Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Quebec Rockcress (*Boechera quebecensis*) in Canada

Quebec Rockcress

2025

Government of Canada
Gouvernement du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2025. Recovery Strategy for the Quebec Rockcress (*Boechera quebecensis*) in Canada, *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa, vii + 34 p.

Official version
The official version of the recovery documents is the one published in PDF. All hyperlinks were valid as of date of publication.

Non-official version
The non-official version of the recovery documents is published in HTML format and all hyperlinks were valid as of date of publication.

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

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Également disponible en français sous le titre
« Programme de rétablissement de l'arabette du Québec (*Boechera quebecensis*) au Canada »

ISBN 978-0-660-77336-0
Catalogue no. En3-4/382-2025E-PDF

[1] www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

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[3]. Under the *Species at Risk Act* (S.C. 2002, c. 29)[4] (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 Species at Risk Public Registry.

The Minister of Environment and Climate Change and Minister responsible for Parks Canada Agency is the competent minister under SARA for the Quebec Rockcress and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Province of Quebec 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 and Parks Canada Agency, or any other jurisdiction alone. All members of the public are invited to join in supporting and implementing this strategy for the benefit of the species and 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 Parks Canada Agency 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 support the recovery and/or survival of the species. It provides all persons in Canada with information to help take action on species conservation, including identification of critical habitat to the extent possible. Where available, critical habitat spatial data is found in the Critical Habitat for Species at Risk National Dataset[5].

When critical habitat is identified, either in a recovery strategy or an action plan, SARA provides a legal framework that enables the protection of that critical habitat.

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[2] www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html
[3] The Government of Quebec is not signatory to the Accord for the Protection of the Species at Risk (1996). However, the Government of Quebec does cooperate with the federal government in the conservation of species at risk of common interest.
[4] https://laws.justice.gc.ca/eng/acts/S-15.3/index.html
[5] https://open.canada.ca/data/en/dataset/47caa405-be2b-4e9e-8f53-c478ade2ca74

In the case of critical habitat identified for terrestrial species, including migratory birds, SARA requires that critical habitat identified in a federal protected area, referred to in SARA ss. 58(2), be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the Public Registry. The prohibition against destruction of critical habitat under subsection (ss.) 58(1) will apply 90 days after the description of that critical habitat is published in the *Canada Gazette*.

For critical habitat located on federal lands that are not a federal protected area, as in SARA ss. 58(2), the competent minister must make an order applying the ss. 58(1) prohibition against destruction of critical habitat if it is not already legally protected by a provision in, or measure under, SARA or any other Act of Parliament. If the competent minister does not make the order, a statement must be included on the Species at Risk Public Registry setting out how the critical habitat, or portions of it are legally protected on those federal lands.

For any other part or portion 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 apply the ss. 61(1) prohibition against 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 recovery strategy was prepared by Guy Jolicoeur (Environment and Climate Change Canada, Canadian Wildlife Service – Quebec Region). The following persons were consulted, and helped to improve the document: Patricia Désilets, Audrey Robillard, Emmanuelle Fay, Karine Picard, Sylvain Giguère, Justine Roy, Jacinthe Letendre, and Louis Boisclair (ECCC, CWS – Quebec Region); Isabelle Ceillier and Thomas Calteau (ECCC, CWS – National SAR Recovery Planning); Benoît Tremblay, Jacques Labrecque, Vincent Piché, Line Couillard and Michèle Dupont-Hébert (Ministère de l'Environnement et de la Lutte contre les changements climatiques du Québec); Norman Dignard (Ministère des Forêts, de la Faune et des Parcs du Québec); and Antoine Plouffe Leboeuf and Jean-David Dupuis (Forillon National Park).

The Centre de données sur le patrimoine naturel du Québec provided updated data on the occurrences of the species. Special thanks go to Matthieu Allard and Maryam Rashidfar for delineating the geographic location of the critical habitat, notably the digital modelling of cliffs and escarpments through the analysis of LiDAR data, and to François Landry for map production (ECCC, CWS – Quebec Region). We also warmly thank Philippe Côté, Patrick Labonté and Justine Roy (ECCC, CWS – Quebec Region), for the drone inventory, which allowed crucial new information to be collected. Finally, credit is due to Frédéric Coursol (COSEWIC report) and Norman Dignard (provincial report), who wrote the two status reports on which this recovery strategy is largely based.

Executive Summary

Quebec Rockcress (*Boechera quebecensis*) is an herbaceous plant in the family Brassicaceae (formerly Cruciferae), or mustard family. The entire global population of this plant is restricted to a few cliffs and escarpments with a calcareous substrate in the Gaspé and Lower St. Lawrence regions of Quebec. This Canadian endemic was listed as Endangered on Schedule 1 of the *Species at Risk Act* in May 2021.

There are only five known occurrences of Quebec Rockcress, none of them consisting of more than 175 mature individuals. While the data do not allow a population trend to be identified, declines have been predicted owing to the threats faced by the different subpopulations. Rock climbing is the most significant threat. In the short term, climbers' behaviours could harm, or even eliminate, the two main subpopulations, which include more than 75% of the known mature individuals of the species in Quebec. Furthermore, the small size of the subpopulations makes them vulnerable to rockfall events, rock face collapses and rock slides on the friable and unstable rock faces where they grow. These natural erosive phenomena are expected to become more common with the increased frequency of extreme precipitation events predicted by climate change models.

For nearly 100 years since the discovery of the Quebec Rockcress in 1907, it was believed that the species' distribution was limited to maritime shorelines composed of limestone. However the importance of maritime influences to the species was called into question when an occurrence was discovered 25 km inland in 2000. This has driven the search for new occurrences in the many suitable habitats on the Gaspé Peninsula which have never before been surveyed due to their inaccessibility. A drone inventory in the summer of 2023 revealed a new colony in the middle of a vertical cliff face, which would have been impossible to detect without using a drone. It is very possible that other individuals or subpopulations will be discovered through the use of drones.

The recovery of Quebec Rockcress is considered feasible. The population and distribution objectives are aimed at preventing the declines that are expected to occur as a result of human activities. They also involve determining the species' distribution and abundance, and population trends, in order to ensure the survival of the global population. The broad strategies and general approaches for achieving the objectives are described in the Strategic Direction for Recovery section.

The critical habitat of Quebec Rockcress has been partially identified—i.e. for the five known extant subpopulations—on the basis of two criteria, geographic location and biophysical attributes. The units containing critical habitat are delineated and maps of the units are presented. A schedule of the studies required to complete the identification of critical habitat and an example of an activity that is likely to destroy critical habitat are provided, along with performance indicators that can be used to measure the progress achieved towards the species' recovery. One or more action plans for Quebec Rockcress will be posted on the Species at Risk Public Registry within 10 years after the final version of this recovery strategy is posted.

Recovery Feasibility Summary

Based on the following three criteria that Environment and Climate Change Canada uses, recovery of Quebec Rockcress is considered to be biologically and technically feasible.

A. Survival Characteristics

Can survival characteristics be addressed to the extent that the species' risk of extinction or extirpation as a result of human activity is reduced? **YES**.

Quebec Rockcress is assessed as Endangered on the basis of three main survival characteristics:

i) **Redundancy**[6] (COSEWIC B2a quantitative criterion) – the species has a small range (24 km^2) and the current number of subpopulations is very small (n= 5).

- **Rationale**: Quebec Rockcress is an uncommon species that is naturally rare. However, the numbers reported are likely less a reflection of the species' actual status than of the difficulty of accessing the area where it occurs, given that the escarpments, cliffs, cliff ledges, and talus slopes on which Quebec Rockcress grows are virtually inaccessible on foot or even by helicopter. Drone technology will enable botanists to gain access to these potential habitats. If new subpopulations are discovered in these previously unexplored habitats, this will prove that the species' redundancy is greater than what was suggested in the last status assessment.

ii) **Resilience**[7] (COSEWIC C2a quantitative criterion) – the total number of mature individuals is very low (n= 317) and none of the subpopulations contains more than 250 mature individuals.

- **Rationale**: The species' resilience will be preserved by mitigating the current threat of rock climbing, primarily in the Cap du Corbeau (Bic) subpopulation. In addition, any discovery of new individuals in Quebec during inventories of previously inaccessible habitats will lead to an increase in resilience from what was previously assessed.

iii) **Vulnerability to human-caused threats** (COSEWIC B2b and C2a quantitative criteria) – a loss of habitat and individuals is expected to occur as a result of human activities, since the plant is threatened by rock climbers and its growth on unstable rocks makes it vulnerable to rock slides, which are likely to increase in frequency due to climate change.

- **Rationale**: The projected declines in the extent of habitat and the number of Quebec Rockcress individuals can be avoided through awareness building and education activities for climbers, legislative measures,

[6] High redundancy, i.e. multiple subpopulations and/or a distribution that is very widespread, is more likely to persist over the long term because of reduced risk of catastrophic loss or extirpation from a single, local event.

[7] The ability of a species to recover from a disturbance (determined primarily by the size of the population).

conservation servitudes, municipal planning mechanisms or stewardship agreements with landowners. To minimize the risk of the partial or even total extirpation of a subpopulation as a result of a rockfall, friable rock faces could be stabilized and Quebec Rockcress individuals protected if extreme measures prove advisable and appropriate.

B. Non-reliance on Human Intervention

Is the species currently able to persist in Canada without deliberate human interventions and/or will it eventually be able to achieve and maintain independence in the state where condition (A) is respected, such that **it is not reliant on significant, direct, ongoing human intervention**? **YES**.

- **Rationale**: The species is naturally rare and, to date, has not required human intervention for its persistence. Taking human-caused threats into account will make it possible to maintain the non-reliance of Quebec Rockcress on human intervention. Periodic monitoring of subpopulations will remain essential considering the importance of this species, which is endemic to Canada and makes up part of the country's outstanding natural heritage; however, this activity does not qualify as "significant, direct and ongoing."

C. Improvement

Can the species' condition be improved over when it was assessed as, and designated, at risk? **YES**.

- **Rationale**: Despite the fact that there is limited information about the species' condition beyond present-day understanding, it is biologically and technically feasible to improve the species' condition by addressing the main survival characteristics identified (resilience, redundancy and vulnerability to human-caused threats), which should reduce the risk of extirpation or extinction. Changes can be made to the practice of rock climbing in order to eliminate the main threat to the species' survival. In addition, drone inventories can be conducted in the extensive area of unexplored potential habitat in order to improve our understanding of the species' redundancy and resilience.

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1. COSEWIC* Species Assessment Information

Date of Assessment: November 2017

Common Name (population): Quebec Rockcress

Scientific Name: *Boechera quebecensis*

COSEWIC Status: Endangered

Reason for Designation: This plant is endemic to Canada and restricted to limestone cliffs and escarpments of the Gaspé Peninsula in eastern Quebec. There are few individuals located in a small number of scattered sites. It is threatened by rock-climbers, and its growth on unstable rocks makes it vulnerable to rock-fall events.

Canadian Occurrence: Quebec

COSEWIC Status History: Designated Endangered in November 2017.

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

2. Species Status Information

Quebec Rockcress is one of 36 species of vascular plants endemic to Canada (Canadian Endangered Species Conservation Council 2022). It occurs only on calcareous cliffs and escarpments in eastern Quebec. It was listed as Endangered on Schedule 1 of the *Species at Risk Act* (SARA) (S.C. 2002, c. 29) on May 12, 2021, and designated Threatened in Quebec in January 2012 under the *Act Respecting Threatened or Vulnerable Species* (CQLR, c. E-12.01). The conservation status ranks assigned to Quebec Rockcress in its range are listed in Table 1.

Table 1. Conservation status ranks assigned to Quebec Rockcress (NatureServe 2020; Tardif *et al*. 2016).

Global (G) Rank *	National (N) Rank *	Subnational (S) Rank*
G1	Canada (N1)	Quebec (S1)

* Ranks: 1- Critically Imperiled.

3. Species Information

3.1 Species Description

Quebec Rockcress is a biennial or short-lived perennial herbaceous plant in the family Brassicaceae (formerly Cruciferae) that grows up to 10–45 cm tall (Dignard 2008; COSEWIC 2017). The leaves have finely toothed margins and form rosettes at the base of the plant. The stems, which are coated in hairs and have a few alternate leaves, emerge from the basal rosette. A raceme of small white flowers, sometimes tinged with a little lilac or purple, are arranged along one side of the stem. The fruits are elongate capsules (siliques). According to herbarium specimens, flowering lasts from mid-May to mid-July, and fruiting from early June to early August. Attempts to grow the species at the Montreal Botanical Garden using field-collected seeds were unsuccessful. The expansion of colonies is greatly limited by the species' asexual production of seeds, which means the seeds are genetically identical to the parent plant, and by the passive dispersal of the seeds over short distances. Quebec Rockcress seems to be fairly resistant to herbivores and insects, and therefore does not appear to be subject to a high predation risk.

3.2 Species Population and Distribution

Quebec Rockcress has been recorded from eight sites, all of them in eastern Quebec, specifically in the Lower St. Lawrence and Gaspé regions. The records include one extirpated occurrence[8] and two historical occurrences which were last observed in 1940, leaving five extant subpopulations (two in the Lower St. Lawrence region and three in the Gaspé region).

The two geographic areas containing most of the subpopulations, that is, the eastern tip of the Gaspé Peninsula and the Bic region, are separated by a distance of about 350 km (Figure 1). This gap in the range of Quebec Rockcress reflects the scarcity of known, accessible and surveyed habitats.

All the known subpopulations of Quebec Rockcress are very small: the total world population (347 mature individuals[9] in 2023) occupies an area of less than 300 m^2. The details of the observations for each known subpopulation are presented in Appendix A.

[8] For the purposes of this report, the terms "occurrence" and "subpopulation" are considered synonymous, corresponding to a portion of the territory that the species currently occupies or has previously occupied. The occurrences consist of one or more colonies that are separated by a distance of at least one kilometre of unsuitable habitat or apparently suitable habitat that is not known to be occupied (NatureServe 2002). According to the Centre de données sur le patrimoine naturel du Québec (CDPNQ), the historical and extirpated occurrences have not been observed for at least 20 years. The criterion used to distinguish between these two categories is whether or not the species' persistence can be confirmed through additional search effort. This is considered possible for a historical occurrence but not for an extirpated occurrence, because the habitat no longer exists or several unsuccessful searches have been conducted by experienced observers (Tardif *et al*. 2016).

[9] Each flowering stem is considered to be a mature individual (COSEWIC 2017). For more details, see the footnote to the table in Appendix A.

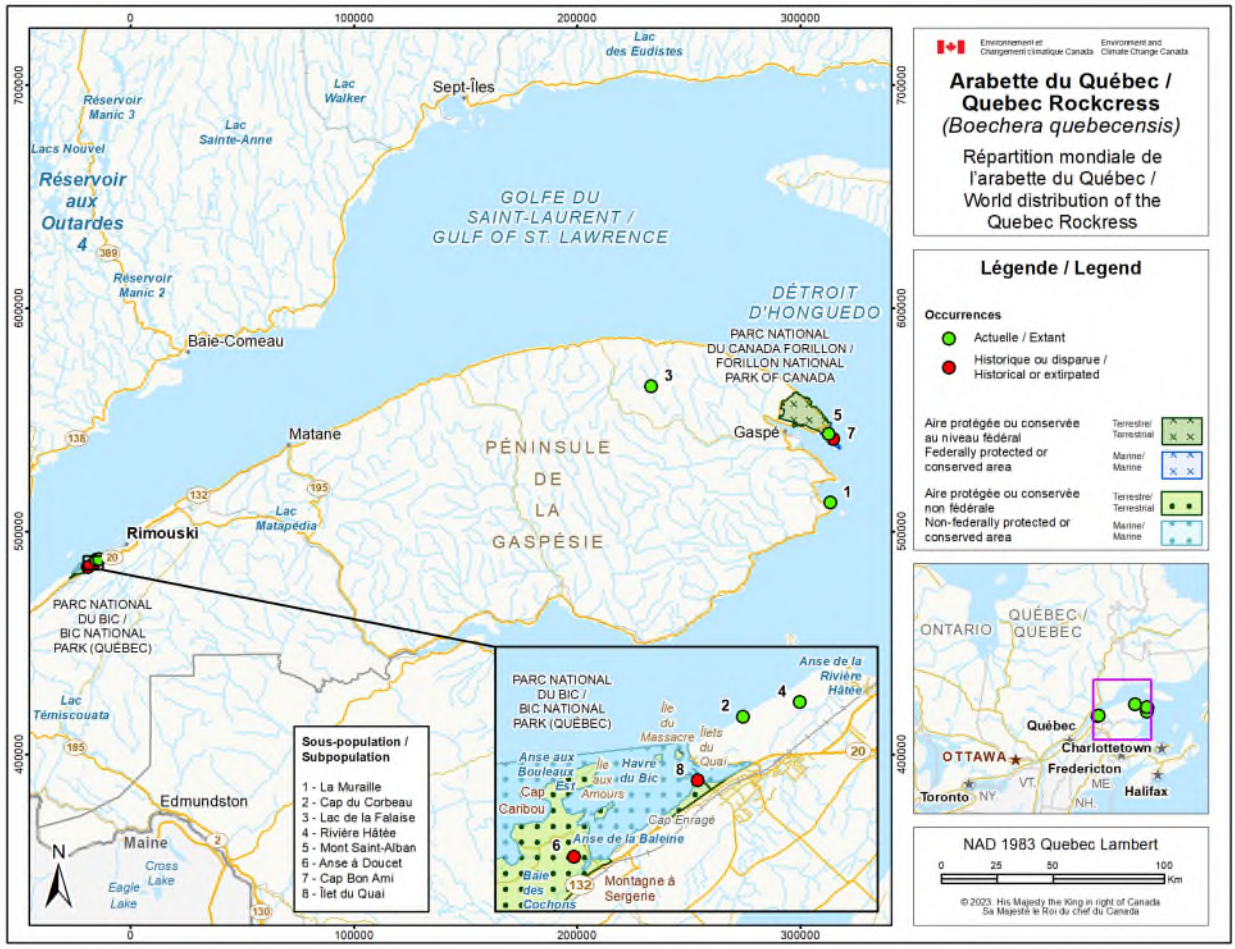

Figure 1. **Global range of Quebec Rockcress and identification of subpopulations**

Although Quebec Rockcress is obviously rare, there is some possibility that a small number of additional occurrences may eventually be found on calcareous rock faces in inland areas of the Gaspé Peninsula (COSEWIC 2017). An inventory targeting the exceptional flora on the high peaks of the Chic-Chocs Mountains (Jolicoeur *et al*. 2016) revealed the existence of a number of potential sites; however, they are very difficult to access, even by helicopter.

3.3 Fluctuations and Trends

The two reports on the status of Quebec Rockcress (Dignard 2008; COSEWIC 2017) reveal a lack of knowledge which makes it impossible to conclude with certainty that the species is in decline. These knowledge gaps make it difficult to determine the cause of the apparent extirpation of three occurrences over the past 80 years. The fact that the Cape Bon Ami and Anse à Doucet occurrences have not been found for many years could be explained by the limited geographic accuracy of the available information (herbarium specimens from 1940). It is possible that the searches conducted since then have simply not targeted the right locations. At the two sites in question, the habitat

remains relatively undisturbed and some inaccessible areas may still harbour undetected individuals (COSEWIC 2017). The species may also have disappeared from these locations as a result of natural vegetation succession, which may have altered the habitat so that it is no longer suitable for the species (Dignard pers. comm. 2020). The complete disappearance of the Îlet du Quai occurrence could be attributable to habitat destruction resulting from wharf construction early in the last century. However, owing to the limited geographic accuracy of the original source (herbarium specimen from 1927) and the lack of details on the construction of this wharf, the cause cannot be determined with certainty.

Since a standardized protocol was not used for demographic monitoring over an extended period of time, it is not possible to draw any conclusions about trends in the extant subpopulations. The fluctuations observed in the numbers of individuals reported in surveys over the years may reflect varying levels of search effort or differences in methodology. However, some declines are to be expected given the threats faced by the various subpopulations. Although recent inventories (COSEWIC 2017) do not allow demographic trends in the subpopulations to be determined, they appear to show that the occupied area is stable.

3.4 Needs of Quebec Rockcress

3.4.1 Habitat Needs

Quebec Rockcress grows in open- or semi-open rocky habitats that are invariably calcareous in nature: escarpments, sea cliffs, ledges, crevices and upper talus slopes. The largest subpopulations generally occur in sheltered spots, in concave depressions at the base of rock walls. Only the smallest subpopulations are found in exposed areas on calcareous rock, which detaches from the escarpment in small chunks (Dignard 2008; COSEWIC 2017).

The distribution of Quebec Rockcress is essentially limited by the availability of maritime shorelines composed of calcareous rock (Dignard 2008; COSEWIC 2017). However, the discovery of an occurrence 25 km inland in 2000 indicates that the species can become established in non-coastal environments with little or no maritime influence. This has driven the search for new occurrences in the many potential habitats that have never been inventoried owing to their inaccessibility (COSEWIC 2017; Dignard pers. comm. 2020; Tremblay pers. comm. 2020; Labrecque pers. comm. 2020). A drone inventory (ECCC 2023) revealed a vigorous, well-established colony at Lac de la Falaise, growing on the ledge of a vertical rock wall. It is not visible from the ground and is very likely the source of the known individuals found underneath at the base of the cliff. Future drone inventories will allow us to definitively determine whether vertical rock walls—which were previously unexplored due to their inaccessibility—are the preferred habitat of Quebec Rockcress.

Quebec Rockcress seems to prefer dry, sunny conditions, although it shows a certain degree of shade tolerance, given that it also grows in cavities at the base of

escarpments, where there is more shade. The species does not always occur in direct sunlight. In fact, all the known subpopulations, except for one, are found on north- or east-facing slopes. The plant seems to tolerate periods of drought since the rock faces are not subject to seepage and the cavities prevent light rain from reaching the ground (COSEWIC 2017).

Quebec Rockcress grows in association with other species typical of rocky habitats such as Smooth Draba (*Draba glabella*), Rock Draba (*Draba arabisans*), Alpine Woodsia (*Woodsia alpina*), Giesecke's Bellflower (*Campanula gieseckeana*) and Common Juniper (*Juniperus communis* var. *depressa*) (Dignard 2008).

3.4.2 Limiting Factors

Quebec Rockcress seems to have a limited capacity for dispersal and/or establishment from seed, given the species' absence from vast areas of apparently suitable habitat in eastern Quebec (COSEWIC 2017). Interspecific competition is not believed to be a limiting factor in open rocky habitats, considering the large expanse of habitat available to the species. However, this competition may be a critical factor on escarpment ledges, where erosion is an important factor in maintaining an open habitat. Canopy closure seems to be responsible for the potential extirpation of a historical subpopulation at Anse à Doucet in the Lower St. Lawrence region (Dignard pers. comm. 2020).

Owing to the small number of subpopulations, their small size and the limited area occupied by the species, its survival in Quebec is precarious. A single destructive event like a rockfall has the potential to cause the partial or complete loss of a colony (Dignard 2008).

4. Threats

4.1 Threat Assessment

The threat assessment for Quebec Rockcress is based on the IUCN-CMP (International Union for Conservation of Nature–Conservation Measures Partnership) unified threats classification scheme (IUCN 2017). Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (adapted from Salafsky *et al*. 2008). Limiting factors are not considered during this assessment process. For purposes of threat assessment, only present and future threats are considered. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help in understanding the nature of the threats are presented in the Description of Threats section (4.2).

Table 2. Threats calculator assessment (COSEWIC, 2017 updated).

Threat #	Threat Description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Subpopulations Concerned
5	Biological resource use	Negligible	Small	Negligible	Low	
5.2	Gathering terrestrial plants	Negligible	Small	Negligible	Low	All
6	Human intrusions & disturbance	Medium - Low	Large	Moderate - Slight	High	
6.1	Recreational activities	Medium - Low	Large	Moderate - Slight	High	Cap du Corbeau and La Muraille (rock climbing), Mount Saint-Alban (trampling)
8	Invasive & other problematic species & genes	Low	Small	Slight	High	
8.2	Problematic native species	Not calculated	Small	Slight	Low	Anse à Doucet
10	Geological events	Medium – Low	Large	Moderate – Slight	High	
10.3	Avalanches/landslides	Medium - Low	Large	Moderate – Slight	High	All

Threat #	Threat Description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Subpopulations Concerned
11	Climate change & severe weather	Low	Pervasive	Moderate	Moderate	
11.1	Habitat shifting & alteration	Low	Restricted	Moderate	Moderate	All
11.2	Droughts	Not Calculated	Pervasive	Unknown	Low	N/A
11.3	Temperature extremes	Low	Small	Slight	Moderate	All
11.4	Storms & flooding	Low	Restricted	Moderate	Low	All

[a] **Impact –** The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

[b] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

[c] **Severity –** Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71-100%; Serious = 31-70%; Moderate = 11-30%; Slight = 1-10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

[d] **Timing –** High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of Threats

Threats are presented below according to the standardized IUCN threat classification system numbering scheme. It should be noted that rock climbing (Threat 6.1) and the risk of rock face collapses (Threat 10.3) are the main threats to Quebec Rockcress. The other threats described in this section are low impact ones.

IUCN Threat 5. Biological resource use (Negligible Impact)
Threat 5.2 Gathering terrestrial plants

The collection of specimens of Quebec Rockcress for institutional herbaria, although an important part of botanical research, could become problematic. The number of individuals of the species is so small that even the harvest of a single plant could affect the survival of subpopulations (COSEWIC 2017). The collection of specimens (stems or rosettes) can affect small populations by damaging the plants or by removing seeds produced at the end of the season (Dignard 2008).

IUCN Threat 6. Human intrusions & disturbance (Medium–Low Impact)
Threat 6.1 Recreational activities

According to Lorite *et al*. (2017), rock climbing is one of the outdoor activities that has increased the most in popularity in recent decades. Rocky cliffs, historically among the least disturbed habitats, now face more intense anthropogenic pressure than ever before. McMillan and Larson (2002) showed the negative effects that rock climbing has on cliff-face vegetation elsewhere in Canada, including a decrease in the diversity of plant species and an increase in the number and abundance of invasive species.

Rock climbing is the most significant threat to the survival of Quebec Rockcress subpopulations. The increase in rock climbing activities in Quebec in recent years has had a pronounced effect on Quebec Rockcress, because it grows directly at the base of escarpments that are popular among climbers (COSEWIC 2017). In the second largest subpopulation (Cap du Corbeau, Bic), the climbing route is located only a few metres away from the two benches where the Quebec Rockcress colonies are located. Parts of these areas are heavily trampled by climbers (Dignard pers. comm. 2020).

In the near future, climbers' actions could cause harm to or even destroy the two main subpopulations, which account for more than 75% of mature individuals of the species, namely the occurrences at Cap du Corbeau (Bic) and La Muraille in Percé (COSEWIC 2017). In fact, climbers often remove vegetation from the cliff face to clean hand- and foot-holds along the climbing route, thereby causing irreversible damage to the vegetation. In addition, at the Cap du Corbeau site, climbers use the benches at the base of the escarpment as their starting point and to have their meals, repeatedly trampling Quebec Rockcress plants and altering the habitat, and thus preventing the species from occupying all of the area on these benches (COSEWIC 2017; Dignard pers. comm. 2020). The cliffs on which the other Quebec Rockcress subpopulations occur do not appear to be used by climbers, at least not at present.

In Forillon National Park, individuals of Quebec Rockcress occur very close to a heavily used lookout. Ongoing vigilance by managers is required to reduce any risk of trampling (Gilbert 2003).

IUCN Threat 8. Invasive & other problematic species & genes (Impact Not Calculated)

Threat 8.2 Problematic native species

Canopy closure appears to have led to the extirpation of Quebec Rockcress in the historical occurrence of Anse à Doucet (Dignard pers. comm. 2020). The impact has not been calculated as the threat is only considered to be in the past.

IUCN Threat 10. Geological events (Medium-Low Impact)

Threat 10.3 Avalanches/landslides

The fact that Quebec Rockcress grows on friable and unstable rock makes it vulnerable to rockfall events, rock face collapses, rock slides and other forms of erosion. By limiting shrub cover, these erosive processes maintain habitat openness and help to encourage the presence of Quebec Rockcress at these sites. However, a rockfall event could lead to the extirpation of an entire subpopulation, given the small number of individuals involved (Dignard 2008). Active erosion occurs at all the sites, but the Lac de la Falaise, Forillon National Park and La Muraille (in Percé) sites are especially vulnerable given that their talus slopes are continually supplied with rockfall from adjacent cliff faces (COSEWIC 2017). Furthermore, the frequency of these natural erosive processes has the potential to be exacerbated due to the increased popularity of rock climbing as well as climate change, if it manifests in the form of intensified rainfalls and an increase in thermal stress (Collins and Stock 2016).

IUCN Threat 11. Climate change & severe weather (Low Impact)

Gendreau *et al*. (2018) calculated a CCVI (Climate Change Vulnerability Index) for all plant species at risk in Quebec. Quebec Rockcress is considered extremely vulnerable: there is a strong likelihood that the species' abundance or distribution will decline significantly by 2050. The species' sensitivity to climate change, as indicated by the results of the CCVI, is attributable to a combination of factors: its rarity, small subpopulations, very limited range, habitat specificity and absolute affinity for calcareous substrates, which are uncommon. In addition, there is a degree of uncertainty associated with the significant gaps in knowledge related to the species' genetics and, more broadly, its biology. This study (Gendreau *et al*. 2018) is more recent and more detailed than the threat calculator in the status report on the Quebec Rockcress (COSEWIC 2017) and explains the modifications made to the report. The climate warming observed so far is only a prelude to more changes expected in the 21st century. This suggests that effects on biodiversity will be amplified (Berteaux *et al.* 2014).

Threat 11.1 Habitat shifting & alteration

The calcareous cliffs and escarpments where Quebec Rockcress occurs are characterized by adverse environmental conditions to which few species are able to adapt. However, the main climate change models predict a warming climate, increased rainfall, a reduced snow cover, and a longer growing season throughout the species' range (Ouranos 2015; Bush and Lemmen 2019). These changes could lead to more favorable conditions for pioneer species to colonize Quebec Rockcress habitat. Although the impacts of interspecific competition on Quebec Rockcress are unknown, the resulting increase in competition for the already limited resources could have adverse effects on certain subpopulations of the species (COSEWIC 2017; Tardif 2019).

Threat 11.2 Droughts

Despite regional variability and some degree of uncertainty, the main climate models predict a slight decreasing trend in the meteorological drought indices for southern Quebec, including the Gaspé and Lower St. Lawrence regions (Ouranos 2015). Tardif (2019) calculated that the potential impact of prolonged summer droughts on Quebec Rockcress is not significant, notably because the species grows in dry habitats. Therefore, this threat, which was identified in the status report (COSEWIC 2017), will not be directly considered in the development of recovery measures for Quebec Rockcress.

Threat 11.3 Temperature extremes

The main climate models (Ouranos 2015; Bush and Lemmen 2019) predict a temperature increase of at least 3° C over the 2021–2050 period throughout the range of Quebec Rockcress. Considering that virtually nothing is known about the species' phenological flexibility or its capacity for physiological adjustment in response to any significant change in a key environmental parameter (Gendreau *et al*. 2016), and taking into account the at-risk status of Quebec Rockcress, we suspect that an increase in temperature as is predicted could have adverse effects on the survival and reproduction of individuals of the species (COSEWIC 2017).

Threat 11.4 Storms & flooding

The IPCC (2013), as well as Ouranos (2015), has identified many studies (Mailhot *et al*. 2007; Mailhot *et al*. 2012; Guinard *et al*. 2014; Paquin *et al*. 2014) that predict more frequent and more intense extreme precipitation events for southern Quebec and the Gulf of St. Lawrence region by the end of this century as a result of global warming. An increase in the intensity of precipitation is recognized as a primary trigger for landslides (Gariano and Guzzetti 2016). D'Amato *et al*. (2016) showed the significant influence that heavy rainfall has had on rockfalls on a limestone cliff in the French Alps. As

mentioned in relation to Threat 10.3, all the Quebec Rockcress subpopulations are vulnerable to extirpation as a result of rockfall events.

The occurrence of the species in Bic provincial park (Cap du Corbeau) could be affected by a potential increase in the water level of the St. Lawrence River over the long term, and the habitat could be exposed to the effects of salt spray and coastal erosion. The species' occurrence in Percé (La Muraille) is situated in a creek's floodplain. It is threatened by the intensification of the creek's flood that could occur due to increased precipitation predicted by climate models (COSEWIC 2017).

5. Population and Distribution Objectives

Objective: By 2035, ensure the survival and recovery of Quebec Rockcress in Canada, and therefore globally, by maintaining or improving its redundancy[10] and its resilience[11] through the management of human-caused threats for all known subpopulations as well as for those that may eventually be discovered, while ensuring that the total population of mature individuals remains above 250 and that the index of area of occupancy[12] remains greater than 20 km^2.

Short-term statement towards meeting the objective:
1. By 2025, mitigate the threat currently posed by rock climbing;
2. By 2030**,** characterize the vulnerability of each subpopulation to rock face collapses and, if necessary, minimize this threat;
3. By 2030, assess and monitor the status of all the subpopulations;
4. By 2030, assess the species' global range.

5.1 Rationale

Quebec Rockcress is a Canadian endemic with a small global range. The Committee on the Status of Endangered Wildlife in Canada assessed the species as Endangered because of its small number of mature individuals and small number of known subpopulations, none of which has more than 250 mature individuals, and its small area of occupancy (24 km^2), as well as the projected decline in the number of individuals and in habitat (COSEWIC 2017). The projected declines are associated with human activity since the plant is threatened by the increasing popularity of rock climbing. Furthermore, its growth on unstable rocks makes it vulnerable to rock slides, and these events are likely to become more frequent with climate change.

[10] Number of subpopulations (n= 5 current + 2 historical) according to the status report (COSEWIC, 2017).
[11] Resilience: A population size and genetic diversity in the total population of a species that is large enough to allow it to rebound from disturbance and avoid demographic collapse.
[12] The index of area of occupancy (IAO) is a parameter that represents the area of suitable habitat occupied by a taxon.

The species' extreme rarity is natural[13]. It is likely that Quebec Rockcress will remain on the list of species at risk under SARA despite the successful implementation of the recovery strategy. According to the *Species at Risk Act* Policy on Recovery and Survival, "for certain species with naturally limited or low abundance and distribution in Canada, a 'recovered' condition under SARA may be a state in which the species still has a high natural risk of extinction/extirpation, even after the significant impacts of human activities have been successfully addressed" (Government of Canada 2020).

However, according to this policy document, the objective of recovery is to "return the species to whatever its natural condition was in Canada prior to being put at risk by human activities." Consequently, the first urgent challenge to be met is to **mitigate the current threat posed by rock climbing**, primarily to the Cap du Corbeau (Bic) subpopulation.

In all likelihood, Quebec Rockcress has been established in its range for several thousands of years and has survived until now by coping with the geomorphological dynamics of the habitats where it occurs, including rock face collapses, rockfall events and rock slides. These same dynamics also create new opportunities for the species to become established and, ultimately, an equilibrium is reached, allowing the species to persist. However, this equilibrium may be affected by climate change impacts, notably the increased frequency of extreme precipitation events which increase the risk of collapses and rock slides. It is essential to **characterize the vulnerability of each subpopulation to these rock face collapses** and to develop a response strategy that is both preventive and reactive.

Measures need to be implemented to minimize these two anthropogenic threats and curb the anticipated decline of Quebec Rockcress so as to restore the species to its natural condition. **Monitoring the entire known population of the species and characterizing its global range** by searching for other subpopulations in potential habitat will allow the objective of preserving a minimum of 250 mature individuals in at least five subpopulations covering more than 20 km^2 to be achieved.

Should these monitoring activities demonstrate a decline, actions must be taken to manage the species and its habitat.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

- Under a project funded by the Habitat Stewardship Program (HSP) for Species at Risk, the trampling of Quebec Rockcress individuals at Cap du Corbeau has been halted thanks to education efforts targeting climbers, as well as the marking of the

[13] There is no evidence of a causal relationship between the fate of three subpopulations that have not been observed for more than 80 years (or are extirpated) and human activity.

colony by the Sud-de-l'Estuaire ZIP Committee, with the participation of the rock climbing club Les Grimpeurs de l'Est.

- A plant habitat was designated under the Quebec *Act Respecting Threatened or Vulnerable Species* for the Mount Saint-Alban subpopulation (Falaise-du-Mont-Saint-Alban plant habitat)
- The Mount Saint-Alban subpopulation is located in Forillon National Park and benefits from some protection under the *Canada Parks Act* and its associated regulations. Under this Act, the picking or collection of plants is prohibited.
- Forillon National Park has begun a process to monitor sensitive plant species in its territory, given that the last systematic inventory was carried out in the summer of 2002 (Gilbert 2003). A literature review was conducted internally in the winter of 2021, and inventories will be carried out in the next five years to better document, and update the knowledge on, the occurrence and status of Quebec Rockcress in Forillon National Park. The park was visited in 2021 in order to conduct a count of mature individuals and rosettes in the Mount Saint-Alban subpopulation, and a systematic drone inventory of the rock faces on Mount Saint-Alban was begun in 2022. Botanists from the Quebec Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP) will conduct an inventory of talus slopes to look for plants in 2023 (Plouffe Leboeuf pers. comm. 2023).
- An exceptional forest ecosystem (EFE) was created under the Quebec *Sustainable Forest Development Act* for the Lac de la Falaise subpopulation (Forêt refuge du Lac-de-la-Falaise EFE).
- A drone inventory (ECCC 2023) has revealed the presence of a new colony in the proposed critical habitat at Lac de la Falaise, on the ledge of a vertical rock wall invisible from the ground, which confirms the usefulness of this technology and validates the approach adopted for the delimitation of critical habitat.

6.2 Strategic Direction for Recovery

The broad recovery strategies for Quebec Rockcress are grouped by category of conservation actions (green bands in the table) based on the classification scheme developed by the Conservation Measures Partnership in collaboration with the International Union for Conservation of Nature (CMP 2016). These strategies are presented in order of importance. Further details are provided on some strategies in the Narrative to Support the Recovery Planning Table (Section 6.3) after the table.

Table 3. Recovery Planning Table

Threat or Limiting Factor	Priority[e]	Broad Recovery Strategy	General Description of Research and Management Approaches
3. AWARENESS RAISING and 6. CONSERVATION DESIGNATION & PLANNING			
Rock climbing	High	Continue to mitigate the threat to the Cap du Corbeau (Bic) subpopulation of Quebec Rockcress associated with the practice of rock climbing	• Continue awareness-raising activities with key stakeholders from the climbing community and continue to work in partnership with them and the conservation community in the Lower St. Lawrence region • Should new colonies be discovered on the rock wall or if the above-mentioned approach is not successful in achieving the desired objectives, define and implement an adequate procedure for moving climbing routes or, if necessary, limit (or even prohibit) access to the site, as needed • Encourage the involvement of private landowners (voluntary conservation agreement), municipalities (modification of municipal zoning) and local environmental groups in the stewardship of known sites as well as any reconfirmed or newly discovered occurrences
	Moderate	Eliminate all threats to the other Quebec Rockcress subpopulations associated with the practice of rock climbing	
8. RESEARCH AND MONITORING			
Gaps in knowledge on demographics	High	Count and monitor the numbers of individuals in known subpopulations	• Develop and use standardized methods for conducting accurate counts, monitoring extant individuals and determining demographic trends in subpopulations
Gaps in knowledge on species distribution	Moderate	Determine if there are other extant Quebec Rockcress subpopulations	• Identify, map, and inventory the numerous potential habitats never visited due to their inaccessibility

1. LAND MANAGEMENT			
Rock face collapses and rock slides	Moderate	Protect subpopulations from possible collapses and rock slides	• Assess the vulnerability of each subpopulation • Develop a response plan for highly vulnerable sites • Implement preventive measures if deemed necessary

[e] "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

Eliminate all threats to Quebec Rockcress associated with the practice of climbing

Identifying and then quickly implementing all appropriate measures is a priority, whether legislative, regulatory or associated with municipal planning tools, to preserve the entire Cap du Corbeau population, which is under strong pressure. Habitat conservation can be ensured through land acquisition, or through conservation servitudes or agreements reached with private landowners. These measures are also appropriate for the other Quebec Rockcress subpopulations, given that 99% of the known mature individuals are located outside the network of protected areas (Appendix A).

Inspired by the efforts of Regroupement QuébecOiseaux to protect birds of prey nesting on rocky cliffs and escarpments (RQO 2007; Bussière 2010), a partnership could and should be developed with the Quebec mountaineering and climbing federation, the Fédération québécoise de la montagne et de l'escalade. Regional climbing clubs could be entrusted with the stewardship of the sites, and could also raise awareness among and educate their climber members. For example, adding explanatory signage at rock faces that provide important habitat for Quebec Rockcress could be an interesting avenue.

Count and monitor numbers of individuals in known subpopulations

The ultimate indicator of the state of health of Quebec Rockcress in Canada remains the number of mature individuals in each subpopulation and the extent to which this number is being maintained. Past inventories provide us with some indications of this but, due to the lack of uniformity in the methodology used and the small number of surveys, no trends can be identified. The preferred approach therefore involves developing a standardized protocol for conducting accurate counts of individuals. It is critical that the inventory of a given population is carried out accurately at regular intervals, using the same protocol. Repeated surveys will demonstrate the natural range of variation in abundance and the area of occupancy of each subpopulation, allowing the demographic trends in each subpopulation to be determined.

Determine if there are other extant Quebec Rockcress subpopulations

The five extant occurrences of Quebec Rockcress do not accurately reflect the species' distribution and abundance but rather the area that is accessible to the botanists conducting the inventories. The escarpments, cliffs, ledges, and talus slopes where Quebec Rockcress grows are virtually inaccessible on foot. However, this major knowledge gap can now be filled due to recent drone technology (Nyberg 2019; Kiss 2021; La Vigne *et al.* 2022). With drones, the probabilities are high of discovering new subpopulations in suitable but inaccessible habitats. Taking specimens of the species for institutional herbaria, should the opportunity arise, may only be done when this activity will not threaten the vitality of the subpopulation and is authorized by the responsible jurisdiction.

Protect subpopulations from potential collapses or rock slides
Active erosion of the rock faces where Quebec Rockcress grows is a real threat, of solely natural origin initially, but now accentuated by climate change. To follow up on the determination of the risk to each population, a response plan combining the rapid detection of rock slides and collapses, the recovery of plants and seeds of the species, habitat restoration and seeding could be developed for the sites at highest risk.

7. Critical Habitat

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.” 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.

The critical habitat of Quebec Rockcress is currently only identified for the five extant subpopulations, based on the best available information.[14] Critical habitat for the two historical subpopulations (Anse à Doucet in Bic provincial park and Cape Bon Ami in Forillon National Park) could not yet be identified due to the age of the records, which both date back to 1940, and consequently lack geographic accuracy. Therefore, there is currently not enough adequate data to make a determination on the species’ persistence at these two sites. Inventories of the inaccessible portions of the areas around those two records as well as any other suitable areas within the range of Quebec Rockcress, where no botanists have conducted surveys, are required to determine if Quebec Rockcress individuals occur there. The identification of critical habitat for the Quebec Rockcress may therefore be partial and insufficient to meet the population and distribution objectives for the species. Once surveyed, if the historical populations are confirmed or new sites are found, more accurate boundaries would be mapped and additional critical habitat could be added.

7.1 Identification of the Species’ Critical Habitat

The critical habitat of Quebec Rockcress is not limited to the areas occupied by the subpopulations of the species (i.e. the five extant occurrences). The habitats used by the species are highly dynamic from a geomorphologic point of view; rock face collapses, rockfall events, and rock slides are frequent, constantly altering the landscape. Some habitats are destroyed while new ones are created. These erosion processes are an integral part of the creation and maintenance of suitable habitats for Quebec Rockcress in both time and space.

[14] Occurrences of Quebec Rockcress known to Environment and Climate Change Canada as of May 2022. Data provided by the Centre de données sur le patrimoine naturel du Québec (CDPNQ).

The identification of critical habitat for Quebec Rockcress is therefore based on two criteria described in detail below: habitat occupancy, in other words, **geographic location**, and the **biophysical attributes** of suitable habitat.

(1) **Geographic Location**

For each occurrence retained, the unit containing the critical habitat is delineated as follows: the polygon linking each escarpment, cliff or talus slope containing rocky slopes steeper than 60 degrees that are associated[15] with each extant occurrence of the species. To take account of the dynamic nature of the habitat, a 50-m buffer zone is created around the resulting polygons. Lastly, some anthropogenic structures (e.g. roads, overpasses, buildings) as well as unsuitable habitat (e.g. water bodies) are excluded.

(2) **Biophysical Attributes**

Within these units, the critical habitat is identified as any area with the biophysical attributes that allow Quebec Rockcress to complete all the stages of its life cycle, including the colonization of suitable habitats, and that are therefore necessary for its survival and recovery.

These biophysical attributes are described in the two reports on the status of the Quebec Rockcress (Dignard 2008; COSEWIC 2017) and comprise:

Open or semi-open rocky habitats, notably escarpments, cliffs, ledges, crevices[16], rocky ridges and slopes, talus slopes, benches on vertical rock faces, and boulders at the foot of cliffs with all the following attributes:

- a calcareous substrate, notably sandstone, mudstone, shales, conglomerates, boulders, colluvial deposits[17]
- absent to sparse vegetation cover (non-woody), which minimizes the competition for limited resources;
- xeric to mesic[18] conditions in the substrate.

The critical habitat is identified for the five extant subpopulations of Quebec Rockcress. The units containing critical habitat are shown in Figures 2 to 6 as yellow-shaded polygons. The critical habitat identified is found within the yellow polygons where all the attributes set out in Section 7.1 (2) are found:

- La Muraille (subpopulation 1; Figure 2)
- Cap du Corbeau (subpopulation 2; Figure 3)

[15] Making up part of a coherent whole based on geology, surface deposits, vegetation and slope.
[16] A gap or fissure in hard rock.
[17] Fine sediment deposits resulting from reworking nearby.
[18] Moderate moisture content.

- Lac de la Falaise (subpopulation 3; Figure 4)
- Hâtée River (subpopulation 4; Figure 5)
- Mount Saint-Alban (subpopulation 5; Figure 6)

Habitats where these biophysical attributes are not found (e.g. forests, dense shrub communities, water bodies or watercourses) are not identified as critical habitat. Existing anthropogenic features (e.g. roads, overpasses, buildings) do not have the biophysical attributes needed by Quebec Rockcress and are not identified as critical habitat.

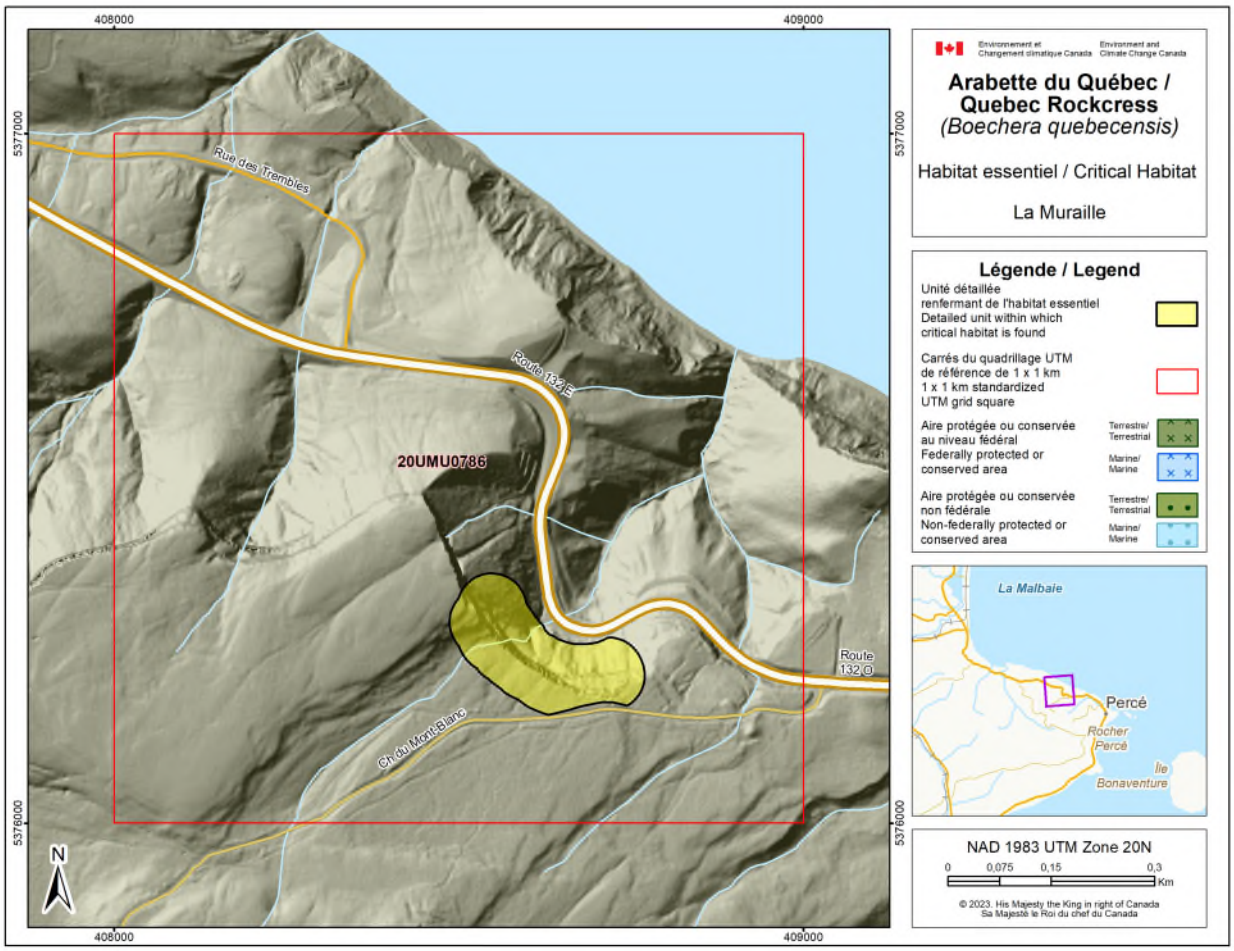

Figure 2. The critical habitat of Quebec Rockcress at La Muraille (subpopulation 1) is represented by the yellow-shaded polygon where the description of habitat criteria and the methodology set out in Section 7.1 are met. The 1 x 1 km UTM grid square overlays (red outline) surrounding this unit are part of a standardized national grid system that indicates the geographic area containing the critical habitat. Areas outside the yellow-shaded polygon do not contain critical habitat.

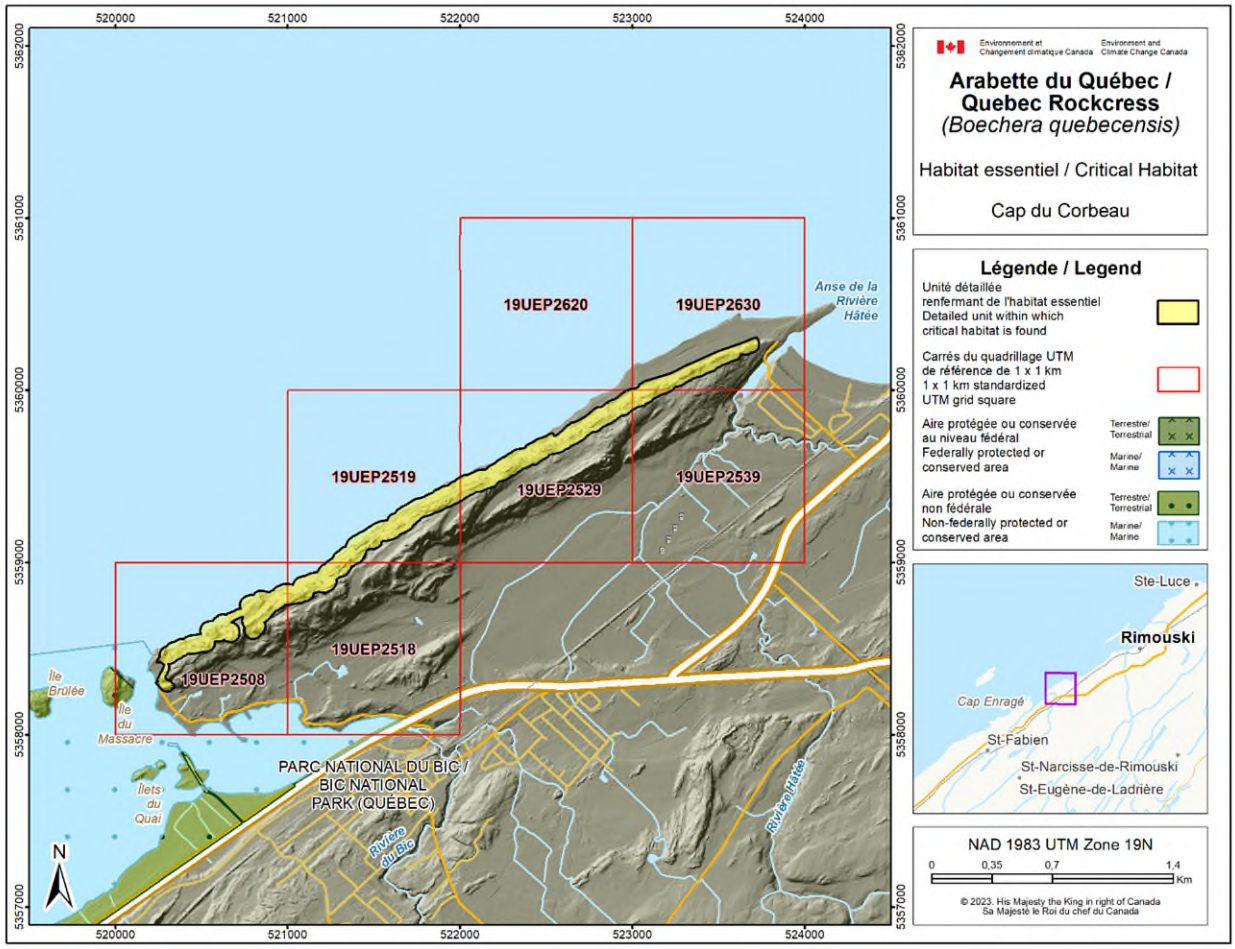

Figure 3. The critical habitat of Quebec Rockcress at Cap du Corbeau (subpopulation 2) is represented by the yellow-shaded polygon where the description of habitat criteria and the methodology set out in Section 7.1 are met. The 1 x 1 km UTM grid square overlays (red outline) surrounding this unit are part of a standardized national grid system that indicates the geographic area containing the critical habitat. Areas outside the yellow-shaded polygon do not contain critical habitat.

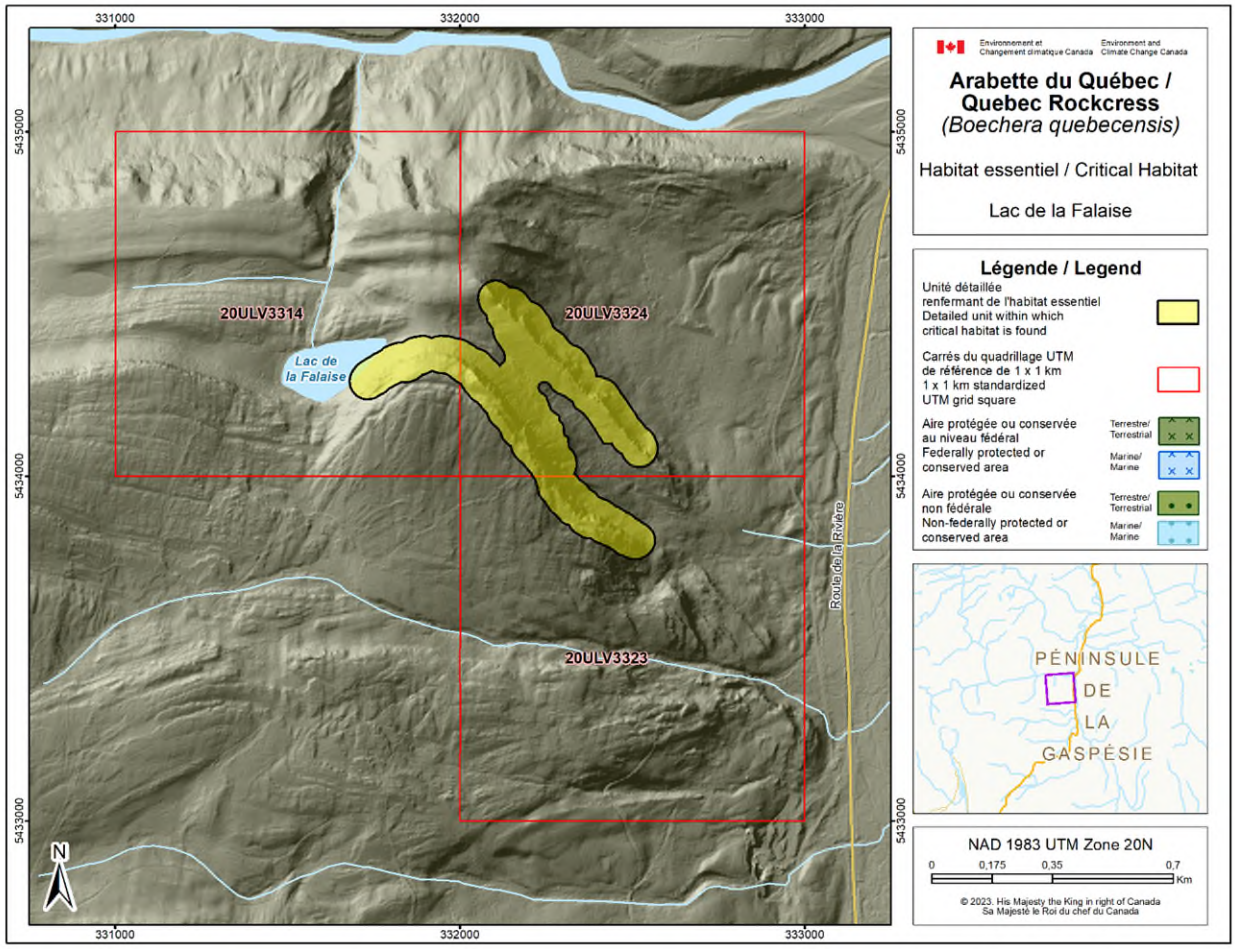

Figure 4. The critical habitat of Quebec Rockcress at Lac de la Falaise (subpopulation 3) is represented by the yellow-shaded polygon where the description of habitat criteria and the methodology set out in Section 7.1 are met. The 1 x 1 km UTM grid square overlays (red outline) surrounding this unit are part of a standardized national grid system that indicates the geographic area containing the critical habitat. Areas outside the yellow-shaded polygon do not contain critical habitat.

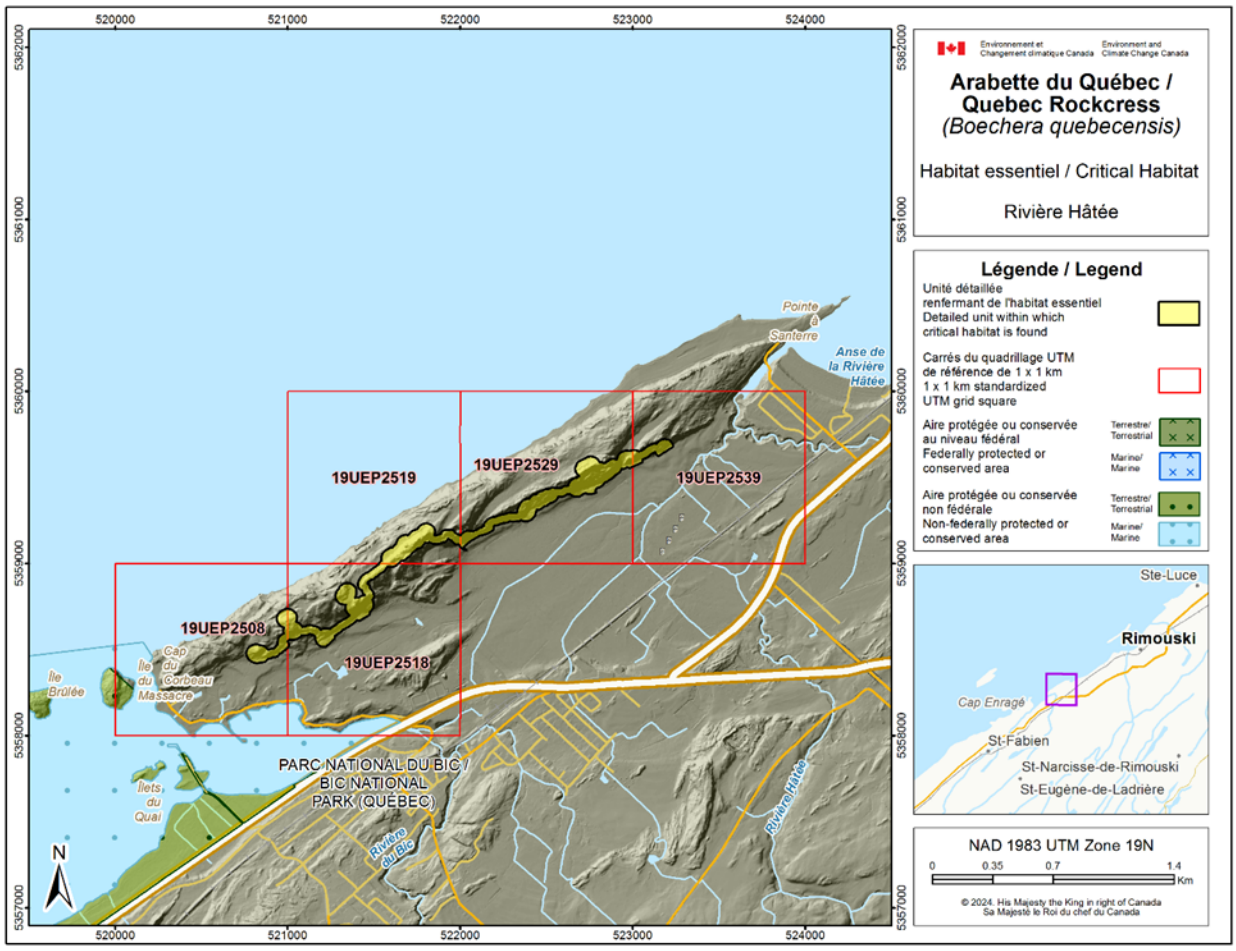

Figure 5. The critical habitat of Quebec Rockcress at Hâtée River (subpopulation 4) is represented by the yellow-shaded polygon where the description of habitat criteria and the methodology set out in Section 7.1 are met. The 1 x 1 km UTM grid square overlays (red outline) surrounding this unit are part of a standardized national grid system that indicates the geographic area containing the critical habitat. Areas outside the yellow-shaded polygon do not contain critical habitat.

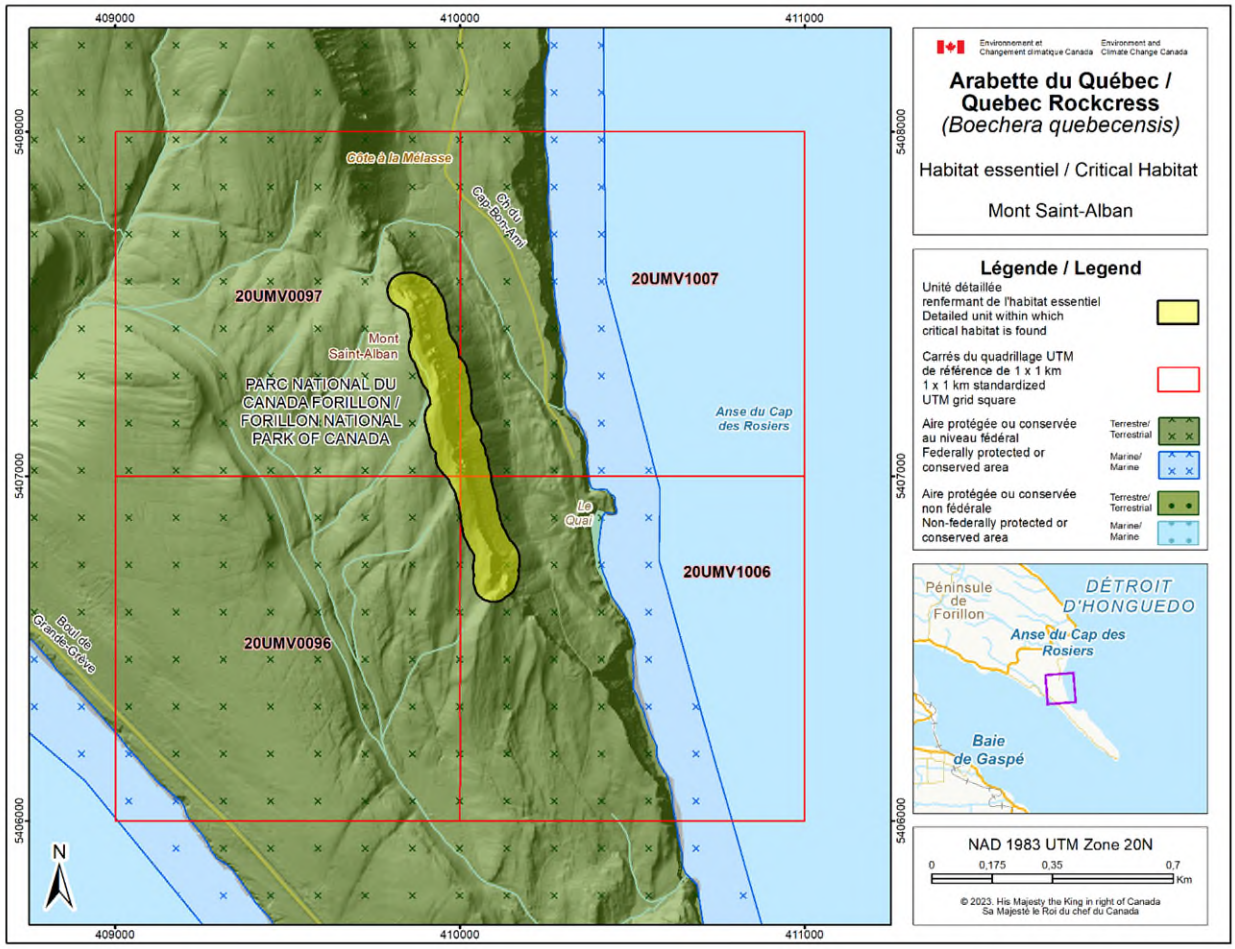

Figure 6. The critical habitat of Quebec Rockcress at Mount Saint-Alban (subpopulation 5) is represented by the yellow-shaded polygon where the description of habitat criteria and the methodology set out in Section 7.1 are met. The 1 x 1 km UTM grid square overlays (red outline) surrounding this unit are part of a standardized national grid system that indicates the geographic area containing the critical habitat. Areas outside the yellow-shaded polygon do not contain critical habitat.

Table 4 shows some of the characteristics of the critical habitat units for Quebec Rockcress, which total 111.39 ha and are located entirely in Quebec. Since not all of the habitat included in these units necessarily has the biophysical attributes of suitable habitat, the actual area of critical habitat is likely smaller than the maximum extent described here. Land tenure is provided as an approximation of the types of land ownership found in the critical habitat units and should be used for guidance purposes only. Accurate land tenure information will require cross referencing the critical habitat boundaries with surveyed land parcel information. The UTM grid squares are part of a standardized national grid system that highlights the general geographic area containing critical habitat, which can be used for land-use planning and/or environmental assessment purposes.

Table 4. Description of units containing critical habitat of Quebec Rockcress.

Critical habitat for Quebec Rockcress occurs within these 1 km x 1 km standardized UTM grid squares (red outline), where the description of habitat criteria (Section 7.1) applies.

Critical habitat unit	Reference no.	Area (ha)	Land tenure	1 km x 1 km grid square ID
La Muraille	1366_QC_1	3.15	Municipal, private	20UMU0786
Cap du Corbeau	1366_QC_2	46.71	Private, provincial	19UEP2620, 19UEP2630, 19UEP2508, 19UEP2518, 19UEP2519, 19UEP2529, 19UEP2539
Lac de la Falaise	1366_QC_3	23.20	Provincial	20ULV3314, 20ULV3323, 20ULV3324
Hâtée River	1366_QC_4	26.09	Private	19UEP2508, 19UEP2518, 19UEP2519, 19UEP2529, 19UEP2539
Mount Saint-Alban	1366_QC_5	12.24	Federal (emphyteusis)	20UMV0096,20UMV0097, 20UMV1006, 20UMV1007

7.2 Schedule of Studies to Identify Critical Habitat

Critical habitat can only be partially identified at this time. A schedule of studies has been developed to provide the information necessary to complete the identification of critical habitat that will be sufficient to meet the population and distribution objectives. The identification of critical habitat will be updated when the information becomes available, in either an amended recovery strategy or an action plan.

Table 5. Schedule of studies to identify critical habitat

Description of Activity	Rationale	Timeline
For each current subpopulation, conduct drone inventories of all the units containing critical habitat, specifically areas of suitable habitat that are otherwise inaccessible, in order to ascertain if Quebec Rockcress individuals are found there.	It must be ascertained whether Quebec Rockcress individuals are present in the inaccessible portions of the vertical rock faces that have not been surveyed by botanists and are in suitable habitat; if appropriate, these areas must be identified as critical habitat; and if climbing poses a risk, this activity must be reduced and its impacts must be mitigated.	2025
For the two historical subpopulations, determine if Quebec Rockcress is still present using drone inventories.	Both historical subpopulations (Cape Bon Ami, Anse à Doucet) must be surveyed using new technology (drones) to determine if Quebec Rockcress is still found there and, if so, to identify and delineate its critical habitat at these sites.	2030
Carry out drone inventories in suitable habitat patches in the species' range that have never been surveyed	The inventories must prioritize suitable habitat patches near the species' occurrences, and are required to fill knowledge gaps on the species' distribution, complete the identification of critical habitat and meet the population and distribution objectives.	2035

7.3 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 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. Activities described in Table 6 include those likely to cause destruction of critical habitat for the species; however, destructive activities are not limited to those listed.

Table 6. Activities likely to destroy critical habitat of Quebec Rockcress

Description of Activity	Description of Effect on Attributes of Habitat	Details of Effect
Repeated trampling of habitat and the removal of vegetation associated with rock and/or ice climbing	Repeated foot traffic on benches and rocks alters the habitat by compacting the soil, reducing species richness[f] and altering the vegetation composition, notably by increasing the number and abundance of invasive species (McMillan and Larson 2002; Lorite *et al.* 2017). The latter have a competitive advantage in accessing the limited resources and can supplant Quebec Rockcress or prevent it from occupying the entire site. Lorite *et al.* (2017) report in their study that the more heavily frequented a climbing site is and the more inexperienced the climbers, the more the survival of rare plants is jeopardized. The removal of vegetation by climbers to get better hand- and foot-holds on the rock face and to clear the climbing route can modify the microhabitat conditions (removal of substrate, increased runoff, loss of symbiosis[g]) to the extent that it becomes unsuitable for Quebec Rockcress. Therefore, this activity has both direct and cumulative effects.	In line with Threat 6.1 in the IUCN-CMP standardized threat classification scheme[h] This activity can result in the destruction of critical habitat only when it occurs within the boundaries of this habitat, regardless of the time of year. The destruction of critical habitat of Quebec Rockcress associated with climbing is more likely to occur at Cap du Corbeau (subpopulation 2), La Muraille (subpopulation 1) and Lac de la Falaise (subpopulation 3). These are the sites that have rock faces that attract climbers and a relatively stable substrate, and are easy to access and unprotected.

[f] Total number of species present in an ecosystem

[g] Long-term and mutually beneficial biological association between two living organisms.

[h] See Table 2 in Section 4.1

8. Measuring Progress

The performance indicators presented below provide a way to define and measure progress towards achieving the population and distribution objectives:

- Successful mitigation of the impacts of rock climbing, i.e. this activity is no longer harmful to Quebec Rockcress;
- Continued persistence of the five extant (2023) subpopulations of Quebec Rockcress, the two historical populations if reconfirmed, and any new subpopulation that may be discovered;
- Maintenance of a total population of over 250 mature individuals in a minimum area of occupancy of 20 km^2;
- Geographic distribution of extant subpopulations maintained.

9. Statement on Action Plans

One or more action plans for the Quebec Rockcress will be posted on the Species at Risk Public Registry within 10 years of the final publication of this recovery strategy.

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Appendix A: Observation Data on Subpopulations and Protection/Land Tenure

Subpopulation	CDPNQ occurrence no.[a]	Year discovered	Last observed	Number of individuals[b]	Comments[c]	Protection or land tenure
1. La Muraille (Percé)	10574	1941	2023	172	Roughly 100 rosettes and an abundance of seedlings in 2002; 600 seedlings in 2015; partial count in 2023 of 109 mature plants with 744 flowering stems and 62 rosettes	Private land
2. Cap du Corbeau (Rimouski – Bic area)	10302	1907	2015	66	1,606 seedlings in 2015	Private land
3. Lac de la Falaise (between Grande-Vallée and Murdochville)	9618	2000	2023	89	112 seedlings in 2015; new colony on vertical rock face with 30 mature individuals and 15 rosettes (ECCC 2023)	Forêt refuge du Lac-de-la-Falaise exceptional forest ecosystem[d]
4. Hâtée River (Rimouski – Bic area)	80442	2002	2015	17	7 seedlings (30 individuals in 2002)	Private land
5. Mount Saint-Alban (Gaspé)	14076	1928	2021	3	Roughly 35 stems and rosettes in 2002; 3 stems and 25 rosettes in 2021.	Forillon National Park Falaise-du-Mont-Saint-Alban plant habitat
6. Anse à Doucet (Rimouski – Bic area)	14675	1940	1940	0	**Historical** (possibly extirpated due to the natural evolution of the habitat)	Bic provincial park
7. Cape Bon Ami (Gaspé)	14440	1940	1940	0	**Historical** (inaccurate geographic location in the record)	Forillon National Park
8. Îlet du Quai (Rimouski – Bic area)	14441	1927	1927	0	**Extirpated** (possibly related to construction of wharf nearly 100 years ago but hypothesis is impossible to confirm)	Bic provincial park
Total number of individuals:				**347**		

a: CDPNQ: Centre de données sur le patrimoine naturel du Québec [Quebec natural heritage data centre]
b: Number of mature individuals (one mature individual corresponds to one flowering stem). Note that the methodologies used vary from inventory to inventory and consequently the numbers of individuals provided do not necessary reflect the same biological reality and are approximate. In addition, most mature individuals have only one flowering stem, while the very small number of large individuals may produce several.
c: Juvenile non-flowering individuals are referred to as seedlings or rosettes; the physical delineation of these vegetative plants (consisting of a few rosettes of leaves interconnected by underground rhizomes) is almost impossible.
d: Not listed in the Registre des aires protégées au Québec [Quebec protected areas registry].
Sources: CDPNQ (2021); COSEWIC (2017).

Appendix B: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted for all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[19]. The purpose of a SEA is to incorporate environmental considerations in 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 objective or goal in the Federal Sustainable Development Strategy[20] (FSDS).

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 on non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized in the statement below.

The possibility that this recovery strategy may have unintended impacts on the environment and other species was examined. On the positive side, the recovery approaches proposed in relation to rock climbing will benefit other arctic-alpine plants found in the critical habitat, notably Griscom's Arnica (a Threatened species listed in Schedule 1 of SARA). In terms of negative impacts, the drone inventories could disturb birds of prey nesting or likely to nest on the cliffs, primarily the Peregrine Falcon and Golden Eagle, both designated vulnerable species under the provincial law on threatened and vulnerable species. This concern, particularly during these raptors' nesting season, will be taken into account in developing the inventory protocol, which will include appropriate ethical behaviours. This will also be done for possible future work to characterize each subpopulation's vulnerability to rock face collapses. The other recommended measures are non-intrusive. Therefore, we conclude that the present recovery strategy is unlikely to produce significant negative effects.

[19] www.canada.ca/en/impact-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html
[20] www.fsds-sfdd.ca/en