

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

Eastern Mountain Avens



2016



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Cover illustration:

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

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¹ <http://www.registrelep-sararegistry.gc.ca>

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 the recovery strategy identifies critical habitat, there may be future regulatory implications,

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

depending on where the critical habitat is identified. SARA requires that critical habitat identified within a national park named and described in Schedule 1 to the *Canada National Parks Act*, the Rouge National Urban 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* be described in the *Canada Gazette*, after which prohibitions against its destruction will apply. 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. 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.

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 (lagg³) 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 ombrotrophy⁴, 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

³ 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).

⁴ 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 ⁵	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	2016-2017
2	Construct predictive models for Eastern Mountain Avens using environmental variables to guide habitat restoration	High	Drainage ditch, Gull nesting	2016-2017
3	Conduct experimental transplantations of Eastern Mountain Avens over naturally occurring moisture gradients	High	Drainage ditch, Gull nesting	2016-2017
4	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	2016-2017
Approach: Continue experimental approach for active vegetation management at old field sites (Phase 3)				
5	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	2016-2018
Approach: Conduct biological and ecological research related to contingency planning for the species at all sites (Phase 3)				
6	Explore methods of population enhancement and determine feasibility for seed banking and transplanting within the Nova Scotia population	Low	All	2016-2021
7	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	2019
8	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	2021

⁵ "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.

9	Further the understanding of the historic role of fire in Eastern Mountain Avens habitats (e.g. Big Meadow Bog and coastal fen) and its potential application as a management tool to maintain population genetic variability	Low	All	2021
Approach: Conduct research related to increasing the understanding of the biology and ecology of Eastern Mountain Avens (Phase 1)				
10	Continue to further understanding life history, population dynamics, reproduction and genetics and implications for population genetic structure	Medium	All	Ongoing
11	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	2016-2020
12	Assess the risk of local extinction at Digby Neck (Harris Lake) marginal fen site and water table implications of 1950 damming	High	All	2018-2019
13	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	2021
14	Planning for and mitigating impacts of climate change on Eastern Mountain Avens	Low	All	2021
Approach: Increase collaboration and coordination of research				
15	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)				
16	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
17	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)				
18	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
19	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
20	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)				
21	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	2015-2016
22	Implement the engineering design to increase water levels and begin restoration	High	Drainage ditch, Gull nesting	2015-2018
23	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	2016-2021
Approach: Implement active vegetation management actions in old field sites (Phase 3)				
24	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	2019
Approach: Employ a variety of approaches to reduce threats and protect habitat at all sites				
25	Use securement approaches on private land including: conservation easements, purchase, or donations	Medium	All	Ongoing
26	Use education and stewardship initiatives with all of audiences to protect habitat	Medium	All	Ongoing
27	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	2016-2019
28	Ensure data and critical habitat locations for all Eastern Mountain Avens sites are available for regulators, such as provincial departments and municipalities	High	All	2016-2017
29	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				
30	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
31	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
32	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

33	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				
34	Continue and improve stewardship initiatives with landowners and continue to build relationships with landowners already contacted and not yet approached	High	All	Ongoing
35	Where possible, recruit, engage, and train volunteers in the monitoring of populations, habitats, threats at Eastern Mountain Avens sites	Low	All	Ongoing
36	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 Aves in Canada.

Description of activity	Description of effect (on biophysical attributes or other) in relation to functional loss of critical habitat	Eastern Mountain Aves 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 Aves</p> <p>A high water table is one of the key attributes of the fen habitat for Eastern Mountain Aves. The vegetation in and surrounding the Eastern Mountain Aves 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 Aves 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 Aves.</p>	<ul style="list-style-type: none"> - All fen habitat - All old field habitat - Wetland areas surrounding Eastern Mountain Aves habitat 	<p>The impact associated with this activity includes all surrounding wetland areas above and around each Eastern Mountain Aves habitat and the wetland in the surrounding areas that influences the hydrology of the Eastern Mountain Aves 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 Aves 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 Aves habitat could result in a loss of the low nutrient availability habitat that Eastern Mountain Aves requires. Low nutrient availability is one of the key attributes of the fen habitat for Eastern Mountain Aves. 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 Aves 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>

	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.		
Habitat disturbance by Off-Highway Vehicles (OHV)	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).	<ul style="list-style-type: none"> - All fen habitat (excluding surrounding wetland areas) - All old field habitat (swamps) 	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.
Road development or expansion	Construction and expansion of roads may cause permanent destruction or degradation of Eastern Mountain Avens habitat by altering the hydrology and causing nutrient runoff.	<ul style="list-style-type: none"> - Fen habitat (including surrounding wetland areas) - All old field habitat 	
Road maintenance	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.	<ul style="list-style-type: none"> - All old field habitat - All fen habitat 	
Dam maintenance	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.	<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 polls⁶. 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 them⁷.

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)⁸. 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 (*Schizaea 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.

⁶ 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.

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

⁸ 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

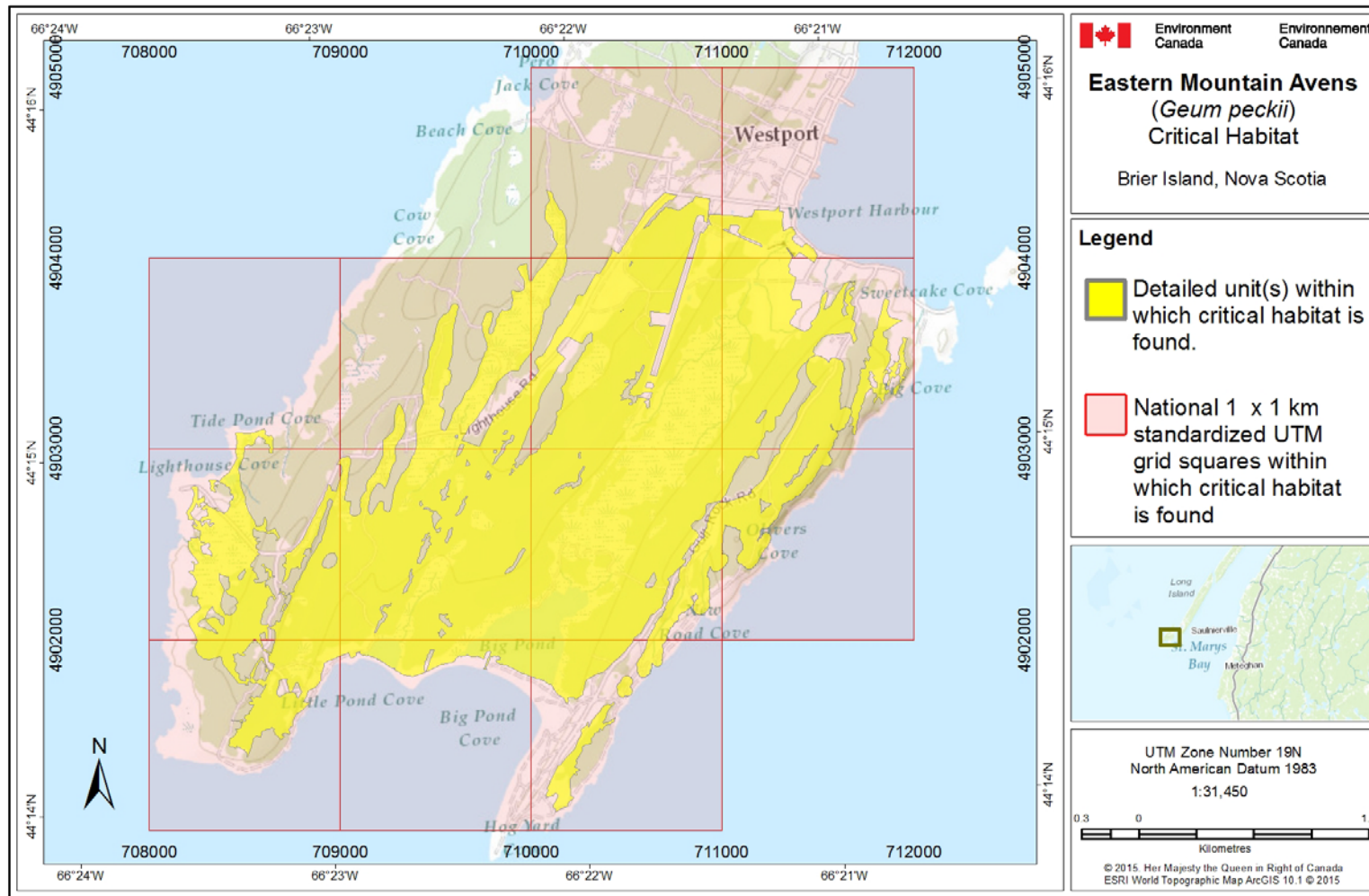


Figure A-1. Boundaries of the critical habitat units (yellow) for Eastern Mountain Avens at sites on Brier Island, Nova Scotia. The 1 km x 1 km UTM grid overlay shown on this figure (red) is a standardized national grid system that highlights the general geographical area containing critical habitat.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

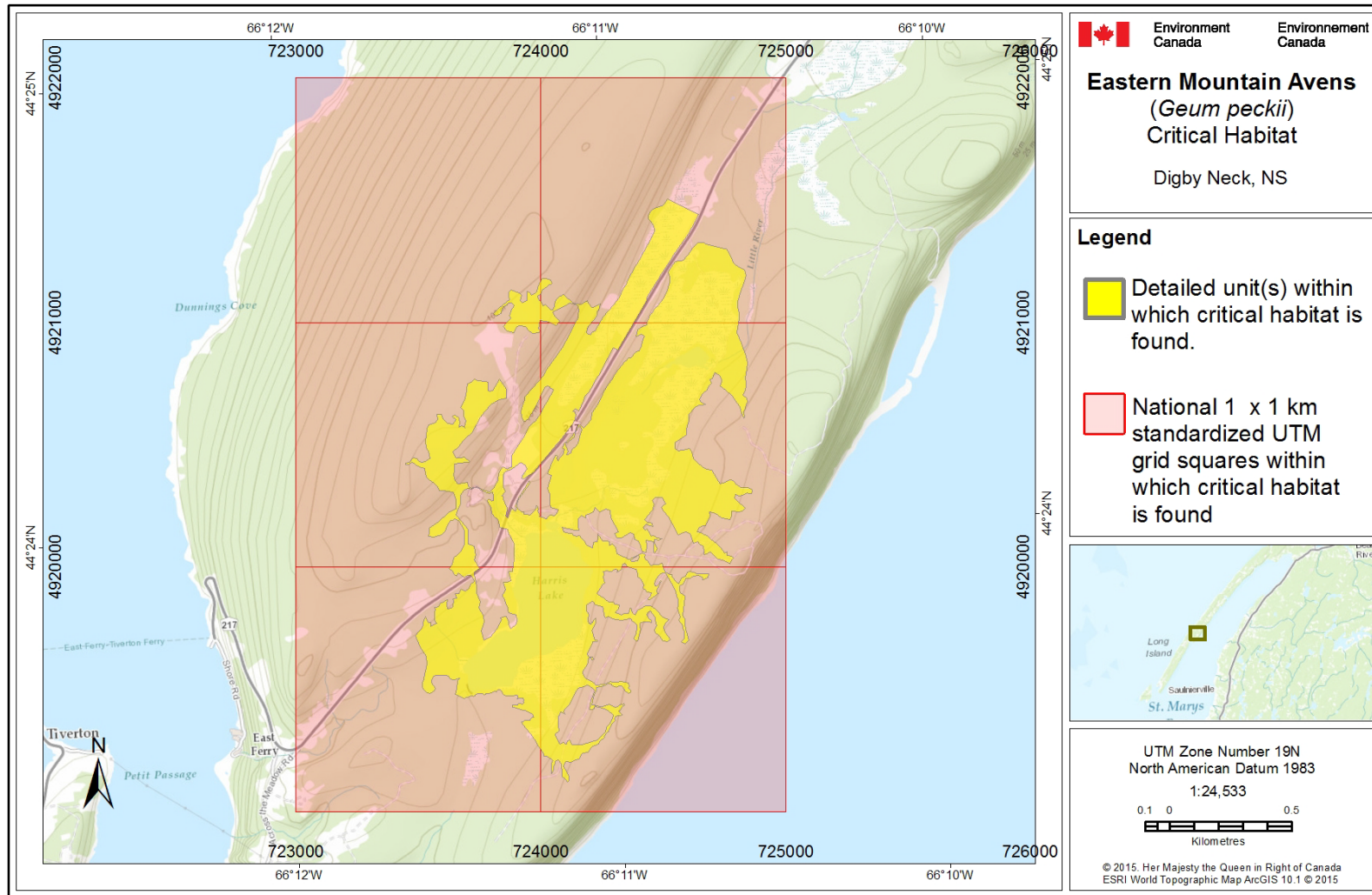


Figure A-2. Boundaries of the critical habitat unit (yellow) for Eastern Mountain Avens at site in Digby Neck, Nova Scotia. The 1 km × 1 km UTM grid overlay shown on this figure (red) is a standardized national grid system that highlights the general geographical area containing critical habitat. Areas 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-boundary/mapping/topographic-mapping/10098>), 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](#)⁹. 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](#)'s¹⁰ (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.

⁹ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

¹⁰ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1