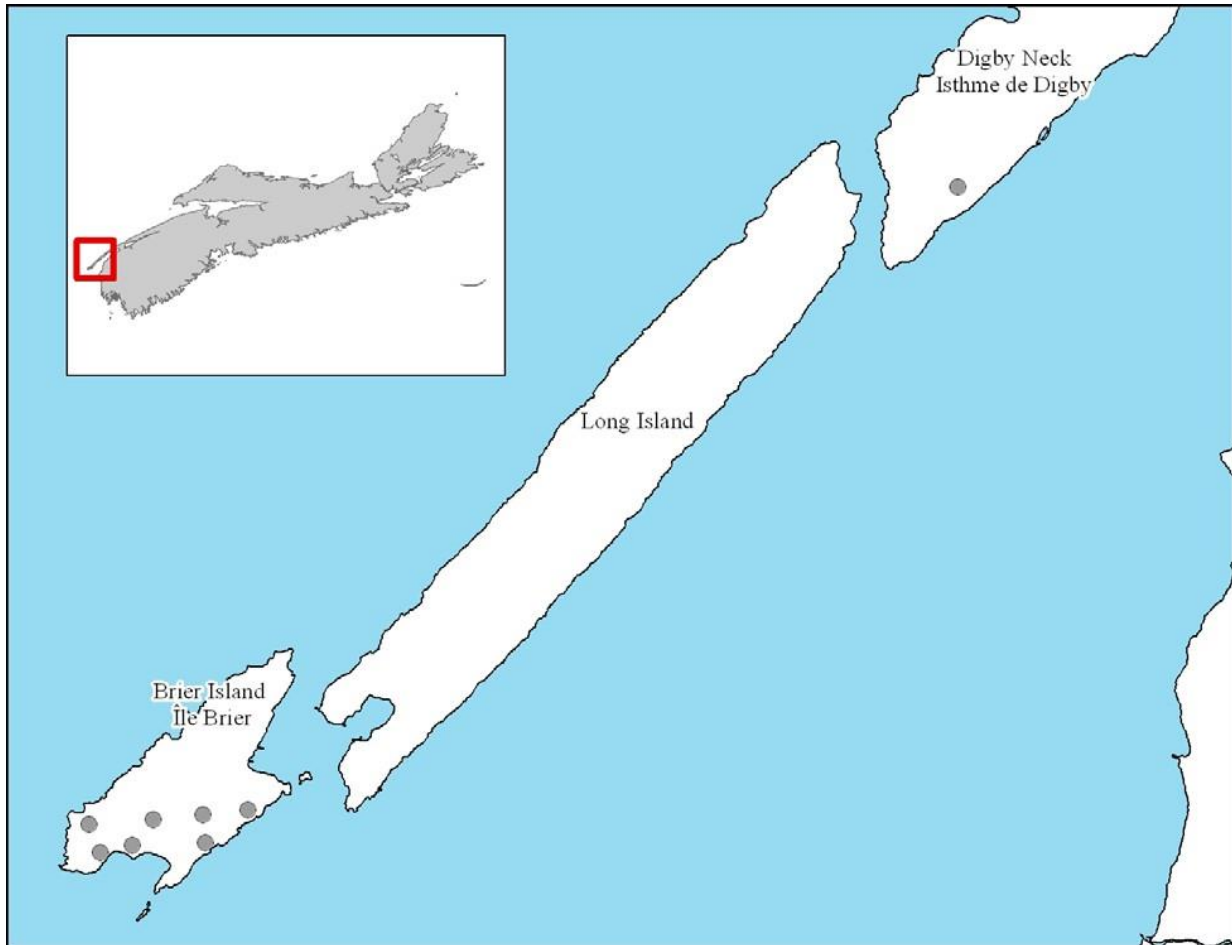
An action plan detailing the steps necessary to achieve the objectives and knowledge gaps presented in this recovery strategy for Eastern Mountain Avens will be developed within two years of the final posting of the Recovery Strategy.

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APPENDIX A

Known sites with Eastern Mountain Avens (*Geum peckii*) as of August 2008. Nova Scotia Department of Natural Resources, 2008



APPENDIX B

This appendix has been removed from the public document to protect the species and its habitat.

APPENDIX C

Threat classification table for threats impacting Eastern Mountain Avens

General Threat (Alpha-numeric Threat Code)	Specific Threat	Stress	Extent	Occurrence	Frequency	Causal Certainty	Severity	Level of Concern	Brier Island	Digby Neck
									Threat Information ⁺	
									Priority*	
A. THREAT CATEGORIES: Habitat Loss or Degradation										
1. Off-highway vehicle (OHV) use	Alteration of habitat characteristics (scarification, substrate compaction)	Scarification of soil; Mortality	W	C	S	L	L	M	M	L
2. Development and road maintenance	Alteration of habitat characteristics	Mortality; Alteration of surface soils; Loss of habitat	L	U	U	H	H	M	M	L
B. THREAT CATEGORY: Changes in Ecological Dynamics or Natural Processes										
1. Drainage ditch	Alteration of surface and/or ground hydrology	Long term habitat loss; Alteration of species composition	L	H/C	C	H	H	H	H	-
2. Gull nesting	Alteration of habitat - soil nitrification	Loss of suitable habitat; Increased competition	L	C	C	H	H	H	H	-
3. Tree and shrub encroachment	Alteration of habitat - reduced sunlight	Loss of suitable habitat; Increased competition	W	C	C	H	H	H	H	-
4. Lakeshore habitat alteration	Alteration of hydrology - increased stochasticity	Alteration of habitat	L	C	OT	H	M	M	-	H
C. THREAT CATEGORY: Pollution										
1. Dumping		Mortality; Loss of habitat	L	C	U	U	M	L	L	-
D. THREAT CATEGORY: Disturbance or Persecution										
1. Off-highway vehicle (OHV) use		Mortality	W	C	S	L	L	M	M	L
2. Collecting (scientific purposes or gardeners)		Mortality	L	C	U	H	M	L	L	-
E. THREAT CATEGORY: Climate and Natural Disasters										
1. Climate change	Alteration of plant community and ecosystem	Uncertain	W	U	C	U	U	H	U	U

⁺Extent: W (widespread) or L (local). Occurrence: H (historic), C (current), I (imminent), A (anticipated), or U (unknown). Frequency: OT (one-time), S (seasonal), C (continuous), R (recurrent), or U (unknown). Causal Certainty: H (high), M (medium), or L (low). Severity: H (high), M (moderate), L (low), or U (unknown). Level of Concern (H: high, M: medium, L: low, or U: Uncertain).

* Priority (H: high, M: medium, L: low, U: Uncertain, or - [dash]: not applicable).

Appendix B:

Environment and Climate Change Canada. 2018. Action Plan for the Eastern Mountain Avens (*Geum peckii*) in Canada. Species at Risk Act Action Plan Series. Environment and Climate Change Canada, Ottawa. v + 23 pp.

Action Plan for the Eastern Mountain Avens (*Geum peckii*) in Canada

Eastern Mountain Avens



2018



Government
of Canada

Gouvernement
du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2018. Action Plan for the Eastern Mountain Avens (*Geum peckii*) in Canada. *Species at Risk Act* Action Plan Series. Environment and Climate Change Canada, Ottawa. v + 23 pp.

For copies of the action plan, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, recovery strategies, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](#)¹.

Cover illustration:

Eastern Mountain Avens on Brier Island, Nova Scotia. Photo by June Swift

Également disponible en français sous le titre
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¹ <http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1>

Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)² agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of action plans for species listed as Extirpated, Endangered, and Threatened for which recovery has been deemed feasible. They are also required to report on progress within five years after the publication of the final document on the SAR Public Registry.

Under SARA, one or more action plan(s) provides the detailed recovery planning that supports the strategic direction set out in the recovery strategy for the species. The plan outlines what needs to be done to achieve the population and distribution objectives (previously referred to as recovery goals and objectives) identified in the recovery strategy, including the measures to be taken to address the threats and monitor the recovery of the species, as well as the proposed measures to protect critical habitat that has been identified for the species. The action plan also includes an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation. The action plan is considered one in a series of documents that are linked and should be taken into consideration together. Those being the COSEWIC status report, the recovery strategy, and one or more action plans.

The Minister of Environment and Climate Change is the competent minister under SARA for the Eastern Mountain Avens and has prepared this action plan to implement the recovery strategy, as per section 47 of SARA. To the extent possible, it has been prepared in cooperation with the Province of Nova Scotia, the Eastern Mountain Avens Recovery Team, environmental non-government organizations, industry stakeholders, Aboriginal groups, and private landowners.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions and actions set out in this action plan and will not be achieved by Environment and Climate Change Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this action plan for the benefit of the Eastern Mountain Avens and Canadian society as a whole.

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

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical

² <http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2>

habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area³ be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

³ These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

Acknowledgments

This action plan was prepared by Samara Eaton (Environment and Climate Change Canada, Canadian Wildlife Service, Atlantic Region) in collaboration with Sherman Boates and Mark Elderkin (Nova Scotia Department of Natural Resources), Nick Hill (Fern Hill Institute for Plant Conservation), and the Eastern Mountain Avens Recovery Team. Their efforts and contribution are gratefully acknowledged. Many organizations and individuals have played an important role in recovery actions already completed or underway for Eastern Mountain Avens and their efforts are recognized and appreciated.

Executive Summary

This action plan complements the *Recovery Strategy for the Eastern Mountain Avens (Geum peckii) in Canada* (Environment Canada 2010) and will be implemented in Nova Scotia, where the species is only known to occur in Canada. This plan addresses all three objectives set out in the recovery strategy for the entire population and distribution of the Eastern Mountain Avens.

Critical habitat for Eastern Mountain Avens was identified in the recovery strategy and as a result of ongoing conservation and recovery efforts, additional information now exists regarding the species and its habitat and thus critical habitat is updated in this action. Critical habitat is all located on non-federal lands, on Brier Island and Digby Neck (Nova Scotia), and is fully identified at this time. Proposed measures to protect critical habitat are presented in section 1.4.

The recovery measures included in this plan are required to implement the recommended recovery approaches outlined in the recovery strategy. Recovery measures in this plan are organized according to broad strategies and the implementation schedule in section 1.2 identifies which threats the measure addresses, indicates the level of priority, and delineates timelines. The recovery measures proposed for the Eastern Mountain Avens are related to five broad strategies: 1) research; 2) monitoring; 3) management; 4) education and outreach; and 5) stewardship.

The socio-economic evaluation was completed and it was determined that the direct and indirect costs associated with the implementation of this action plan are considered low. Implementation of this action plan will benefit not only Eastern Mountain Avens, but also other species, wetlands, and biodiversity.

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1. Recovery Actions

1.1 Context and Scope of the Action Plan

The Eastern Mountain Avens (*Geum peckii*) is a rhizomatous perennial herb that produces sunny yellow flowers in the summer. It grows in moist to wet, sparsely treed coastal peatlands where competition is low. In Canada, it is found only in southwestern Nova Scotia at sites on Brier Island and one site on the southern tip of Digby Neck. The only other location for this species in the world is the White Mountains of New Hampshire in the United States where it grows in alpine habitat.

Eastern Mountain Avens was assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1986 and that status was confirmed during the reassessment in 1999, 2000 and 2010. The species was listed as Endangered under the *Nova Scotia Endangered Species Act* in 2000 and federal *Species at Risk Act* (SARA) in 2003.

Eastern Mountain Avens is a highly disjunct species with a very limited distribution and substantial population declines in Canada. Threats to the species include: habitat alteration; changes in hydrology through road maintenance and development; drainage ditches; and off highway vehicle use. Historical loss of habitat at one location was caused by the creation of a drainage ditch through a wetland, which in turn led to succession of the wetland and nutrient enrichment by nesting gulls.

The recovery measures outlined in this action plan are required to implement the strategies and recommended approaches found in the *Recovery Strategy for the Eastern Mountain Avens (Geum peckii) in Canada* (Environment Canada 2010). As a result of ongoing conservation and recovery efforts, additional information now exists regarding the species and its habitat and thus critical habitat is updated in this action plan.

The goal of the recovery strategy is to protect and maintain extant populations at current levels of abundance or greater with no reduction in the current range. The recovery objectives are to:

- 1) Maintain populations at occupied sites
- 2) Improve conditions and enhance populations at occupied sites
- 3) Improve conditions at previously occupied sites

This action plan covers the entire population and distribution of the Eastern Mountain Avens in Canada and recovery measures in this action plan address all three objectives from the recovery strategy.

This action plan should be considered along with the *Recovery Strategy for the Eastern Mountain Avens (Geum peckii) in Canada* (Environment Canada 2010). The recovery strategy provides more details on the strategic direction and approaches for recovery of

Eastern Mountain Avens, critical habitat information, and background information on the species and its threats.

1.2 Measures to be Taken and Implementation Schedule

The recovery measures outlined in the implementation schedule (Table 1) are arranged according to the broad strategies identified in the recovery strategy. The implementation schedule includes the level of priority (high, medium, low) assigned to each measure, the threats addressed, and the timeline. Since the posting of the recovery strategy, conservation and recovery efforts have resulted in significant new information which is incorporated into this action plan.

Within Nova Scotia, Eastern Mountain Avens is found in two geographic locations: Brier Island and on Digby Neck (peninsula on the mainland 15 km east of Brier Island). Over 95% of all Eastern Mountain Avens individuals are at the sites on Brier Island. There are two different habitats within which Eastern Mountain Avens is found: fen habitat and old field habitat (described in critical habitat section). On Brier Island, there are multiple Eastern Mountain Avens sites; the majority of plants (90%) occur in fen habitats, the remainder (10%) occurs in old field habitat. At Digby Neck, Eastern Mountain Avens occurs at one site only, in fen habitat.

Recovery approaches and measures for Eastern Mountain Avens will be implemented in a phased approach, with the initial two phases focusing on the restoration of Big Meadow Bog on Brier Island. These two initial phases are the highest priority and are on an immediate timeline. These first phases move recovery through knowledge gathering, planning, monitoring and risk assessment to on the ground restoration. The third phase addresses the long term maintenance of Eastern Mountain Avens sites that occur around Big Meadow Bog as well as in the other habitat categories.

Phase 1: Building knowledge base for Recovery

- Big Meadow Bog, Brier Island – Gathering baseline ecological and biological information for restoration and determining feasibility of restoration
- Increasing understanding of Eastern Mountain Avens
- Non-Big Meadow Bog sites – Monitoring and assessment of risk

Phase 2: Restoration of the Big Meadow Bog wetland complex, Brier Island

- Conducting restoration

Phase 3: Long term maintenance and protection of Eastern Mountain Avens

- Maintaining all sites with Eastern Mountain Avens (other than Big Meadow Bog)
- Contingency planning
- Ongoing monitoring for the adaptive management of the restoration of Big Meadow Bog

Eastern Mountain Avens sites are grouped according to the following four *habitat categories* in order to facilitate planning, prioritization, and delivery of recovery action on the ground. The following is a description of each of these categories and linkages to the relevant phases of recovery that pertain to each.

Marginal Fens at Big Meadow Bog, Brier Island: Eastern Mountain Avens at this one site are found in marginal fens (lagg⁴) between the central raised bog of Big Meadow and the surrounding swamp. Sites are threatened by conversion of open fen to forest and by enrichment of peat by nesting gulls and both of these processes are driven by lowered water tables from the historic ditching. This site has been identified as the highest priority for immediate recovery efforts because it has the largest population density of Eastern Mountain Avens and historic ditching has resulted in over 30% loss of suitable open fen habitat, which has led to a loss of function in the Eastern Mountain Avens meta-population structure.

Phase 1 and 2: Recovery measures will focus on increasing water levels to reverse the degradation of habitat caused by the historic ditching. Goals include: recovery of ombrotrophy⁵, restoration of lagg (bog margin) hydrology, and restoration of an open fen landscape with increased Eastern Mountain Avens populations around Big Meadow Bog.

Discrete Fens: The Eastern Mountain Avens sites of this category are discrete, small fen habitats in inland or coastal settings. These support natural peatland plant communities which include: unmodified sites with no observable threat; sites that have had localized historic disturbance by off-highway vehicles (OHVs); and one site where ditching has lowered the water table.

Phase 1 and 3: These sites (excepting the latter that is ditched) are in Eastern Mountain Avens habitats under no apparent threat; hence recovery measures will focus on maintaining the integrity of sites through monitoring of populations and habitat. Future efforts may include assessing the risks at these sites and taking management actions where needed.

Old Fields: The sites within this category contain 10% of all Eastern Mountain Avens on Brier Island and are found in old field swamps and their adjacent upland edges. These sites were opportunistically colonized by Eastern Mountain Avens and are currently threatened as the habitat succeeds towards tall shrub and treed communities.

Phase 1 and 3: Although this habitat is not typical for Eastern Mountain Avens, recovery measures will focus on maintaining these sites through monitoring of populations and habitat. These individuals could be

⁴ Lagg: The transition zone at the margin of a raised bog that receives water from both the bog and the surrounding mineral soil. The lagg is an integral element of a raised bog because the high water table in the lagg helps maintain the water mound of the bog (Howie and van Meerveld 2012).

⁵ Ombrotrophy: The state of a vegetation community which receives all of its water supply (and consequently its nutrients) from precipitation.

important source populations for potential contingency actions should they be required.

Marginal Fen at Digby Neck: Eastern Mountain Avens at this one site are found in marginal fen (in the lagg zone, as at Big Meadow Bog), between raised peatland and the surrounding swamp slope. The site's water table has been disrupted by damming of Harris Lake in 1950.

Phase 1 and 3: Recovery measures at this time will focus on monitoring Eastern Mountain Avens, habitat and threats, in order to maintain this site. Future efforts may include assessing the risks at these sites and taking management actions when needed. The importance of this Eastern Mountain Avens site needs to be assessed to determine its potential significance for recovery. The extensive nearby fenland should also be assessed with respect to its importance for the long term recovery of the species.

Table 1. Implementation schedule for all recovery measures.

#	Recovery measures	Priority ⁶	Threats or objectives addressed	Timeline
Broad Strategy: Research				
Approach: Conduct biological and ecological research related to the restoration of Big Meadow Bog (Phase 1)				
1	Further the understanding of surface and ground water hydrology to inform restoration planning with emphasis on landscape linkages (swamp to fen) that determine lagg hydrology	High	Drainage ditch, Gull nesting	2017-2019
2	Conduct experimental transplantations of Eastern Mountain Avens over naturally occurring moisture gradients	High	Drainage ditch, Gull nesting	2017-2019
3	Complete baseline sampling to provide performance benchmarks regarding vegetation, Eastern Mountain Avens metrics, nutrients, contaminants, hydrology, water quality, and gulls	High	Drainage ditch, Gull nesting	2017-2019
Approach: Continue experimental approach for active vegetation management at old field sites (Phase 3)				
4	For old field sites, continue active vegetation management experimental approach for the rescue of populations facing eradication through competitive exclusion, and determine whether to implement active vegetation management at a larger scale on an ongoing basis	Low	Encroachment	2017-2019
Approach: Conduct biological and ecological research related to contingency planning for the species at all sites (Phase 3)				
5	Explore methods of population enhancement and determine feasibility for seed banking and transplanting within the Nova Scotia population	Low	All	2017-2022
6	Conduct genetic analyses to identify natural patterns and key areas of genetic importance for the long-term safety of the Canadian Eastern Mountain Avens population, and the possibility/feasibility for human-assisted rescue of Eastern Mountain Avens populations	Medium	All	2020
7	Evaluate the potential risks associated with alien and native invasive species apart from their known indicator value as reflecting habitat disturbance and enrichment (e.g. Big Meadow ditching and enrichment by gulls)	Low	All	2022
8	Further the understanding of the historic role of fire in Eastern Mountain Avens habitats (e.g. Big Meadow Bog and and coastal fen) and its potential application as a management tool to maintain population genetic variability	Low	All	2022

⁶ "Priority" reflects the degree to which the measure contributes directly to the recovery of the species or is an essential precursor to a measure that contributes to the recovery of the species. High priority measures are considered those most likely to have an immediate and/or direct influence on attaining the population and distribution objectives for the species. Medium priority measures may have a less immediate or less direct influence on reaching the population and distribution objectives, but are still important for the recovery of the population. Low priority recovery measures will likely have an indirect or gradual influence on reaching the population and distribution objectives, but are considered important contributions to the knowledge base and/or public involvement and acceptance of the species.

Approach: Conduct research related to increasing the understanding of the biology and ecology of Eastern Mountain Avens (Phase 1)				
9	Continue to further understanding life history, population dynamics, reproduction and genetics and implications for population genetic structure	Medium	All	Ongoing
10	Assess risk of local extinction at all sites on Brier Island other than Big Meadow Bog, through monitoring and analysis to inform the priority of recovery measures	High	All	2017-2021
11	Assess the risk of local extinction at Digby Neck (Harris Lake) marginal fen site and water table implications of 1950 damming	High	All	2019-2020
12	Apply the Eastern Mountain Avens predictive model from Brier Island to unoccupied fen land between Brier Island and Tiddville (Digby Neck) to determine the suitability of unoccupied fen land and its significance with respect to the longer term recovery of Eastern Mountain Avens	Low	All	2023
13	Planning for and mitigating impacts of climate change on Eastern Mountain Avens	Low	All	2022
Approach: Increase collaboration and coordination of research				
14	Meet, collaborate, and coordinate research efforts with other species at risk Recovery Teams and other academic researchers and cooperate with conservation efforts on Eastern Mountain Avens in New Hampshire	Low	All	Ongoing
Broad Strategy: Monitoring				
Approach: Develop and implement a monitoring program related to the restoration of Big Meadow Bog (Phase 2 and 3)				
15	Once bog restoration has been initiated, implement restoration monitoring plan, including monitoring of species, vegetation community, hydrology, nutrients, and gulls	High	Drainage ditch, Gull nesting	Ongoing
16	Coordinate monitoring efforts with volunteers, non-government organizations, academia, and government and engage multiple stakeholders in the implementation	Medium	Drainage ditch, Gull nesting	Ongoing
Approach: Implement a long-term monitoring program for Eastern Mountain Avens and its habitat at all sites (Phase 1)				
17	Implement protocols and methods of counting for surveying populations and, for all sites, to determine population abundance and distribution and enable determination of population trends	High	All	Completed
18	Implement systematic habitat and threat monitoring (permanent plots) for all sites other than Big Meadow Bog (Brier Island) particularly OHV use, encroaching vegetation, as well as lakeshore alteration and dam management for Digby Neck	High	All	Ongoing
19	Ensure databases containing all population data, as well as habitat and threat monitoring data are up to date, well documented, and readily accessible	High	All	Ongoing

Broad Strategy: Management				
Approach: Conduct restoration of the marginal fen at Big Meadow Bog (Phase 2)				
20	Finalize restoration plan, including engineering design, for increasing water levels in order to recover ombrotrophy, restore the bog margin (lagg) hydrology, restore open fenland for Eastern Mountain Avens and increase Eastern Mountain Avens populations and spatial distribution	High	Drainage ditch, Gull nesting	2016-2017
21	Implement the engineering design to increase water levels and begin restoration	High	Drainage ditch, Gull nesting	2016-2019
22	Adaptively manage the restoration, based on results of monitoring and the return of the bog to ombrotrophic conditions and the recovery of Eastern Mountain Avens	High	Drainage ditch, Gull nesting	2017-2022
Approach: Implement active vegetation management actions in old field sites (Phase 3)				
23	For old field sites, if results of research actions regarding active vegetation management result in a positive impact on Eastern Mountain Avens, implement at old field sites	Low	Encroachment	2020
Approach: Employ a variety of approaches to reduce threats and protect habitat at all sites				
24	Use securement approaches on private land including: conservation easements, purchase, or donations	Medium	All	Ongoing
25	Use education and stewardship initiatives with all of audiences to protect habitat	Medium	All	Ongoing
26	Support and encourage enforcement of all existing laws and regulations that pertain to the threats, including appropriate species at risk training and seek amendments and/or increased resource for enforcement, where appropriate	High	All	2016-2020
27	Ensure data and critical habitat locations for all Eastern Mountain Avens sites are available for regulators, such as provincial departments and municipalities	High	All	2016-2018
28	Reduce OHV traffic through Eastern Mountain Avens habitat by working with riders to establish acceptable re-routing of trails and discouraging off-trail riding	Low	OHV use	Ongoing
Broad Strategy: Education and Outreach				
Approach: Continue to develop and strengthen education and outreach initiatives regarding Eastern Mountain Avens conservation and recovery				
29	Develop a plan regarding outreach and communication for restoration related recovery measures including interpretation, access, programs and communication	High	Drainage ditch, Gull nesting	2016-2021
30	Continue to work with the Brier Island community and encourage a community led, post restoration, development of interpretation enterprises and promotion of ecotourism components	High	Drainage ditch, Gull nesting	Ongoing
31	For all non-Big Meadow sites, develop strategic education initiatives that specifically target landowners with Eastern Mountain Avens and critical habitat or members of the public who access known sites	Medium	All	Ongoing

32	Overall, develop broader education initiatives for Eastern Mountain Avens conservation that target the whole community, with particular focus on engaging youth	Medium	All	Ongoing
Broad Strategy: Stewardship				
Approach: Continue to foster cooperative relationships for Eastern Mountain Avens conservation and recovery with landowners, community, OHV riders, volunteers, industry, and ecotourists				
33	Continue and improve stewardship initiatives with landowners and continue to build relationships with landowners already contacted and not yet approached	High	All	Ongoing
34	Where possible, recruit, engage, and train volunteers in the monitoring of populations, habitats, threats at Eastern Mountain Avens sites	Low	All	Ongoing
35	Develop stewardship initiatives that engage OHV riders and frequent users of the lands adjacent to Eastern Mountain Avens habitat	Low	OHV use	Ongoing

*Unless otherwise noted in the text, the recovery measure applies to all Eastern Mountain Avens sites.

1.3 Critical Habitat

The Species at Risk Act (SARA) requires the identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Critical habitat was identified for Eastern Mountain Avens in the recovery strategy (Environment Canada 2010); however, conservation and recovery efforts have resulted in significant new information regarding the location of the species and its habitat. As a result, the critical habitat identified in the recovery strategy is no longer in effect and is replaced with the critical habitat identified in this action plan. The 'activities likely to result in destruction of critical habitat' section of the recovery strategy is also being replaced in this action plan. Critical habitat is identified based on the best available information for Eastern Mountain Avens; more precise boundaries may be mapped, and additional critical habitat may be added (or taken away/ removed) in the future if supported by additional data.

This is a full critical habitat identification for Eastern Mountain Avens at all sites in both known Canadian locations: Brier Island and Digby Neck, Nova Scotia. The critical habitat identified in this action plan is considered sufficient to achieve the population and distribution objectives established in the recovery strategy.

1.3.1 Identification of the Species' Critical Habitat

The Eastern Mountain Avens is an arctic-alpine forb that survives in mountain streams at high elevation in New Hampshire, United States, and in wetlands at sea level at Brier Island and on the Digby Peninsula at the mouth of the Bay of Fundy in Nova Scotia, Canada. This Nova Scotia setting provides a boreal climate, with low summer temperatures, and many fogbound days. The majority, more than 95%, of the Eastern Mountain Avens individuals occur at sites on Brier Island but a small number of individuals occur at a site on the mainland end of the Digby Neck peninsula, 15 km east of Brier Island. Most of the Eastern Mountain Avens occur in fens with a minority occurring in anthropogenically disturbed moist to wet old fields on Brier Island. Intensive surveys for Eastern Mountain Avens populations in Nova Scotia have not discovered Eastern Mountain Avens outside of these areas and its occurrence in Nova Scotia is limited to this basaltic peninsula where the vegetation includes various rich fen indicator plants (viz. Shrubby Potentilla (*Dasiphora fruticosa*), Mountain Fly Honeysuckle (*Lonicera villosa*), Buckbean (*Menyanthes trifoliata*), and Livid Sedge (*Carex livida*)).

As mentioned previously, there are two different habitats within which Eastern Mountain Avens is found. More than 90% of individuals are found in fen habitat. The remaining 10% of individuals (approximately 600) are in old field habitat. Critical habitat is identified and described below for each of these two habitat types.

Fen habitat

The biophysical attributes of the fen habitat for Eastern Mountain Avens include:

- a high water table;
- low nutrient availability;
- approximately 50% Sphagnum cover;
- trace amounts only of weedy herbs (e.g. *Holcus lanatus*, *Juncus effusus* and *Epilobium ciliatum*);
- more than 15% native graminoids, dominated by wiry sedges (i.e. *Carex exilis* and/or *Trichophorum cespitosum*);
- high cover (approximately 75-100% = the sum of cover values of constituent species) of a diverse, low (canopy height less than 40 cm) shrubbery in which the Heather family dominates the weedy Rose family; and
- Heather family cover is dominated (e.g. 2/3 total cover) by evergreen species (e.g. *Andromeda glaucophylla*, *Chamaedaphne calyculata*, *Kalmia angustifolia*, and *Ledum groenlandicum*).

A high water table and low nutrient availability are two of the key attributes of the fen habitat for Eastern Mountain Avens. The vegetation in and surrounding the Eastern Mountain Avens fens is diverse and its low stature is due to waterlogging and low nutrient stresses. If either of these is altered (e.g. a reduction in waterlogging or an increase in nutrient availability), Eastern Mountain Avens habitat is degraded.

For example, anthropogenic, historic alterations of drainage at Big Meadow Bog and another bog on Brier Island (Lighthouse Bog), lowered the peat water tables, resulting in loss of Sphagnum and the proliferation of tall shrubs and trees that exclude Eastern Mountain Avens. Also at Big Meadow Bog, gull enrichment has increased nutrient levels and caused a proliferation of fast-growing herbs and tall herbs that outcompete and overtop Eastern Mountain Avens and other native vegetation.

As a result of the importance of hydrology, critical habitat for all fen habitat sites is identified as the fen habitat with the above biophysical attributes in which Eastern Mountain Avens occurs and all of the wetland area that influences the water tables and the hydrological regimes of that fen habitat within the surrounding wetland. This includes all surrounding wetland area above and around each Eastern Mountain Avens fen and the wetland in the outflow zone that influences the hydrological regime of the Eastern Mountain Avens habitat.

Old field habitat

The biophysical attributes of the old field habitat for Eastern Mountain Avens include:

- tall shrub swamp dominated by Common Winterberry, Speckled Alder and Black Huckleberry (*Ilex verticillata*, *Alnus incana* and *Gaylussacia baccata*);
- outside of a wetland in a saturated microtopographic depressions with wetland plant indicator species (i.e. obligate or facultative wetland) in both the herb (e.g. Tufted bulrush, *Trichophorum caespitosum* and Pickering's Reed-grass,

- Calamagrostis pickeringii*) and shrub (e.g. Speckled alder and Bog Labrador tea, *Ledum groenlandicum*) communities; and
- upland near (from 5- 25 m) the wetland edges, with upland indicator species (i.e. facultative upland) in both the herb (e.g. *Festuca filiformis* (Hair Fescue) and *Eurybia macrophylla* (Large-leaved Aster)) and shrub (e.g. *Alnus viridis* (Mountain Alder) and *Diervilla lonicera* (Northern Bush-honeysuckle)) communities.

Vegetation change resulting from the cessation of farming will increase rates of evapotranspiration, which should lower the water table in old field areas and reduce the habitat suitability for Eastern Mountain Avens, as the height and proportion of woody plants increase over successional time. The old field Eastern Mountain Avens habitat occurs along the Gull Rock Road, Brier Island over a landscape that was actively farmed until the late 1980s.

Critical habitat for all old field habitat sites is identified as the old field habitat with the above biophysical attributes and includes the swamp where Eastern Mountain Avens occurs, a 25 m upland zone around the swamp edge, as well as the wetland area that influences the water tables and the hydrological regimes of the swamps. A 25 m zone is included because this is the maximum distance between the Eastern Mountain Avens individuals in microtopographic depressions and uplands and the nearest Eastern Mountain Avens wetland, swamp habitat, thus maintaining habitat connectivity between these wetland and non-wetland Eastern Mountain Avens habitats. The long-term persistence of Eastern Mountain Avens in these successional habitats is uncertain; however, it is necessary to include these as critical habitat in support of the population and distribution objectives.

In summary, critical habitat for Eastern Mountain Avens is fully identified in this action plan as all of the fen habitats within which Eastern Mountain Avens occurs, with the biophysical attributes listed above and all of the wetland area that influences the water tables and the hydrological regimes of the Eastern Mountain Avens fen habitats (Appendix A, Figure A-1 and A-2). For old field habitats, critical habitat is the swamp, a 25 m upland zone around the swamp edge, as well as the wetland area that influences the water tables and the hydrological regimes of the swamp and that contain the above biophysical attributes for old field habitat (Figure 3).

In Figures A-1 and A-2 critical habitat occurs within the yellow-shaded polygons (units) shown on the maps, where the criteria described in this section are met. The 1 km × 1 km UTM grid (red) overlay shown on these figures is a standardized national grid system that highlights the general geographical area containing critical habitat, for land use planning and/or environmental assessment purposes. Anthropogenic structures (e.g., roads, buildings) do not possess the biophysical attributes of the suitable habitat and are not identified as critical habitat.

Overall, four critical habitat units covering approximately 610.6 ha are identified for Eastern Mountain Avens, including 3 on Brier Island, Nova Scotia (total of 481.1 ha with

36.3 ha in Old Field and 444.8 ha in Fen) and 1 on Digby Neck, Nova Scotia (129.5 ha). The description of these critical habitat units is presented in Appendix A, Table A-1.

1.3.2 Examples of Activities Likely to Result in Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time.

Critical habitat for the Eastern Mountain Avens may be destroyed by any alteration to the fen or old field habitat within which Eastern Mountain Avens occurs or to the surrounding wetland habitats that influence the hydrological regime and general suitability of the fens or old field habitats for the survival of Eastern Mountain Avens. Activities described in Table 2 include those likely to cause destruction of critical habitat for the species; destructive activities, however, are not limited to those listed.

Table 2. Examples of activities likely to destroy the critical habitat of Eastern Mountain Avens in Canada.

Description of activity	Description of effect (on biophysical attributes or other) in relation to functional loss of critical habitat	Eastern Mountain Avens habitat type to which the activity applies	Other considerations
Alterations of hydrology (e.g. creation of drainage ditches)	<p>The creation of drainage ditches may alter the hydrology of the habitat, which in turn can alter the vegetation community such that habitat conditions become unsuitable for Eastern Mountain Avens</p> <p>A high water table is one of the key attributes of the fen habitat for Eastern Mountain Avens. The vegetation in and surrounding the Eastern Mountain Avens fens is diverse and its low stature is due to waterlogging and low nutrient stresses. If either of these is altered (e.g. a reduction in waterlogging or an increase in nutrient availability), Eastern Mountain Avens habitat is degraded. For example, anthropogenic, historic alterations of drainage at Big Meadow Bog and another bog on Brier Island (Lighthouse Bog), lowered the peat water tables, resulting in loss of Sphagnum and the proliferation of tall shrubs and trees that exclude Eastern Mountain Avens.</p>	<ul style="list-style-type: none"> - All fen habitat - All old field habitat - Wetland areas surrounding Eastern Mountain Avens habitat 	<p>The impact associated with this activity includes all surrounding wetland areas above and around each Eastern Mountain Avens habitat and the wetland in the surrounding areas that influences the hydrology of the Eastern Mountain Avens habitat.</p> <p>Ditching done in the 1950s drastically altered the hydrology at Big Meadow Bog, Brier Island and has resulted in the loss of Eastern Mountain Avens habitat.</p>
Nutrient enrichment (e.g. nutrient runoff from development)	<p>Any activity, such as development of residences or roads, that could cause runoff into Eastern Mountain Avens habitat could result in a loss of the low nutrient availability habitat that Eastern Mountain Avens requires. Low nutrient availability is one of the key attributes of the fen habitat for Eastern Mountain Avens. The vegetation in and</p>	<ul style="list-style-type: none"> - All fen habitat - All old field habitat (swamps) 	<p>Historically, alteration to the hydrology of an Eastern Mountain Avens fen habitat (Big Meadow Bog) resulted in changes to vegetation such that Herring Gulls were able to nest within the fen habitat, which in turn has resulted in enrichment (increased nutrients), which has led to changes in the vegetation composition and structure.</p>

	<p>surrounding the Eastern Mountain Avens fens is diverse and its low stature is due to waterlogging and low nutrient stresses. If either of these is altered (e.g. a reduction in waterlogging or an increase in nutrient availability), Eastern Mountain Avens habitat is degraded. For example, at Big Meadow Bog, gull enrichment has increased nutrient levels and caused a proliferation of fast-growing herbs and tall herbs that outcompete and overtop Eastern Mountain Avens and other native vegetation.</p>		
Habitat disturbance by Off-Highway Vehicles (OHV)	<p>OHV use can affect surface water movement and alter the vegetation community such that habitat conditions become unsuitable for Eastern Mountain Avens (as described in the activities above).</p>	<ul style="list-style-type: none"> - All fen habitat (excluding surrounding wetland areas) - All old field habitat (swamps) 	<p>Occasional use in non-wetland sites (within old field habitat) would not typically result in destruction, especially if use occurred in winter or during late summer dry conditions.</p>
Road development or expansion	<p>Construction and expansion of roads may cause permanent destruction or degradation of Eastern Mountain Avens habitat by altering the hydrology and causing nutrient runoff.</p>	<ul style="list-style-type: none"> - Fen habitat (including surrounding wetland areas) - All old field habitat 	
Road maintenance	<p>If activities related to the maintenance of existing roads extend beyond the road itself this could result in the degradation of Eastern Mountain Avens habitat by altering the hydrology and causing nutrient runoff.</p>	<ul style="list-style-type: none"> - All old field habitat - All fen habitat 	
Dam maintenance	<p>Maintenance of an existing earthen berm, dam structure, that exists at Digby Neck location could negatively impact the surface and ground water hydrology of the site.</p>	<ul style="list-style-type: none"> - Fen habitat at Digby Neck (excluding surrounding wetland areas) 	<p>Alterations and maintenance of the dam structure could lead to increased negative impacts to the hydrology of the site.</p> <p>The earthen dam has already negatively altered the hydrology at the Harris Lake site and has resulted in the loss of Eastern Mountain Avens habitat.</p>

1.4 Proposed Measures to Protect Critical Habitat

With regard to the portions of critical habitat on non-federal lands, Environment and Climate Change Canada will assess the protection currently in place. This involves first working with the Government of Nova Scotia to determine which provincial laws and legal instruments are in place to prevent destruction of critical habitat. If there are gaps in the protection of critical habitat, provisions or measures in place under SARA or other federal legislation will be reviewed to determine whether they prevent destruction of critical habitat. Conservation measures, including stewardship initiatives that contribute to preventing critical habitat destruction will also be considered. The laws, legal agreements, and conservation measures in place that protect critical habitat will be monitored for efficacy at least every five years.

If it is determined that any portions of critical habitat are not protected, and steps are being taken to protect those portions, those steps will be communicated via the Species at Risk Public Registry through the reports referred to in section 63 of SARA.

2. Socio-economic Evaluation

The Species at Risk Act requires that an action plan include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation (SARA 49(1)(e), 2002). This evaluation addresses only the incremental socio-economic costs of implementing this action plan from a national perspective as well as the social and environmental benefits that would occur if the action plan were implemented in its entirety, recognizing that not all aspects of its implementation are under the jurisdiction of the federal government. It does not address cumulative costs of species recovery in general nor does it attempt a cost-benefit analysis. Its intent is to inform the public and to guide decision making on implementation of the action plan by partners.

The protection and recovery of species at risk can result in both benefits and costs. The Act recognizes that “*wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons*” (SARA, 2002). Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians. A review of the literature confirms that Canadians value the preservation and conservation of species in and of themselves. Actions taken to preserve a species, such as habitat protection and restoration, are also valued. In addition, the more an action contributes to the recovery of a species, the higher the value the public places on such actions (Loomis and White 1996; DFO 2008). Furthermore, the conservation of species at risk is an important component of the Government of Canada’s commitment to conserving biological diversity under the *International Convention on Biological Diversity*. The Government of Canada has also made a commitment to protect and recover species at risk through the [Accord for the Protection of Species at Risk](#). The specific costs and benefits associated with this action plan are described below.

2.1 Policy Baseline

The province of Nova Scotia has access to many legislative, regulatory, and management tools for the conservation and stewardship of Eastern Mountain Avens (e.g., *Nova Scotia Endangered Species Act*, *Nova Scotia Special Places Protection Act*, and *Nova Scotia Environment Act*). Additionally, many recovery measures can be carried out by federal or provincial species at risk funding programs, in-kind contributions by recovery biologists, or research by universities.

2.2 Socio-economic Profile and Baseline

The areas targeted by this action plan include sites on Brier Island, Nova Scotia and a site on Digby Neck and there are few communities affected by this action plan. This is an area with low human population densities and a low level of economic activity with the primary industries relating to the fishery and ecotourism. Stakeholders are largely private landowners and other stakeholders include the Government of Canada, the Government of Nova Scotia, and Nature Conservancy of Canada. A recovery and conservation partnership has been ongoing in the area for several years in an effort to restore habitat and promote the long term protection and conservation of Eastern Mountain Avens on Brier Island.

2.3 Socio-economic Costs of Implementing this Action Plan

Implementation of the recovery measures identified in Table 1 may generate direct costs as well as social costs. Only the incremental costs are considered and therefore do not include ongoing actions or initiatives discussed in section 2.1 (Policy Baseline).

For Eastern Mountain Avens, both direct and indirect costs as well as social costs are expected to be low (between 0 and 5 million \$) over the short-term (2015-2020). Costs at the regional or provincial scale are expected to be minimal. Long-term costs are also expected to be minimal. Direct costs are those that result from the implementation of the measures identified in the implementation schedule of the action plan. These anticipated costs include, salary, travel, materials, equipment and other related costs. Indirect costs are those resulting from the implementing the action plan, which may have an impact on various stakeholders. Impacts to stakeholders include foregoing or modifying current and future activities.

2.4 Benefits of Implementing this Action Plan

It is anticipated that this action plan will contribute to the recovery of Eastern Mountain Avens and lead to the achievement of the population and distribution objective and the conservation and protection of habitat for the species.

Biodiversity is essential for healthy ecosystems, human health, prosperity, security and well being. Canadians derive many benefits from biodiversity including recreational, aesthetic, educational, cultural benefits as well as ecological goods and services essential to human survival. Care for the environment is consistently ranked as one of Canada's top priorities in public opinion polls⁷. A recent opinion poll found that three quarters of Canadian respondents feel that preserving natural areas and the variety of native plant and animal life in Canada is important to them⁸.

The total value of endangered species consists of non-consumptive use values (such as recreation, spiritual/cultural, research and education), indirect use values (value of the ecological role of a species in an ecosystem) and non-use values (i.e. preserving the benefits of nature for future generations)⁹. Achieving the goal of this action plan (i.e. the recovery of the Eastern Mountain Avens) will have a positive impact on society. Brier Island has an existing eco-tourism industry and it is possible that the implementation of recovery measures outlined in Table 1 to restore the Big Meadow Bog could lead to increased eco-tourism on Brier Island. Eco-tourism is the fastest-growing area of the tourism industry (Mastny 2001). In 2004, this market grew three times faster than the industry as a whole and the World Tourism Organization estimates that global spending on eco-tourism is increasing by 20% a year, about six times the industry-wide rate of growth (TEEB 2008).

Eastern Mountain Avens is part of a community of bog vegetation that is unique in Canada, and found only in Nova Scotia. Wetland habitats, where most Eastern Mountain Avens are located, are rich in biodiversity and provide important ecosystem services. By protecting the Eastern Mountain Avens and its critical habitat, benefits extend to other species and the ecosystem. One of the locations for Eastern Mountain Avens is also home to other rare plant species including various orchids, Curly Grass Fern (*Schizea pusilla*) and Northern Dwarf Birch (*Betula michauxii*) (Brown 2003). By focusing on increasing protection measures, as well as increasing communication, improved public outreach, education and local stewardship, it is expected that the recovery approaches outlined in the action plan will benefit the larger ecological community as well.

2.5 Distributional Impacts

Although Eastern Mountain Avens occur on private properties, private landowners are not expected to absorb the direct incremental costs for the species' recovery. Any indirect incremental costs resulting from the implementation of recovery measure will be shared. Non-governmental organizations are active where the species occurs and this action plan includes measures aimed at building on current stewardship initiatives.

⁷ Canada's Fourth National Report to the United Nations Convention on Biological Diversity, 2010. Available online www.cbd.int/doc/world/ca/ca-nr-04-en.pdf Accessed December 3, 2010.

⁸ Ipsos Reid Opinion Poll "Nine in Ten (87%) Canadians Say That When Connected to Nature They Fell Happier." Released January 7, 2011, www.ispsos.ca

⁹ Non-use values include bequest value (satisfaction of knowing that future generations will have access to nature's benefits), altruist value (satisfaction of knowing that other people have access to nature's benefits) and existence value (satisfaction of knowing that a species or ecosystem exists).

3. Measuring Progress

The performance indicators presented in the associated recovery strategy provide a way to define and measure progress toward achieving the population and distribution objectives.

Reporting on *implementation* of the action plan (under s. 55 of SARA) will be done by assessing progress towards implementing the broad strategies.

Reporting on the ecological and socio-economic impacts of the action plan (under s. 55 of SARA) will be done by assessing the results of monitoring the recovery of the species and its long term viability, and by assessing the implementation of the action plan.

4. References

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Appendix A: Eastern Mountain Avens Critical Habitat in Canada

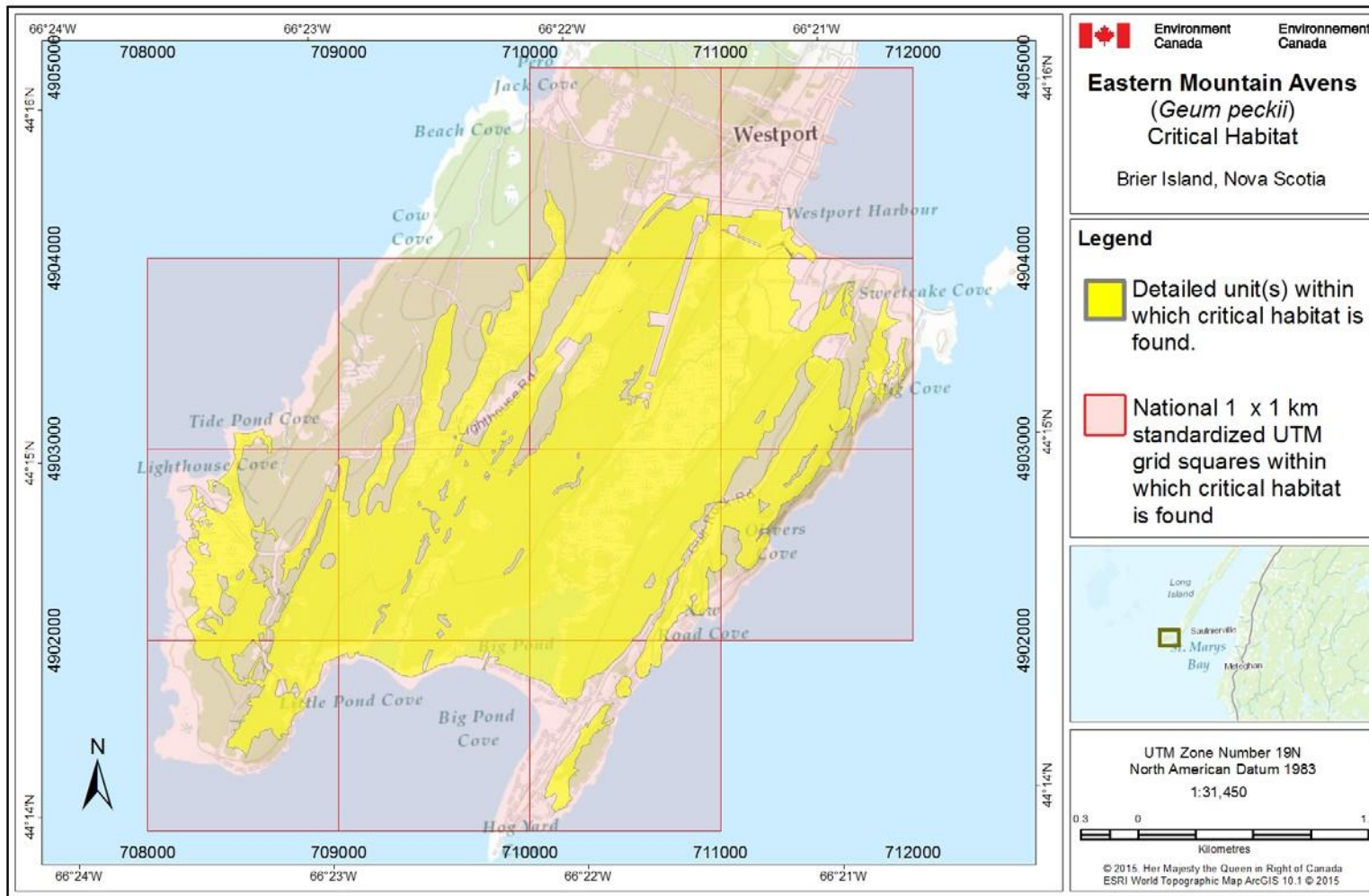


Figure A-1. Boundaries of the critical habitat units (yellow) for Eastern Mountain Avens at sites on Brier Island, Nova Scotia. The 1 km x 1 km UTM grid overlay shown on this figure (red) is a standardized national grid system that highlights the general geographical area containing critical habitat. Areas outside the shaded yellow polygons do not contain critical habitat.

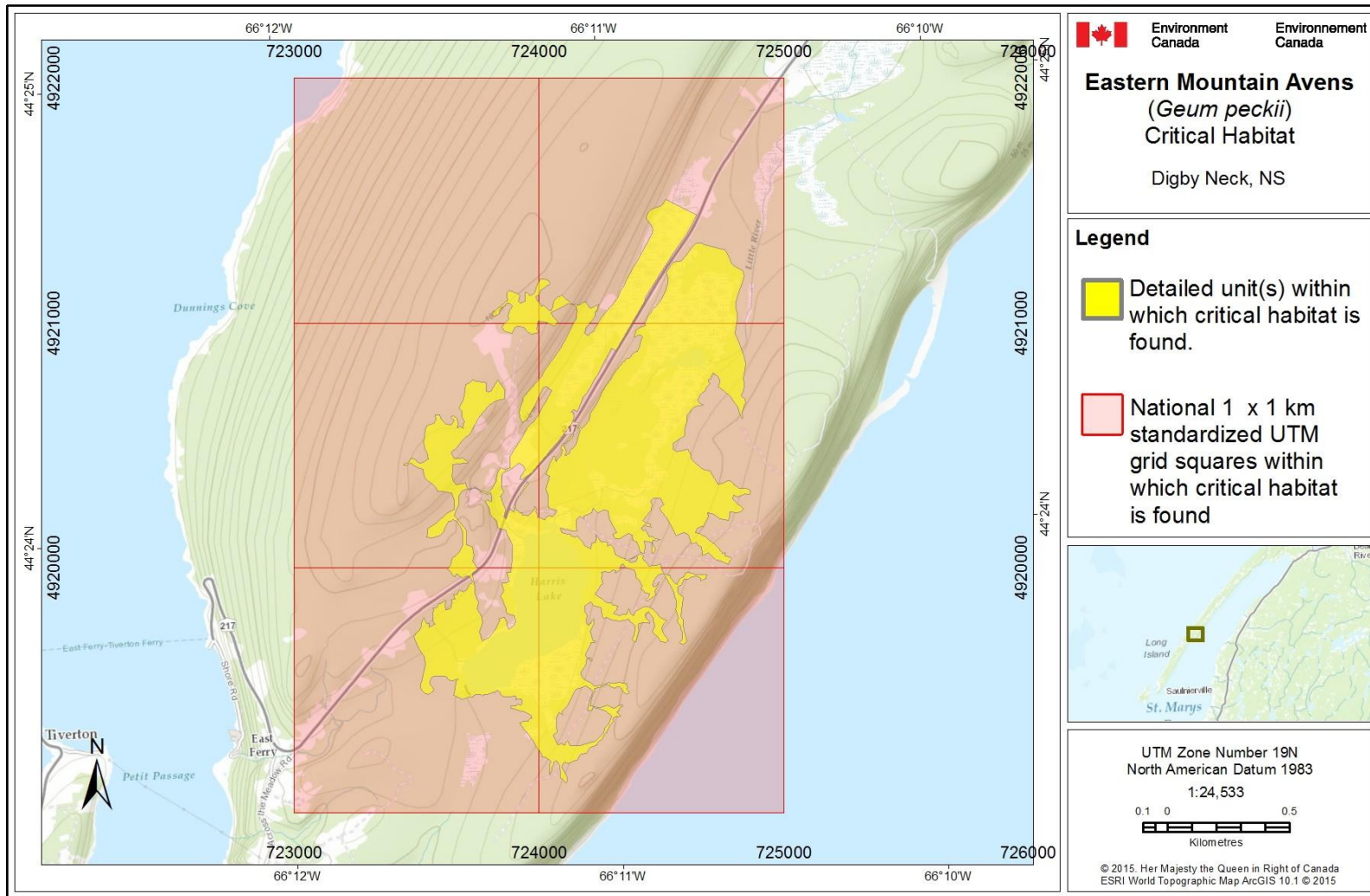


Figure A-2. Boundaries of the critical habitat unit (yellow) for Eastern Mountain Avens at site in Digby Neck, Nova Scotia. The 1 km x 1 km UTM grid overlay shown on this figure (red) is a standardized national grid system that highlights the general geographical area containing critical habitat. Areas outside the shaded yellow polygons do not contain critical habitat.

Table A–1. 1 km × 1 km standardized UTM Grid Squares containing critical habitat for Eastern Mountain Avens in Canada. Critical habitat occurs where the criteria described in Section 1.3 of the Action Plan are met.

1 × 1 km Standardized grid square ID ¹	Province/ Territory	UTM Grid Square Coordinates ²		Land tenure ³	Location
		Easting	Northing		
19GK1004	NS	710000	4904000	Non-federal	Brier Island
19GK1014	NS	711000	4904000	Non-federal	Brier Island
19GK0083	NS	708000	4903000	Non-federal	Brier Island
19GK0093	NS	709000	4903000	Non-federal	Brier Island
19GK1003	NS	710000	4903000	Non-federal	Brier Island
19GK1013	NS	711000	4903000	Non-federal	Brier Island
19GK0082	NS	708000	4902000	Non-federal	Brier Island
19GK0092	NS	709000	4902000	Non-federal	Brier Island
19GK1002	NS	710000	4902000	Non-federal	Brier Island
19GK1012	NS	711000	4902000	Non-federal	Brier Island
19GK0081	NS	708000	4901000	Non-federal	Brier Island
19GK0091	NS	709000	4901000	Non-federal	Brier Island
19GK1001	NS	710000	4901000	Non-federal	Brier Island
19GK2231	NS	723000	4921000	Non-federal	Digby Neck
19GK2241	NS	724000	4921000	Non-federal	Digby Neck
19GK2230	NS	723000	4920000	Non-federal	Digby Neck
19GK2240	NS	724000	4920000	Non-federal	Digby Neck
19GK2139	NS	723000	4919000	Non-federal	Digby Neck
19GK2149	NS	724000	4919000	Non-federal	Digby Neck

¹ Based on the standard UTM Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789>), where the first 2 digits represent the UTM Zone, the following 2 letters indicate the 100 x 100 km standardized UTM grid, followed by 2 digits to represent the 10 x 10 km standardized UTM grid. The last 2 digits represent the 1 x 1 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See <http://www.bsc-eoc.org/> for more information on breeding bird atlases).

² The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the [eg. 1 x 1] km standardized UTM grid squares containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.

³ Land tenure is provided as an approximation of the types of land ownership that exist at the critical habitat units and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

Appendix B: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)¹⁰. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy](#)'s¹¹ (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of action plans may inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the action plan itself, but are also summarized below in this statement.

This action plan will clearly benefit the environment by promoting the recovery of the Eastern Mountain Avens. The potential for the plan to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this plan will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to relevant sections in this document (Measures to be Taken and Implementation Schedule and Socio-economic Evaluation) and in the recovery strategy (Ecological Role; Limiting Factors; Threats; Critical Habitat; Approaches Recommended to Meet Recovery Objectives; and Effects on Other Species).

The effects on other species have been described in the Recovery Strategy for the Eastern Mountain Avens (*Geum peckii*) in Canada (Environment Canada 2010). Overall, it is anticipated that the recovery actions for the Eastern Mountain Avens will benefit non-target species, ecological processes, and the environment in general. Some threat mitigation actions may impact species, for example, the displacement of gulls, however, it will not be harmful to gull populations overall.

¹⁰ www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1

¹¹ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1