

Recovery Strategy for the Branched Bartonia (*Bartonia paniculata* ssp. *paniculata*) in Canada

Branched Bartonia



2016



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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 recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change is the competent minister under SARA for the Branched Bartonina and has prepared this strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Province of Ontario (Ministry of Natural Resources and Forestry³), and any others as per section 39(1) of 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 and Climate Change Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Branched Bartonina and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment and Climate Change Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy 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 habitat is identified, either in a recovery strategy or an action plan, there may be future regulatory implications, 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

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

³ On June 26, 2014 the Ontario Ministry of Natural Resources became the Ontario Ministry of Natural Resources and Forestry.

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

A preliminary draft of this recovery strategy was prepared by Talena Kraus (Artemis Eco-Works). Subsequent drafts were developed by Lee Voisin and Jocelyn Sherwood (Environment and Climate Change Canada, Canadian Wildlife Service – Ontario). This recovery strategy benefited from input, review and suggestions from the following individuals and organizations: Krista Holmes, Burke Korol, Angela McConnell, Judith Girard, Liz Sauer, Ken Corcoran, Elizabeth Rezek (Environment and Climate Change Canada, Canadian Wildlife Service – Ontario), and Eric Snyder, Amanda Fracz and Glenn Desy (Ontario Ministry of Natural Resources and Forestry).

Acknowledgement and thanks is given to all other parties that provided advice and input used to help inform the development of this recovery strategy including various Aboriginal organizations and individuals, individual citizens, and stakeholders who provided input and/or participated in consultation meetings.

Executive Summary

Branched Bartonian is an annual herb that typically grows with *Sphagnum* moss, in open wetlands. It is 10 to 40 cm tall with a green or purple, angled stem. It has small and scale-like, alternate leaves, and a few to numerous flowers that are small, white, and four-lobed. The species reproduces by seed, but it is not known how long seeds remain viable in the seed bank. Flowering occurs from late July through to September and fruiting occurs from late August to late October and possibly November. Dispersal mechanisms and pollinators of this species are not well known.

There are three subspecies of Branched Bartonian in North America: *Bartonia paniculata paniculata*, *B.p. texana*, and *B.p. iodandra*. The only subspecies that is at risk in Canada is the subspecies *B.p. paniculata*, which is the focus of this recovery strategy.

Branched Bartonian is found along much of the Atlantic Coastal Plain in the United States but only in one area in Canada. The Ontario population is considered an Atlantic Coastal Plain disjunct, as it occurs in the Muskoka-Parry Sound area of Ontario and is isolated from its main range in the United States. This disjunct population is approximately 600 km from the main population, and is genetically distinct from it. It is believed that seeds of the subspecies were moved to Canada as a result of glaciation.

Branched Bartonian was designated as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2003, and is ranked as Threatened by the province of Ontario and the federal *Species at Risk Act* (SARA). It is estimated that <1% of the global population is located in Canada.

The main threat to this species is encroachment into its habitat by the invasive shrub, Glossy Buckthorn. Other possible threats include encroachment of Non-native Common Reed, railway embankment enlargement, trampling by humans, off-road vehicle use, peat harvesting, global reduction of pollinators and climate change.

The population and distribution objective for this species is to maintain, and where feasible, increase the distribution and abundance of Branched Bartonian at extant local populations in Canada. Maintaining the current populations and their habitat would provide protection for plants not previously found and for seeds that may be lying dormant in the seedbank.

Critical habitat for Branched Bartonian is fully identified in this recovery strategy due to meeting the population and distribution objective, and is based on habitat occupancy and habitat suitability. Broad strategies to be taken to address the threats to the survival and recovery of this species are presented in the section on Strategic Direction for Recovery.

One or more action plans will be posted on the Species at Risk Public Registry for Branched Bartonian by 2022.

Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of Branched Bartonian. In keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible. This recovery strategy addresses the unknowns surrounding 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. There are local populations at each currently known location that have been found over multiple years, indicating the ability of the plant to reproduce successfully over a long period (e.g., >20 years) of time (COSEWIC 2003; Brinker 2006). The core range of the subspecies is 600 km away from the Canadian population, and because of this, there is little to no rescue effect available for the species (COSEWIC 2003). Since the development of the COSEWIC report in 2003, new local populations have been found (Natural Heritage Information Centre [NHIC] 2014). There has been survey evidence of demographic fluctuation with some local populations found 14 years apart, but not in subsequent years. This would suggest that seeds can remain viable in the seed bank, even though mature plants may not be found during a survey.

As the minimum viable population size of the species has not been investigated in Ontario, the loss of part or whole local populations would further fragment the disjunct Canadian population and render it more susceptible to extirpation.

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

Unknown. The suitable habitat that is currently available to the species appears sufficient to support the populations at all locations; however, there are uncertainties regarding the suitable habitat conditions for the Canadian population of Branched Bartonian. The species has been found repeatedly in known locations since its initial discovery in the province, and much of the habitat remains in good to excellent condition (COSEWIC 2003; Brinker 2006). The occupied habitat differs amongst several locations in Canada, and more research to determine the specific range of habitat preferences should be conducted. In addition, there has been some research that suggests Branched Bartonian may be reliant on a fungal associate (Matthews et al. 2009). Further research should be conducted to confirm if Branched Bartonian is in need of a specific fungal associate, as that would be an essential component of suitable habitat.

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

Yes. The primary threat to this species and its habitat is the spread of invasive species in some of the wetlands in which Branched Bartonian populations occur (COSEWIC 2003; Brinker 2006). There are factsheets and best practice guides available detailing control methods for Glossy Buckthorn and Non-native Common Reed (*Phragmites australis*); these control methods have been shown to be effective and further research into biological controls is underway as well (Upper Thames River Conservation Authority 2015; Michigan Department of Natural Resources 2012). Research to address knowledge gaps and actions to address widespread threats such as climate change and global reduction of pollinators would assist in the recovery of the species.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Yes. The recovery techniques necessary to achieve the population and distribution objectives exist and are detailed under (3) above; however, as the species contains several small local populations in Canada, large scale threats or disturbance could cause some local populations to be extirpated. Continuous monitoring and further understanding of the species' biology and threats will need to be conducted to allow for the objectives to be met. Further information on the life cycle of Branched Bartonian would also assist in developing effective recovery techniques (e.g. propagation, or reintroduction) in the future.

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1. COSEWIC* Species Assessment Information

Date of Assessment: November 2003

Common Name (population): Branched Bartonian

Scientific Name: *Bartonia paniculata* ssp. *paniculata*

COSEWIC Status: Threatened

Reason for Designation: A cryptic wetland annual species of Atlantic Coastal Plain affinity, highly restricted both geographically and ecologically and present at only six of seven documented sites. Ontario populations are disjunct by about 600 km from the main range of the species with little potential for a rescue effect. The greatest potential risk is from the invasive shrub, glossy buckthorn, at two localities.

Canadian Occurrence: Ontario

COSEWIC Status History: Designated Special Concern in April 1992. Status re-examined and designated Threatened in November 2003.

*COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

2. Species Status Information

In Canada, Branched Bartonian (*Bartonia paniculata* ssp. *paniculata*) is listed as Threatened⁴ on Schedule 1 of the federal *Species at Risk Act* (SARA). In Ontario, the species is listed as Threatened⁵ under the *Endangered Species Act, 2007* (S.O. 2007, ch.6) (ESA 2007).

Branched Bartonian is globally common, with a rank of G5T5⁶. It is not ranked in the United States and is Nationally Imperiled (N2) in Canada (Appendix A) (NatureServe 2015). In Canada, the species occurs only in Ontario, where it is Imperiled (S2) (Appendix A) (NatureServe 2015). It is unranked (SNR) in much of its range in the United States (Alabama, Connecticut, District of Columbia, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas), Apparently Secure (S4) in Arkansas and New Jersey, Vulnerable (S3) in Virginia,

⁴ Threatened (SARA): A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

⁵ Threatened (ESA): A species that lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening it.

⁶ Global, national and subnational conservation ranks and their definitions are listed in Appendix A.

Vulnerable to Imperiled (S2S3) in North Carolina, Imperiled (S2) in Delaware and Critically Imperiled (S1) in Maine, Missouri, New Hampshire, New York and West Virginia (Appendix A) (NatureServe 2015).

It is not known precisely how much of the global population range is in Canada, but given how common both the species and the subspecies are in the United States, the number is certain to be less than one percent. However, the conservation importance of the Ontario population is likely quite high based on recent genetic work demonstrating that the Ontario population has high genetic divergence from the core populations, and diverged earlier than previously believed (Ciotir et al. 2013).

3. Species Information

3.1 Species Description

Branched Bartonian has three currently recognized subspecies: *Bartonia paniculata paniculata*, *B.p. texana*, and *B.p. iodandra* (Ciotir et al. 2013). Only subspecies *B.p. paniculata* occurs in Canada (in Ontario) (Hingman and Penskar 1996; COSEWIC 2003; Mathews et al. 2009; Ciotir et al. 2013), and mention of Branched Bartonian throughout this recovery strategy refers to subspecies *B.p. paniculata*, unless otherwise stated. This species is also referred to as Panicked Screwstem or Twining Screwstem, and the names may be used to refer to other subspecies (e.g., ssp. *texana*) that do not occur in Canada (Gillett 1959; Hingman and Penskar 1996; COSEWIC 2003).

Branched Bartonian is an annual herb that is 10-40 cm tall with a green or purple, angled stem, though it generally appears much shorter as it often grows in *Sphagnum* moss (COSEWIC 2003). The leaves are small and scale-like, and alternate, with a few to numerous flowers that are small, white, and four-lobed (COSEWIC 2003). These alternate leaves and small, white flowers are important identifying features that distinguish Branched Bartonian from other plants. Reproduction of Branched Bartonian is not completely understood, although it has been confirmed that the subspecies reproduces by seed (COSEWIC 2003). It is not known how long seeds may remain viable in the seed bank⁷ (COSEWIC 2003). Flowering occurs from late July through to September and fruiting occurs from late August to late October and possibly into November (Gillett 1959; Hingman and Penskar 1996). Dispersal mechanisms and potential pollinators for this species are not well known. Unless the species is in bloom or fruiting, Branched Bartonian is very inconspicuous, due to its small size and growth among *Sphagnum* mosses.

⁷ Seed bank: the natural storage of seeds, often dormant, within the soil. Annual plants may rely heavily on banked seeds for successful perpetuation from year to year, particularly in early successional and/or dynamic and naturally transient/patchy habitats; germination is favoured when and where ideal microhabitat conditions occur.

The genus *Bartonina* is believed to be saprophytic⁸ (Nilsson and Skvarla 1969), though there is little evidence for this in *B.p. paniculata* specifically. Branched Bartonina's small leaves suggest that photosynthesis is not effective (Reznicek and Whiting 1976; COSEWIC 2003). Because of this, it has been hypothesized, but not confirmed, that Branched Bartonina is heterotrophic⁹ (COSEWIC 2003).

3.2 Population and Distribution

Branched Bartonina is found along much of the Atlantic Coastal Plain in the United States, from Massachusetts, south to Florida, west to Texas and north to Arkansas and Tennessee, with isolated populations in Michigan, Wisconsin and Ontario, and is considered to be common through the majority of its range (see Figure 1) (COSEWIC 2003; Hill 2003; Mathews et al. 2009).

Within Canada, Branched Bartonina (subspecies *paniculata*) is found only in Ontario. The Ontario population is disjunct from its main range in the United States, and because of this, it is referred to as an Atlantic Coastal Plain disjunct¹⁰ (Reznicek and Whiting 1976; Reznicek 1994; Ciotir et al. 2013). The wetland areas in which the Ontario populations are found are within the Georgian Bay Ecoregion 5E¹¹ (COSEWIC 2003; Brinker 2006). There are 10 known extant local populations in the Muskoka-Parry Sound/Muskoka area, near Georgian Bay on the Canadian Shield (NHIC 2014). Three of these known local populations have been found since the development of the COSEWIC (2003) report.

Based on recent data, the Canadian population is estimated to be about 767 plants (See Figure 2; Table 1); however, Branched Bartonina is easily overlooked during surveys and often occurs in extensive habitat that requires significant surveying effort (COSEWIC 2003; Brinker 2006). Because of these factors, and the discovery of three new local populations since the publication of the COSEWIC Update Status Report (2003), the actual Canadian population size may be underestimated. Based on the 2003 COSEWIC Update Status Report, the extent of occurrence¹² and area of occupancy¹³ are noted as stable, at 400 km² and <1 km², respectively.

The main range of the subspecies is approximately 600 km southwest of the Canadian population (COSEWIC 2003). Since the known Canadian population is clearly isolated from the larger population in the United States, there is little to no possibility of a rescue

⁸ Obtaining nutrients from dead or decaying organic matter

⁹ Heterotrophic: reliant on organic carbon for nutrients

¹⁰ A species isolated from its main range along the Atlantic coast of North America. This isolated population was created as a result of glaciation (glaciers physically moving the species to a new location with suitable habitat).

¹¹ These ecoregions are defined by the Ministry of Natural Resources (Crins et al. 2009).

¹² Extent of occurrence: the area included in a polygon without concave angles that encompasses the geographic distribution of all known populations of a wildlife species

(http://www.cosewic.gc.ca/eng/sct2/sct2_6_e.cfm)

¹³ Area of Occupancy: a biological measure of the occupied habitat within a wildlife species' range, determined by COSEWIC using an Index of Area of Occupancy (IAO).

effect¹⁴ at this time. Branched Bartonina was found relatively recently in Canada (1973) (Reznicek and Whiting 1976); it is therefore possible that more populations exist than are currently known, and may be found as additional surveys of suitable habitat are conducted.

¹⁴ Rescue effect: genetic or demographic immigration into a population to reduce extinction pressures

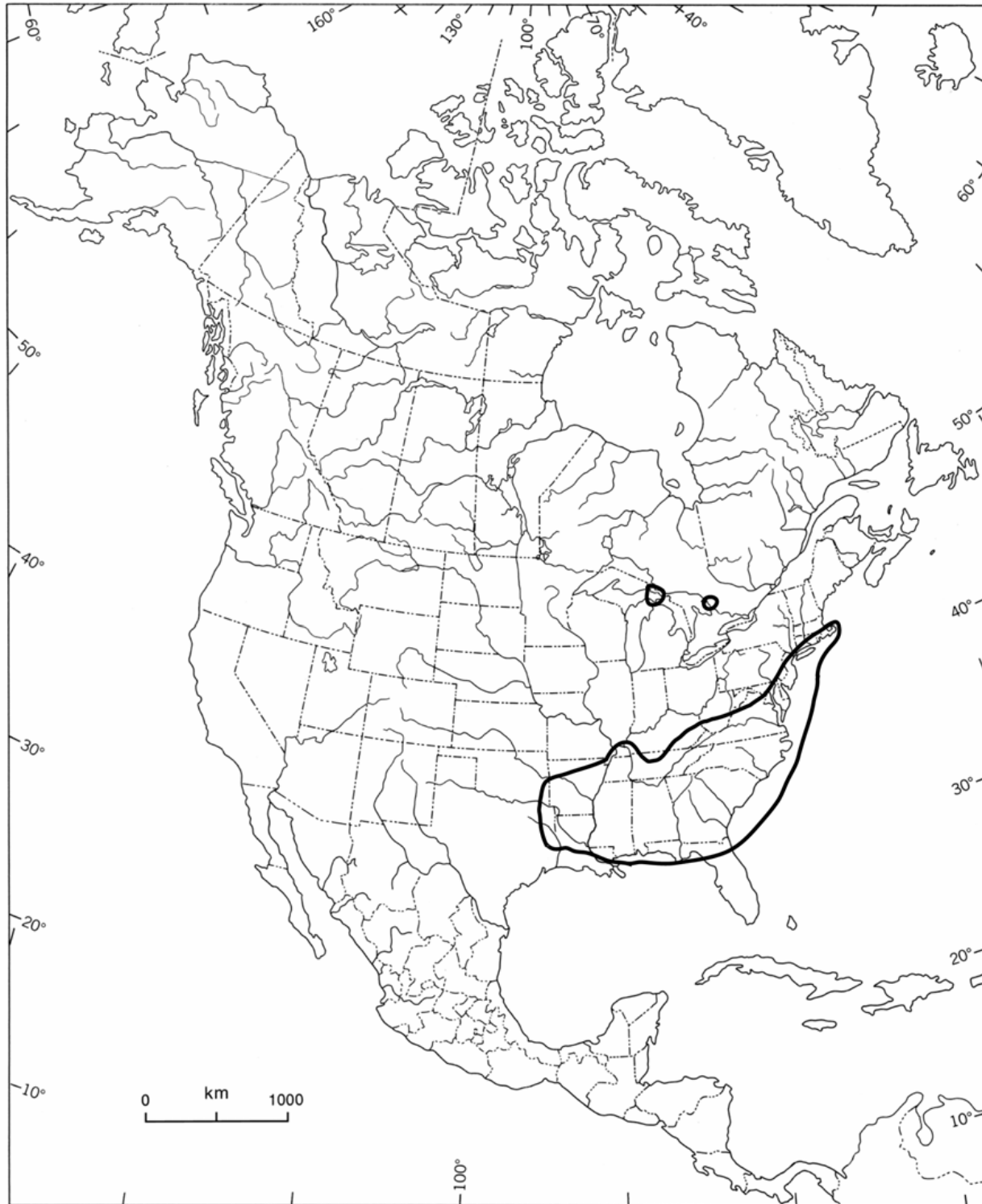


Figure 1. North American Distribution map of Branched Bartonina (subspecies *Bartonina paniculata paniculata*) (COSEWIC 2003).

Table 1. Branched Bartonia local populations in Ontario.

Local Population	Plant Count	Habitat Type	References
Axe Lake	159	Low shrub shore fen/bog complex	COSEWIC 2003; Brinker 2006;
Barrett Lake	4	Low shrub shore fen	COSEWIC 2003; Brinker 2006;
MacTier Bog	120	Moderately rich poor fen; poor fen	COSEWIC 2003; Brinker 2006;
Medora Lake Road Fen	46	Moderately rich poor fen	COSEWIC 2003; Brinker 2006;
O'Donnell Point	44	Moderately rich poor fen	COSEWIC 2003; Brinker 2006;
Bala Bog	57	Moderately rich poor fen	COSEWIC 2003; Brinker 2006;
Loon Lake Bog	100	Poor fen	COSEWIC 2003; Brinker 2006;
Little Hellagone Lake Fen	46	Poor fen	NHIC 2014
Torrance Barrens	62	Poor fen	NHIC 2014
Jevins & Silver Lake Conservation Area	129	Poor fen	NHIC 2014
Total	767		

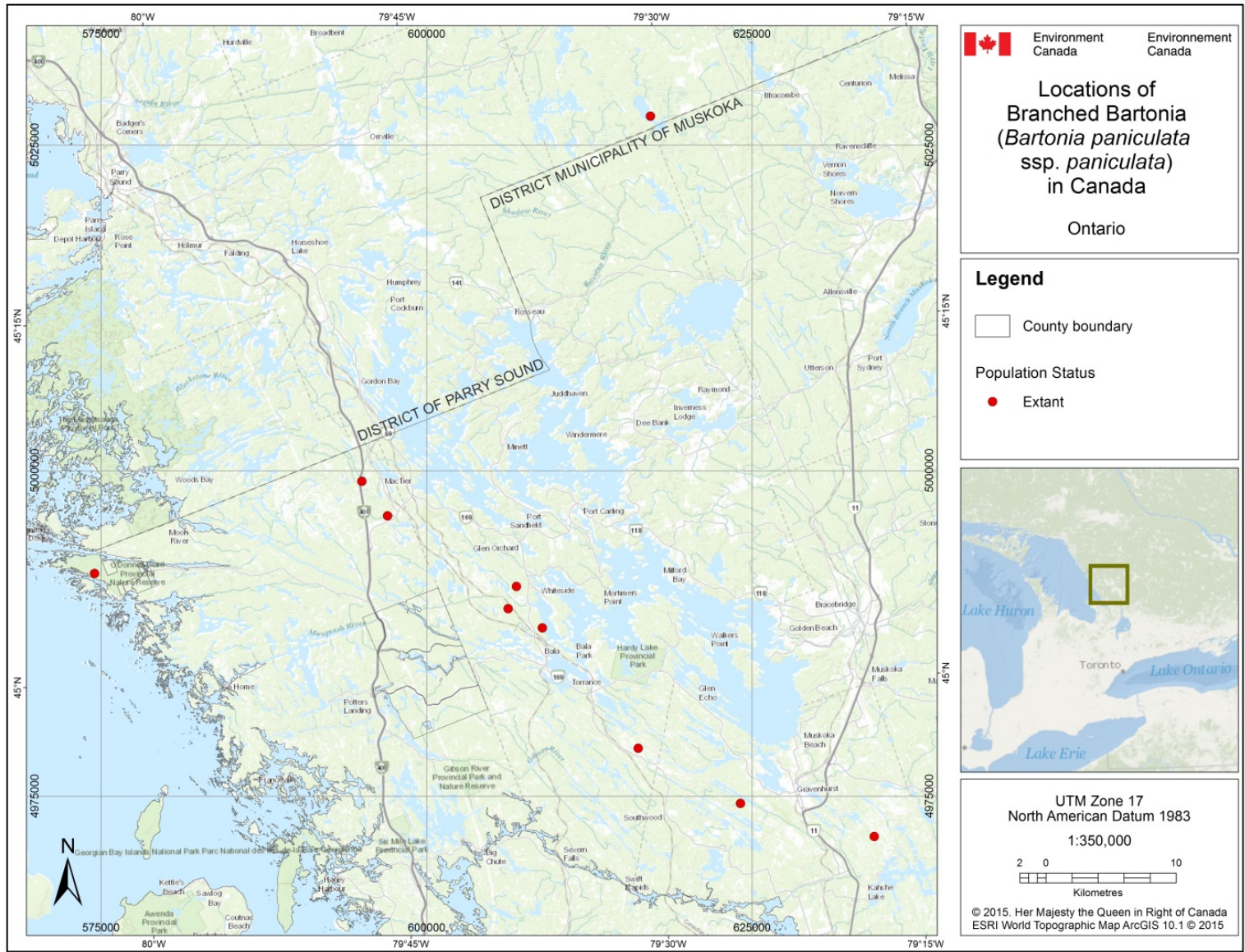


Figure 2. Locations of Branched Bartonia in Canada. There are ten extant populations in Canada.

3.3 Needs of the Branched Bartonian

In Ontario, Branched Bartonian is found in open graminoid or low shrub acidic wetlands, with nutrient poor, peat or sandy soils. Branched Bartonian grows within wetland complexes, including bogs or fens with scattered Tamarack (*Larix laricina*) and Black Spruce (*Picea mariana*) and *Sphagnum* mosses. Typically, it occurs on the Canadian Shield between low ridges of granitized rock. Associated species include (but are not limited to): Black Chokeberry (*Aronia melanocarpa*), Virginia Cotton-grass (*Eriophorum virginicum*), Mountain-holly (*Nemopanthus mucronatus*), White-fringed Orchid (*Platanthera blephariglottis*), Rose Pogonia (*Pogonia ophioglossoides*), White Beak-rush (*Rhynchospora alba*) and Virginia Chain Fern (*Woodwardia virginica*) (COSEWIC 2003; Brinker 2006). It sometimes occurs with other Atlantic Coastal Plain species, which appears to be true within all of its range and not solely in Ontario (Gillett 1959; Reznicek and Whiting 1976; Higman and Penskar 1996; COSEWIC 2003; Hill 2003; Brinker 2006; Georgian Bay Biosphere Reserve 2015).

Branched Bartonian is dependent on the openness of habitat, substrate type and continuous moisture for establishment of shoots and plant health (COSEWIC 2003; Brinker 2006). Under natural conditions the hydrology of these habitats are typically stable, but do fluctuate seasonally. Thus, the plant is particularly susceptible to habitat drying or water level stabilization that may provide conditions that favour shrub encroachment (Reznicek 1994; Higman and Penskar 1996; COSEWIC 2003; Hill 2003; Brinker 2006). Dependence on openness is based on the shade intolerance of shoots and the lack of competition for sunlight with invasive plants (Brinker 2006).

3.4 Biological Limiting Factors

Branched Bartonian is biologically limited to specific wetland habitat within its Canadian range. Branched Bartonian reproduces by seed; however, specific reproductive biology is unknown (COSEWIC 2003).

Although yet to be confirmed, it is possible that Branched Bartonian relies on a fungal association with specific mycorrhizal fungi (Mathews et al. 2009). If the presence of a specific fungus is required by Branched Bartonian, then the species would be limited by the fungus' distribution in Canada.

In addition, most of the extant populations occupy an area of less than a few square kilometres. Such populations may be vulnerable to local chance events such as storms and certain human disturbances.

4. Threats

4.1 Threat Assessment

This section highlights the threats outlined in Table 2, emphasizes key points, and provides additional information. The threats are presented in decreasing order of level of concern within each category.

Table 2. Threat Assessment Table

Threat	Level of Concern ¹	Extent	Occurrence	Frequency	Severity ²	Causal Certainty ³
Exotic, Invasive, or Introduced Species/Genome						
Glossy Buckthorn	High	Localized	Current	Continuous	High	High
Non-native Common Reed	Medium	Localized	Anticipated	Continuous	Moderate	Low
Climate and Natural Disasters						
Climate change	Medium	Widespread	Unknown /Anticipated	Continuous	Moderate	Medium
Changes in Ecological Dynamics or Natural Processes						
Global reduction of pollinators	Medium	Widespread	Current/ Anticipated	Seasonal	High	Medium
Railway embankment expansion	Low	Localized	Anticipated/ Unknown	One-time	Low	Low
Disturbance or Harm						
Trampling by humans and ATVs	Low	Localized	Unknown/ Anticipated	Seasonal	Low	Low
Peat harvesting	Low	Unknown	Unknown	Seasonal	Low	Low

¹ Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.

² Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).

³ Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).

4.2 Description of Threats

Exotic, Invasive, or Introduced Species/Genome

Glossy Buckthorn:

The invasive shrub, Glossy Buckthorn (*Rhamnus frangula*) is encroaching upon three local populations of Branched Bartonian (Brinker 2006). Glossy Buckthorn can spread quickly and form dense thickets (Catling and Zorebski 1994; Michigan Department of Natural Resources 2012; Upper Thames River Conservation Authority 2015). As such it can eliminate open habitat, causing competition for space, over shading, and drying of habitat, thereby altering habitat conditions required by Branched Bartonian. Given that this species is present near three local populations, along with its invasive nature and ability to spread quickly and densely, it is the most concerning threat for Branched Bartonian (COSEWIC 2003).

Non-native Common Reed:

The invasive subspecies of Non-native Common Reed (*Phragmites australis*) is present near one local population of Branched Bartonian and may be spreading closer to the local population along a railway corridor (Brinker 2006). The effects of Common Reed are similar to that of Glossy Buckthorn as this species aggressively invades open wet areas, outcompetes local flora, and occupies large areas in high density (Mazur et al. 2014). As it is not currently found at any Branched Bartonian locations, it is a threat that should be monitored rather than one that requires immediate active mitigation.

Disturbance or Harm

Trampling by humans and all-terrain vehicles:

Evidence of low levels of human activities such as hunting and all-terrain vehicle (ATV) use have been noted at two locations where Branched Bartonian is present, but the locations are relatively inaccessible and this threat was not noted to be of high concern (Brinker 2006). This species can be difficult to see due to its tendency to grow in *Sphagnum* moss (COSEWIC 2003), which could increase its susceptibility to being trampled during hunting or surveying activities. As Branched Bartonian has quite a short growing season, trampling of mature plants from late July to late October could severely impact seed production at small local populations. Extensive foot traffic or ATV use in Branched Bartonian habitat could cause the development of compacted trails, rendering the habitat unsuitable for seed establishment and altering the suitable habitat conditions required by the species. Evidence of trail creation from foot traffic and ATVs is already present at some local populations (Brinker 2006).

Peat Harvesting:

Branched Bartonian is found in wetlands with peat substrates, therefore removal of peat in the wetlands supporting Branched Bartonian would damage and destroy habitat for the species. At present, this threat is not known to occur at any sites occupied by the species. At least two populations are located in areas where peat harvesting is prohibited (i.e. a provincial park and a conservation area).

Climate and Natural Disasters

Climate Change:

The wetlands in which this species is found may be sensitive to warming temperatures and acidification due to climate change (Higman and Penskar 1996). Warming of the wetlands may also lead to drier conditions, which would negatively impact the species. Branched Bartonia is a wetland species that is reliant on continuous soil moisture and specific habitat conditions (see section 3.3). As such, changes to the water levels or chemistry in, or flowing to, the wetland it inhabits could be detrimental to the species. Considering the rarity of the species in Canada, and the relatively small amount of plants in each local population, Branched Bartonia is very vulnerable to catastrophic events, and the loss of a single or multiple local populations would further fragment the Canadian population and make it more susceptible to current and anticipated threats.

Changes in Ecological Dynamics or Natural Processes

Railway embankment expansion:

There is one local population near a railway embankment and it would likely be destroyed if that embankment were expanded (COSEWIC 2003; Brinker 2006). It is not known if plans to expand the embankment exist, although legislation and regulatory practices exist to address threats that would impact local populations of species at risk.

Global reduction of pollinators:

Although not confirmed, it is assumed that Branched Bartonia is dependent on pollinators for reproduction (COSEWIC 2003), and the species has been observed to be visited by pollinators such as moths (Korol pers. comm. 2015). A number of factors are suspected to be contributing to the decline in insect pollinator populations globally and in Canada, including loss of habitat and food sources, diseases, viruses, pests, and pesticide exposure (Health Canada 2014). Notably, there is growing evidence to suggest that pesticides, including neonicotinoids, may be having negative effects on pollinator populations due to their toxic properties and persistence in soil and water (van der Sluijs et al. 2013; Cutler et al. 2014). Currently, the extent to which the decline in pollinator populations may impact the Branched Bartonia is not known.

5. Population and Distribution Objective

The population and distribution objective for this species is:

- To maintain, and where feasible, increase the distribution and abundance of Branched Bartonia at extant local populations in Canada.

Branched Bartonia is an Atlantic Coastal Plain species. The Ontario population is disjunct from the main population and genetically distinct (Higman and Penskar 1996; COSEWIC 2003; Ciotir et al. 2013). Its dispersal mechanisms are unknown. With the low number of locations, the loss of one or a few would fragment the Canadian population further and render it more susceptible to extirpation.

The area of occupancy of Branched Bartonia in Canada is estimated to be <1 km² (COSEWIC 2003). Based on the most recent plant counts at each local population, the abundance of the Canadian population of Branched Bartonia is estimated to be around 767 plants; however, the species is cryptic (i.e., very hard to see unless flowering), and populations tend to fluctuate in size due to annual habitat conditions and the varying dormancy period of Branched Bartonia seeds (COSEWIC 2003; Brinker 2006; NHIC 2014). Therefore, maintaining plant and seed viability will be important for the local populations to remain stable.

Maintaining the current local populations would provide protection for dormant seeds that may allow for increased abundance and range expansion within existing habitat. Surveys to better understand the natural range of variation in population size, and habitat associations will be required to meet the population and distribution objective. Management of Glossy Buckthorn and Common Reed is also likely to be required in order to maintain the size and extent of Branched Bartonia for at least two locations (Brinker 2006). Activities, such as habitat management in adjacent wetland ecosystems, may encourage expansion of the Branched Bartonia into suitable but currently unoccupied habitats in its current range in Ontario and may assist with recovery of the species.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

Ongoing monitoring of known local populations, and searches for new locations in habitat deemed by experts to be suitable, are undertaken by the Parry Sound office of the Ontario Ministry of Natural Resources and Forestry (OMNRF) (J. Rouse, pers. comm. 2015). Branched Bartonia receives general habitat protection under the *Endangered Species Act, 2007* (as of June 30, 2013) and is a species tracked by the Natural Heritage Information Centre (NHIC). Preliminary genetic work on the Ontario population was completed by Ciotir et al. (2013). The Georgian Bay Biosphere Reserve and the Muskoka Watershed Council have webpages with information on the species and links to, or outlines of, general stewardship guidance (Georgian Bay Biosphere Reserve 2015; Muskoka Watershed Council 2015).

6.2 Strategic Direction for Recovery

Table 3. Recovery Planning Table

Threat or Limitation	Priority ^a	Broad Strategy to Recovery	General Description of Research and Management Approaches
Knowledge gaps	High	<p>Determine local population sizes at known locations and follow fluctuations between years</p> <p>Determine specific hydrologic and other needs (e.g. mycorrhizal fungi) of the species</p> <p>Better define and quantify the vegetation communities it occurs in</p> <p>Develop a survey protocol for the species to minimize survey impact on the habitat and reduce the occurrence of human disturbance (i.e. trampling) during surveys</p>	<ul style="list-style-type: none"> • Conduct standard local population surveys, determine if fluctuations follow any pattern over time • Conduct studies to assess the hydrology of the habitat and its influence on the species • Conduct a study to determine presence or absence of mycorrhizal fungi (or other indications that species is saprophytic) • Conduct studies to determine which species of <i>Sphagnum</i> it is associated with and measure overstory cover percentage in known locations • Continue genetic studies to further understand the life history of this subspecies • Develop and evaluate a standard survey/monitoring protocol • Conduct surveys using the developed survey protocol to address knowledge gaps such as: longevity, natural variations in population size, pollination, pollinators, seed establishment, and habitat associations
Glossy Buckthorn	High	Evaluate and implement control measures	<ul style="list-style-type: none"> • Assess possible control measures (e.g., cutting, pulling, chemical) and implement those most likely to be effective in the locations threatened by Glossy Buckthorn • Record and report on results to inform further similar work for this and other species at risk
Common Reed	Medium	Monitor spread of Common Reed near Branched Bartonina locations	<ul style="list-style-type: none"> • Regular (annual/biennial) monitoring of the location of Common Reed • If necessary, assess and implement control measures
Disturbance or Harm; Natural Systems Modification	Low	Communicate with appropriate stakeholders and the public regarding best management practices	<ul style="list-style-type: none"> • Identify relevant landowners and stakeholders • Create and provide communication and outreach information to enhance stewardship of the species
Climate Change	Low	Develop a plan to mitigate the potential impacts of climate change	<ul style="list-style-type: none"> • Connect with other agencies working on climate change scenarios in Ontario to guide creation of climate change predictions and measures to mitigate their impact

^a "Priority" reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species.

6.3 Narrative to Support the Recovery Planning Table

Current knowledge of local populations sizes and fluctuations is somewhat lacking, as the species was not found in Canada until 1973 (Reznicek and Whiting 1976) and surveys were not conducted with regularity until relatively recently.

Systematic and regular surveys will provide much more accurate information about local population sizes and their fluctuations. Studies to address knowledge gaps will provide information to inform habitat management, control and/or mitigation of human-caused or natural changes to hydrology. Research on methods to control invasive species such as Glossy Buckthorn and Common Reed will benefit Branched Bartonnia through identification of mitigation measures for these threats. Information obtained from research and species surveys provide a strong basis for developing communication and outreach materials that can become part of stewardship initiatives and resources that could reduce or prevent many of the listed threats.

7. Critical Habitat

7.1 Identification of the Species' Critical Habitat

Section 41(1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Under section 2(1) of SARA, critical habitat is "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species".

This federal recovery strategy identifies critical habitat for Branched Bartonnia in Canada to the extent possible, based on the best available information as of August 2015. Critical habitat is identified for the 10 extant local populations of Branched Bartonnia in Ontario (see Figure 3 and Table 4), and is sufficient to meet the population and distribution objective; therefore, a schedule of studies is not required. Additional critical habitat may be added in the future, if new or additional information supports the inclusion of areas beyond those currently identified (e.g., new populations are found or existing, extant local populations expand into adjacent areas).

Critical habitat identification for Branched Bartonnia is based on two criteria: habitat suitability and habitat occupancy.

7.1.1 Habitat Suitability

Habitat suitability relates to areas possessing a specific set of biophysical attributes that can support individuals of the species in carrying out essential aspects of their life cycle. At extant locations in Canada, Branched Bartonnia is typically found growing with *Sphagnum* moss in the peat soils of wetlands containing Tamarack (*Larix laricina*) and Black Spruce (*Picea mariana*) trees, in areas where the canopy is open. Associated

vegetation may include but not be limited to Black Chokeberry (*Aronia melanocarpa*), Virginia Cotton-grass (*Eriophorum virginicum*), Mountain-holly (*Nemopanthus mucronatus*), White-fringed Orchid (*Platanthera blephariglottis*), Rose Pogonia (*Pogonia ophioglossoides*), White Beak-rush (*Rhynchospora alba*) and Virginia Chain Fern (*Woodwardia virginica*).

Suitable habitat for Branched Bartonian is currently defined as the extent of the biophysical attributes at known local populations. These biophysical attributes, which capture the characteristics required by the species to carry out its life processes, include:

- Open, graminoid or low shrub wetland
 - wet sand or peat soils
- water pH that is slightly acidic to neutral
- presence of *Sphagnum* mosses
- presence of scattered Tamarack and Black Spruce

It is expected that other biophysical attributes (especially the identification of specific *Sphagnum* subspecies it occurs with) may be identified as more becomes known about the species.

In Ontario, suitable habitat for Branched Bartonian is described using the Northern Ontario Wetland Evaluation System (OWES) (MNR 2014). The OWES framework provides a standardized approach to the interpretation and delineation of wetland boundaries. The OWES approach classifies wetlands not only by vegetation community but also considers hydrology and topography, and as such encompasses the biophysical attributes of the habitat for Branched Bartonian. In addition, the OWES terminology is familiar to many land managers and conservation practitioners who have adopted this tool as the standard approach for northern wetlands in Ontario and is typically used by the province of Ontario to aid land use planning.

Within the OWES, wetland habitat is described by the vegetation community boundary. In addition, the area within 120 m of this wetland habitat boundary contributes to maintaining microhabitat conditions and the functional integrity of the wetland and is included as critical habitat. This boundary will include habitat occupied by Branched Bartonian and the surrounding areas that provide suitable habitat conditions (e.g., open canopy) to carry out essential life processes for the species and should allow for natural processes related to population dynamics and reproduction (e.g., dispersal and pollination) to occur. This 120 m boundary will also prevent invasive species or pollution from impacting the Branched Bartonian population. 120 m is also the area identified within the Ontario's Natural Heritage Reference Manual (OMNR 2010), as the area where any development may adversely affect the ecological function of a wetland.

As wetland habitats have high ecological value (MNR 2014), and are vulnerable to degradation (e.g., from non-natural water level fluctuations, invasive plant species and pollution) (Brinker 2006), a habitat-based approach to critical habitat identification is important. This larger area around the plant may also promote ecosystem resilience to invasive species (i.e., Glossy Buckthorn) while protecting what are typically rare plant

communities in Ontario and providing room for population expansion. While there is a lack of data regarding the dispersal distances of Branched Bartonia (COSEWIC 2003), the more recent discovery of local populations at Little Hellangone Lake Fen, Torrance Barrens and Jevins & Silver Lake Conservation Reserve indicate that the species may be present in the seedbank of surrounding suitable habitat.

7.1.2 Habitat Occupancy

The habitat occupancy criterion refers to areas of suitable habitat where there is a reasonable degree of certainty of current use by the species.

Habitat is considered occupied when:

- One or more Branched Bartonia individuals have been observed within the past 20 years.

Occupancy is based on recent occurrence reports available for all known extant local populations from Ontario's Conservation Data Centre (Natural Heritage Information Centre) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Branched Bartonia is very cryptic. There are local populations where the subspecies was found 14 years apart but not in the intervening years (Brinker 2006), which could be due to cryptic plants, or demonstrate the species' potential for extended dormancy (the length of time for which seeds remain viable in the seedbank is currently not known). The twenty-year window¹⁵ (since 1996) corresponds to the threshold beyond which a record is considered historical in Conservation Data Centres (i.e. 20 years for the Ontario Natural Heritage Information Centre (NHIC)) and allows for the inclusion of data for all ten local populations known to be extant. Additional local populations may exist, as site accessibility is low in some suitable habitat areas. If new observations become available, they will be considered for the identification of additional critical habitat.

7.1.3 Application of the Criteria to Identify Critical Habitat for Branched Bartonia

Critical habitat for Branched Bartonia is identified as the extent of suitable habitat (7.1.1) where the occupancy criterion (7.1.2) is met. The area within a radial distance of 120 m of the occupied wetland habitat is also included as critical habitat.

In Ontario, as noted above, suitable habitat for Branched Bartonia is most appropriately identified by the OWES wetland type. At the present time, 5 occupied wetlands have been evaluated by the OWES and assigned a wetland type. For the locations that have not yet been evaluated by the OWES, Ontario base mapping wetland boundaries¹⁶ are used and wetland type confirmed using high-resolution aerial photography. Critical habitat is located within these boundaries where the biophysical attributes described in section 7.1.2 are

¹⁵ A period of 1996 to 2015 has been used to identify critical habitat in this Recovery Strategy.

¹⁶ Wetland boundaries as part of the Ontario Base Mapping (OBM) in northern Ontario are mapped at a 1:20,000 scale (+/- 10 m horizontal accuracy). This accuracy is within the tolerances of the OWES, but boundaries have not been field verified.

found and where the occupancy criterion is met (section 7.1.1). When wetland boundaries are evaluated the identification of critical habitat will be updated.

Application of the critical habitat criteria to the best available information identifies critical habitat for the ten known extant local populations of Branched Bartonia in Canada (Figure 3, Table 4), totaling approximately 656 ha¹⁷. While critical habitat is identified for ten extant local populations, some of these local populations are near each other, resulting in the critical habitat grid squares of some local populations to overlap and thus appear to be represented as one. Refer to Table 4 for the names and grid square identification for each of these ten local populations.

Critical habitat for the Branched Bartonia is presented using 1 x 1 km standardized UTM grid squares. The UTM grid squares presented in Figure 3 are part of a standardized grid system that indicates the general geographic areas containing critical habitat, which can be used for land use planning and/or environmental assessment purposes. In addition to providing these benefits, the 1 km x 1 km UTM grid respects provincial data-sharing agreements in Ontario. Critical habitat within each grid square occurs where description of habitat suitability (section 7.1.1) and habitat occupancy (section 7.1.2) are met. More detailed information on critical habitat to support protection of the species and its habitat may be requested on a need-to-know basis by contacting Environment and Climate Change Canada – Canadian Wildlife Service at ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

¹⁷ This area includes up to 120m from the Ontario Wetland Evaluation System, wetland type boundaries or habitat boundaries that can be delineated from high resolution aerial photography.

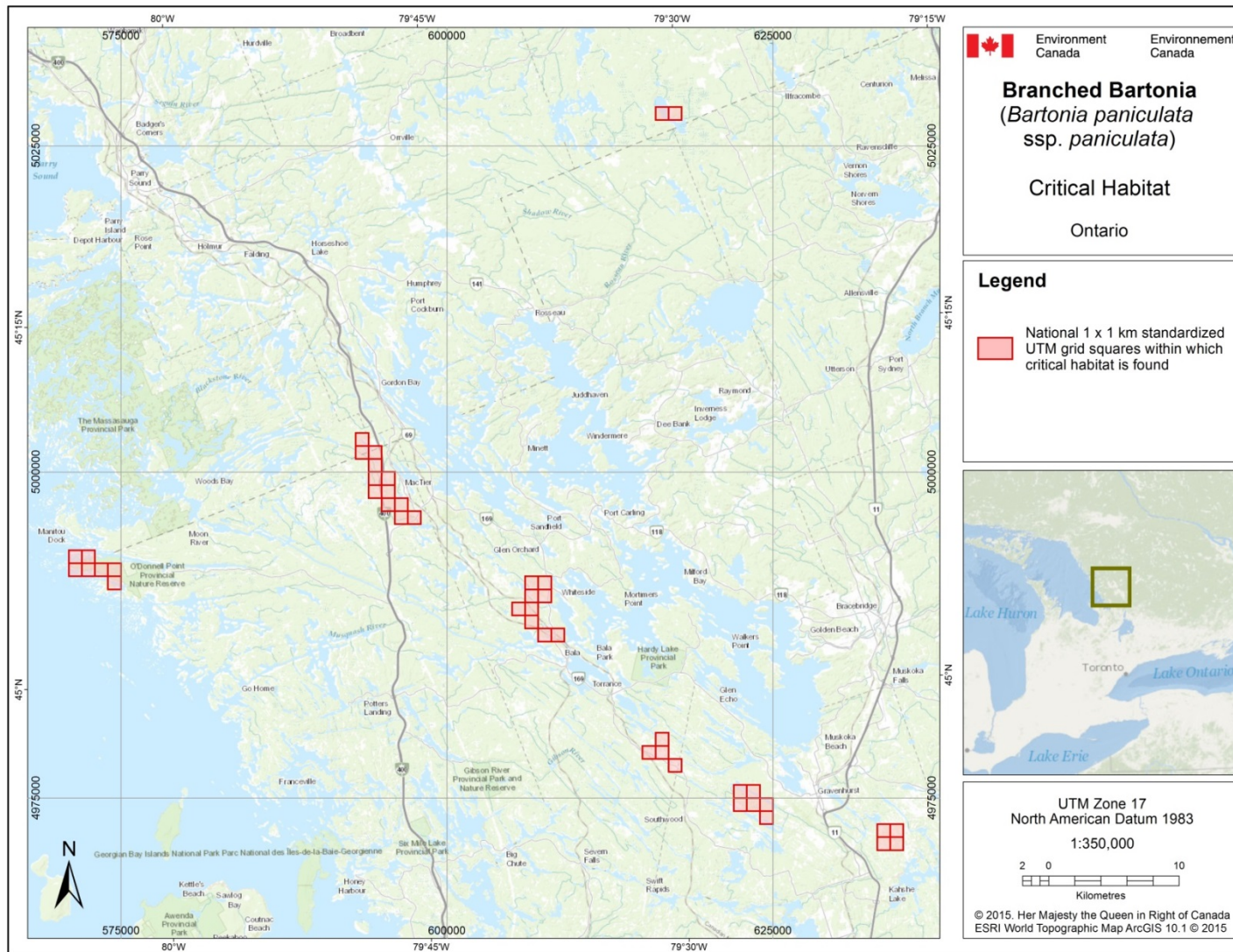


Figure 3. Grid squares that contain critical habitat for the Branched Bartonia in Canada. Critical habitat for the Branched Bartonia occurs within these 1 x 1 km standardized UTM grid squares (red shaded squares), where the description of habitat suitability (section 7.1.1) and habitat occupancy (section 7.1.2) are met.

Table 4. Grid squares that contain critical habitat for the Branched Bartonina in Canada. Critical habitat for the Branched Bartonina occurs within these 1 x 1 km standardized UTM grid squares where the description of habitat suitability in section 7.1.1 and habitat occupancy (section 7.1.2) are met.

Local Population	1 x 1 km Standardized UTM grid square ID ¹	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
O'Donnell Point	17TNK7912	571000	4992000	Non-federal land
	17TNK7913	571000	4993000	
	17TNK7922	572000	4992000	
	17TNK7923	572000	4993000	
	17TNK7932	573000	4992000	
	17TNK7941	574000	4991000	
	17TNK7942	574000	4992000	
Little Hellangone Lake Fen	17TNK9948	594000	4998000	
	17TNK9949	594000	4999000	
	17TNK9957	595000	4997000	
	17TNK9958	595000	4998000	
	17TNK9959	595000	4999000	
	17TNL9031	593000	5001000	
	17TNL9032	593000	5002000	
	17TNL9040	594000	5000000	
	17TNL9041	594000	5001000	
MacTier Bog	17TNK9966	596000	4996000	
	17TNK9967	596000	4997000	
	17TNK9976	597000	4996000	
Bala Bog	17TPK0859	605000	4989000	
	17TPK0868	606000	4988000	
	17TPK0869	606000	4989000	
Barrett Lake	17TPK0877	607000	4987000	
	17TPK0887	608000	4987000	
Medora Lake Road Fen	17TPK0960	606000	4990000	
	17TPK0961	606000	4991000	
	17TPK0970	607000	4990000	
	17TPK0971	607000	4991000	
Torrance Barrens	17TPK1758	615000	4978000	
	17TPK1768	616000	4978000	
	17TPK1769	616000	4979000	
	17TPK1777	617000	4977000	
Loon Lake Bog	17TPK2724	622000	4974000	
	17TPK2725	622000	4975000	
	17TPK2734	623000	4974000	
	17TPK2735	623000	4975000	
	17TPK2743	624000	4973000	
	17TPK2744	624000	4974000	
Jevens & Silver Lake Conservation Reserve	17TPK3731	633000	4971000	
	17TPK3732	633000	4972000	
	17TPK3741	634000	4971000	
	17TPK3742	634000	4972000	
Axe Lake	17TPL1267	616000	5027000	
	17TPL1277	617000	5027000	
				Total = 44 grid squares

¹Based on the standard UTM Military Grid Reference System (see www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098), where the first 2 digits and letter 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 www.bsc-eoc.org/ for more information on breeding bird atlases).

²The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 1 x 1 km Standardized UTM grid square that is the critical habitat unit. The coordinates are provided as a general location only.

³Land 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.

7.2 Activities Likely to Result in the 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 was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time. It should be noted that not all activities that occur in or near critical habitat are likely to cause its destruction.

Activities described in Table 5 include those likely to cause destruction of critical habitat for the species; however, destructive activities are not limited to those listed.

Table 5. Activities Likely to Destroy Critical Habitat of Branched Bartonia

Description of Activity	Descriptions of Effect in Relation to Function Loss	Details of Effect
Activities that introduce or promote the establishment of exotic and/or invasive species (e.g., planting non-native species, moving fill)	The introduction of invasive plant species can result in increased competition with Branched Bartonia for limited resources. Invasive species can also alter the ecological dynamics and/or cause physical and chemical changes to habitat (e.g., altered shade or soil moisture) and render it no longer suitable for Branched Bartonia. Invasive species such as Glossy Buckthorn and Common Reed spread rapidly and convert the open habitat needed by Branched Bartonia to closed habitat not suitable for the species, leading to loss of critical habitat.	If this activity were to occur either within or adjacent to the bounds of critical habitat, effects would be direct and cumulative, at any time of the year. A single event within critical habitat could lead to habitat destruction because once seeds are introduced it can lead to rapid expansion of invasive species. Loss of habitat at one location could lead to loss of that local population and could compromise the long-term sustainability of the Ontario population.
Activities that result in the degradation or fragmentation of critical habitat (e.g. residential development or construction or expansion of roads, rail lines or recreational trails)	Degrading habitat quality and hydrology may change critical habitat and make it unsuitable, reducing or eliminating critical habitat.	If this activity were to occur within or outside the bounds of critical habitat, effects could be cumulative, or may occur from a single event, at any time of the year.

Description of Activity	Descriptions of Effect in Relation to Function Loss	Details of Effect
Activities that result in the alteration of natural wetland water regimes and chemistry (e.g., drainage or filling of wetlands, changes to groundwater recharge areas such as paving)	As a wetland species, Branched Bartonian relies on open wet habitat, and changes to the hydrology in the wetland itself or its recharge (source) areas would degrade or destroy critical habitat.	If this activity were to occur within or outside the bounds of critical habitat, effects could be cumulative, or may occur from a single event, at any time of the year. Loss of habitat at one location could lead to loss of that local population and could compromise the long-term sustainability of the Ontario population.
Operation of off-road vehicles (e.g., ATVs)	Use of off-road vehicles in critical habitat could compact the substrate and make it unable to support the growth of Branched Bartonian.	If this activity were to occur within the bounds of critical habitat, effects would be direct and cumulative, at any time of the year.
Activities that cause native plant removal (e.g., digging, clearing, or gathering)	Removal of peat, the substrate for the wetlands comprising critical habitat, or native vegetation that contributes to suitable habitat would result in direct removal and loss of critical habitat.	If this activity were to occur within the bounds of critical habitat, effects would be direct and cumulative, at any time of the year.

8. Measuring Progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objective. Every five years, success of recovery strategy implementation will be measured against the following performance indicator:

- The distribution and abundance of Branched Bartonian has been maintained, and where feasible, increased in Canada.

9. Statement on Action Plans

One or more action plans will be completed for the Branched Bartonian and posted on the Species at Risk Public Registry by 2022.

10. 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](#)¹⁸. 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](#)'s¹⁹ (FSDS) goals and targets.

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 in this statement.

Branched Bartonia habitat is shared by many other wetland species including other rare species and species at risk. Recovery activities that conserve and/or maintain open graminoid or low shrub sphagnum wetlands will positively affect a number of other species requiring similar habitats.

¹⁸ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

¹⁹ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1

Table 6. Some of the species that may benefit from conservation and management of habitat in those areas where Branched Bartonian occurs.

Common Name	Scientific Name	SARA Status
Intermediate Pinweed	<i>Lechea intermedia</i>	Not at Risk
Inland Sedge	<i>Carex interior</i>	Not at Risk
St. John's Wort	<i>Triadenum virginicum</i>	Not at Risk
White-fringed Orchid	<i>Platanthera blephariglottis</i>	Not at Risk
Brownish Beakrush	<i>Rhynchospora capitellata</i>	Not at Risk
Northern Yellow-eyed Grass	<i>Xyris montana</i>	Not at Risk
Eastern Ribbonsnake (Great Lakes population)	<i>Thamnophis sauritus</i>	Special Concern
Eastern Foxsnake (Great Lakes population)	<i>Pantherophis gloydi</i>	Endangered
Massassauga	<i>Sistrurus catenatus</i>	Threatened
Blanding's Turtle (Great Lakes/St. Lawrence population)	<i>Emydoidea blandingii</i>	Threatened

The proposed recovery activities will benefit the environment in general, and are expected to positively affect other native species. It is possible, however, that activities that control invasive shrub species may be detrimental to some species to a limited extent (e.g., cutting or uprooting may damage adjacent vegetation). Consequently, it is important that these habitat management activities for Branched Bartonian be considered carefully and all reasonable efforts to minimize such possibilities be made. It is also important that habitat management activities for Branched Bartonian be considered from an ecosystem perspective through the development, with input from responsible jurisdictions, of multi-species plans, ecosystem-based recovery programs or area management plans (as appropriate) that take into account the needs of multiple species, including other species at risk.

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Appendix A: Subnational Conservation Ranks of Branched Bartonia (*Bartonia paniculata* ssp. *paniculata*) in Canada and the United States

Branched Bartonia (<i>Bartonia paniculata</i> ssp. <i>paniculata</i>)				
Global (G) Rank	National (N) Rank (Canada)	Sub-national (S) Rank (Canada)	National (N) Rank (United States)	Sub-national (S) Rank (United States)
G5T5	N2	Ontario (S2)	NNR	Alabama (SNR), Arkansas (S4), Connecticut (SNR), Delaware (S2), District of Columbia (SNR), Florida (SNR), Georgia (SNR), Illinois (SNR), Indiana (SNR), Kentucky (SNR), Louisiana (SNR), Maine (S1), Maryland (SNR), Massachusetts (SNR), Michigan (SNR), Mississippi (SNR), Missouri (S1), New Hampshire (S1), New Jersey (S4), New York (S1), North Carolina (S2S3), Oklahoma (SNR), Pennsylvania (SNR), Rhode Island (SNR), South Carolina (SNR), Tennessee (SNR), Texas (SNR), Virginia (S3), West Virginia (S1)

Table A-1. Ranks of Branched Bartonia in Canada and the United States. (NatureServe 2015)

Rank Definitions (NatureServe 2015)

S1: Critically Imperilled: Critically imperilled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2: Imperilled: Imperilled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3: Vulnerable: Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4: Apparently Secure: Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5: Secure: Common, widespread, and abundant in the nation or state/province.

SNR: Unranked: Nation or state/province conservation status not yet assessed.

S#S#: **Range Rank**—A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

T#: **Infraspecific Taxon** (trinomial)—The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperilled subspecies of an otherwise widespread and common species would be G5T1. A T-rank cannot imply the subspecies or variety is more abundant than the species as a whole—for example, a G1T2 cannot occur. A vertebrate animal population, such as those listed as distinct population segments under the U.S. Endangered Species Act, may be considered an infraspecific taxon and assigned a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status.