

Management Plan for the Spiked Saxifrage (*Micranthes spicata*) in Canada

Spiked Saxifrage



2023



Government
of Canada

Gouvernement
du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2023. Management Plan for the Spiked Saxifrage (*Micranthes spicata*) in Canada. *Species at Risk Act* Management Plan Series. Environment and Climate Change Canada, Ottawa. iv + 17 pp.

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.

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Cover illustration: Spiked Saxifrage, Syd Cannings

Également disponible en français sous le titre
« Plan de gestion de la saxifrage à épis (*Micranthes spicata*) au Canada »

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ISBN 978-0-660-68077-4

Catalogue no. En3-5/138-2023E-PDF

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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. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed species of special concern 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 and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Spiked Saxifrage and has prepared this management plan, as per section 65 of SARA. To the extent possible, it has been prepared in cooperation with Yukon government, Parks Canada Agency, Wildlife Management Boards, and Indigenous organizations, as per section 66(1) of SARA.

Success in the conservation 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 plan and will not be achieved by Environment and Climate Change Canada and/or the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Spiked Saxifrage and Canadian society as a whole.

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

² www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

Acknowledgments

The initial draft of this management plan was written by Rhonda Rosie (Private Consultant). Subsequent drafts were developed by Saleem Dar and Syd Cannings (Environment and Climate Change Canada, Canadian Wildlife Service – Northern Region [ECCC]), and were reviewed by Heather Milligan and Thomas Jung (Yukon Department of Environment). The Yukon Conservation Data Centre provided details on the species' occurrences.

The threats calculator table was developed initially at the 2014 COSEWIC threats calculator meeting (attended by Bruce Bennett, Tom Jung, Shannon Stotyn, Saleem Dar, and Syd Cannings); this table was updated in February 2021 in a meeting with Bruce Bennett, Tom Jung, and Syd Cannings.

Executive Summary

In May 2013, the Spiked Saxifrage (*Micranthes spicata*) was designated as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Subsequently, based on new survey information, it was re-examined and designated as Special Concern in May 2015. It was added to Schedule 1 of the *Species at Risk Act* (SARA) in February 2019.

Spiked Saxifrage is endemic to the Yukon and Alaska. In Alaska, it occurs throughout much of the central part of the state. In Canada it is known from 24 subpopulations (18 creeks and 6 alpine and subalpine sites) in western and southwestern Yukon. The Canadian population is at the eastern edge of the species' range and preliminary work shows that it has some genetic markers not yet known from the Alaskan population to the west.

In Canada, Spiked Saxifrage grows in two distinct habitats, both characterized by cool, moist conditions during the growing season: the shores of cool, shady, lowland creeks, and moist, rocky alpine meadows. Along creeks, it grows on moist rock shelves of adjacent outcrops and on narrow bordering floodplains. In moist alpine and upper subalpine, it grows among boulders and rock rubble, in turf at the edge of stabilized scree.

Placer mining and, to a lesser extent, quartz mining and mineral exploration, are the main current threats to Spiked Saxifrage in the Yukon. Subpopulations along creeks can be destroyed or diminished as a direct result of mining, or by upstream activities that affect habitat, such as siltation, damming, stream realignment, etc. Additionally, natural processes such as flash flooding, forest fires, and landslides may be increasing in frequency and severity as a result of human-induced climate change. Climate warming and subsequent afforestation of mountain meadow habitat could threaten the alpine and subalpine subpopulations in the future.

The management objective for the Spiked Saxifrage is:

- To ensure long-term persistence of all extant native subpopulations in Canada, including any newly located or rediscovered subpopulations.

Broad strategies and conservation measures have been identified to help achieve the management objectives; these are detailed in Section 6.

Continuing presence of apparently stable subpopulations at known sites requires continued habitat integrity. At some sites, continued habitat integrity may require mitigation measures.

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1. COSEWIC* Species Assessment Information

Date of Assessment: May 2015

Common Name (population): Spiked Saxifrage

Scientific Name: *Micranthes spicata*

COSEWIC Status: Special Concern

Reason for Designation: This perennial wildflower grows only in Yukon and Alaska. In Canada it is restricted to small sites in a restricted geographical area where it shows genetic differences from the Alaskan population. It lives along cool, shady creeks and in moist, rocky alpine areas that may be affected by mining activities and the potential effects of climate change.

Canadian Occurrence: Yukon

COSEWIC Status History: Threatened in May 2013. Status re-examined and designated Special Concern in May 2015.

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

2. Species Status Information

Table 1. Conservation status of the Spiked Saxifrage (NatureServe 2020).

Global (G) Rank*	National (N) Rank *	Sub-national (S) Rank*	COSEWIC Status	SARA Schedule 1 Status
G4	Canada (N2) United States (N4)	Canada: Yukon (S2) United States: Alaska (S3S4)	Special Concern (2015)	Special Concern (2019)

*Rank 1– critically imperiled; 2– imperiled; 3- vulnerable to extirpation or extinction; 4- apparently secure; 5– secure; X – presumed extirpated; H – historical/possibly extirpated; NR – status not ranked; U – unrankable

3. Species Information

3.1. Species Description

Spiked Saxifrage (Figure 1) is a showy perennial herb, growing singly or in clumps from short, thick rhizomes (modified rootstalks). Leaves are mainly basal, with long petioles (stalks), and are round or kidney-shaped. They are usually covered with fine short hair, and have sharply toothed, ciliate margins. The cluster of flowers is borne on a stalk 15-70 cm tall, forming slender, compact, glandular-pubescent panicles (branched arrangements). Fruits are green and purplish-tinged capsules, 5-8 mm long. Seeds are small, brown, and longitudinally ribbed (Brouillet and Elvander 2009).



Figure 1. Left: Mature Spiked Saxifrage plant Photo: Shannon Stotyn. Right: Alpine habitat of Spiked Saxifrage. Photo: Shannon Stotyn.

3.2. Species Population and Distribution

Spiked Saxifrage is an eastern Beringian endemic—it is one of a small group of species known globally only from unglaciated areas in the western Yukon and throughout much of the central part of Alaska from the Yukon border to the west coast. The Canadian population is at the eastern edge of the species' range and preliminary data from ITS2³

³ The genetic sequence of the internal transcribed spacer 2 region (ITS2) of nuclear ribosomal DNA is commonly used to distinguish closely related species of animal and plants.

barcoding indicates that these plants contain genetic diversity not yet seen in the Alaskan population (Barcode of Life Data System 2022, B.A. Bennett pers. comm. 2022). Approximately 10% of its global range is in Canada; all of the Canadian range is in the Yukon (COSEWIC 2015).

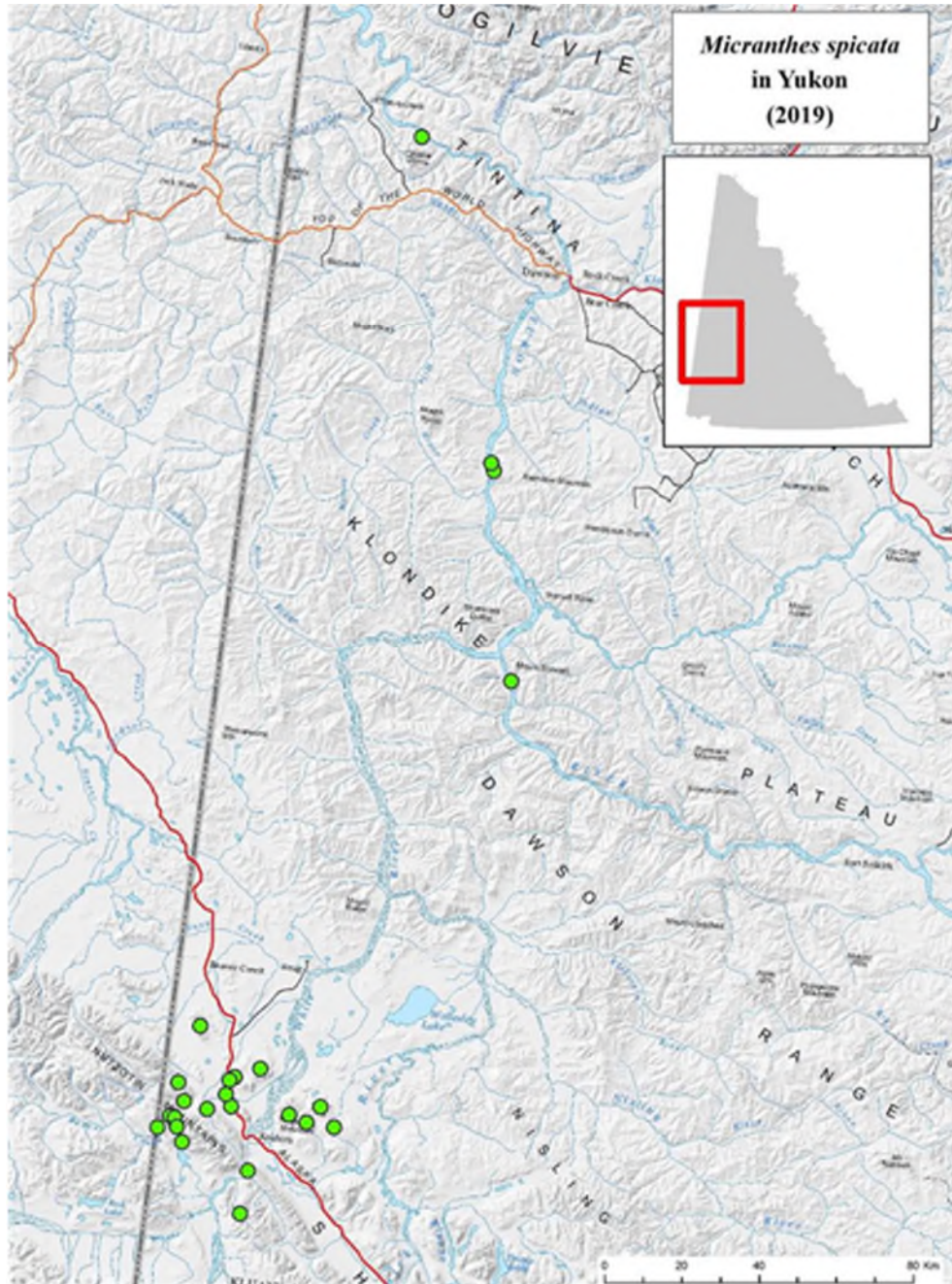


Figure 2. Green dots indicate Spiked Saxifrage occurrences in Canada. Note two distinct areas: scattered small creeks along the Yukon River, and creeks and mountaintops in Beaver Creek region. Data from the Yukon Conservation Data Centre (2019).

In Canada, Spiked Saxifrage is made up of 24 subpopulations⁴ in the western Yukon, 4 of which occur along small narrow creeks tributary to the Yukon River and 14 of which occur along creeks further south, tributary to the White River. The remaining 6 subpopulations occur on moist rocky alpine and subalpine slopes south of the community of Beaver Creek in the southwest Yukon (Figure 2). The subpopulations in Beaver Creek area and those along the Yukon River are separated from one another by at least 120 km.

The estimated total of all subpopulations of individual mature and immature Spiked Saxifrage plants is at least 32,000. Five subpopulations ranged from 2 to 70 plants, 12 between 130 and 700, and 3 between 1682 and 4250. Two high elevation subpopulations (Koidern Mountain and nearby “Wellesley Mountain”) were estimated at 10,000+ plants each. Two other subpopulations were seen only from the air but no counts were made (COSEWIC 2015, Yukon Conservation Data Centre 2022).

3.3. Needs of the Spiked Saxifrage

High moisture levels combined with cool temperatures are the key habitat requirements for Spiked Saxifrage (COSEWIC 2015). Within the range of Spiked Saxifrage in Canada, these attributes are associated with shady, low elevation streams in the boreal ecozone, and with moist, rocky, alpine and subalpine mountain slopes. Along creeks, Spiked Saxifrage grows on the banks and rock shelves (cover photo), on the moist ledges of adjacent outcrops, and on the narrow bordering floodplain. It grows singly or in clusters in small piles of silt and moss-covered substrate, and on exposed soil. Creeks supporting Spiked Saxifrage in the Yukon share a number of characteristics: year-round flow of clear, cold water in narrow, rocky beds that are subject to *aufeis* (i.e., persistent ice that forms in winter as spring-fed water constantly flows over the frozen creek) and/or permafrost, which helps to maintain a humid, cold microclimate; and abundant shade from forests of Alaska Paper Birch (*Betula neoalaskana*) and/or White Spruce (*Picea alba*), alders (*Alnus* spp.) and willows (*Salix* spp.) (COSEWIC 2015).

The Beaver Creek area in the southwest Yukon experiences significantly wetter summers than does the central Yukon, and alpine and subalpine meadows are relatively lush. Water, especially in the mossy crevices between rocks, is readily available. Six subpopulations of Spiked Saxifrage were found in alpine and open subalpine habitats, between 1131 and 1674 m in elevation and on a variety of aspects. Plants occur in moist crevices among boulders and rock rubble, in turf at the edge of stabilized scree and talus, and on moist slopes where the rocky substrate is thinly covered in vegetation (Figure 1; COSEWIC 2015, Yukon Conservation Data Centre 2022).

Little is known of the basic biology of the Spiked Saxifrage including its needs related to pollination and dispersal.

⁴ Subpopulations here are defined as clusters of plants separated by more than 1 km (NatureServe 2020).

4. Threats

4.1. Threat Assessment

The Spiked Saxifrage threat assessment is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system. 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). 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 understand the nature of the threats are presented in section 4.2 Description of Threats.

Table 3. Threat calculator assessment for Spiked Saxifrage. Based on the COSEWIC (2015) threats assessment; reviewed and updated in February 2021 (teleconference with S. Cannings, B. Bennett and T. Jung).

Threat #	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d	Detailed threats
1	Residential & commercial development	Negligible	Small	Negligible	Low	
1.1	Housing & urban areas	Negligible	Small	Negligible	Low	Two occurrences are on land that could be developed.
3	Energy production & mining	Medium-Low	Pervasive	Moderate-Slight	High	
3.2	Mining & quarrying	Medium-Low	Pervasive	Moderate-Slight	High	All sites are available for mining and mining exploration. 32% of plants are on active claims. This percentage could increase quickly if the price of gold increases.

Threat #	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d	Detailed threats
4	Transportation & service corridors	Negligible	Negligible	Extreme	Moderate	
4.1	Roads & railroads	Negligible	Negligible	Extreme	Moderate	Alaska Highway maintenance has the potential to impact two or three sites
11	Climate change & severe weather	Medium-Low	Pervasive	Moderate-Slight	High	
11.1	Habitat shifting & alteration	Unknown	Pervasive	Unknown	High	
11.4	Storms & flooding	Medium-Low	Pervasive	Moderate-Slight	High	

^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

Mining and mining exploration, and the effects of climate change have been identified as the greatest threats to Spiked Saxifrage. Habitats and plants can be directly affected by mining activities. Lowland sites can be impacted by upstream events such as flooding, landslides, siltation, damming, stream realignment, and any activities that affect the water flow. Alpine habitats are susceptible to changes in moisture and rising treeline as a result of climate change.

IUCN-CMP Threat 3. Energy Production and Mining

Placer mining is the primary concern within this threat category; quartz (hard rock) mining and mineral exploration are lower concerns.

Historically, placer mining (the mining of stream-bed deposits for gold) has very likely been the most extensive cause of habitat loss for Spiked Saxifrage. Placer gold is found in gravels along creeks and in the adjacent terraces and lower hill slopes; it can result in the complete removal of pre-existing vegetation, redirection, damming or infilling of streams, and slope thawing and removal by blasting with hydraulic hoses.

On creeks where mining has ceased, vegetation has re-established in the valleys to varying degrees. Except for the presence of second-growth forest, landscapes may appear relatively undisturbed except for the occasional decaying cabin, cart track, cut logs, shafts, and so on. Many larger and more recent placer operations are either still being mined, or have been left to revegetate naturally. In some cases, the gravel piles have been recontoured and covered with overburden (excavated material), the vegetation is still in early seral phases of young trees, shrubs, and grasses and forbs, and there is no habitat present considered suitable for Spiked Saxifrage (COSEWIC 2015).

Exploration and staking recently have shown an increase in rate and scope as a result of the dramatic rise in the price of gold. With the recent discovery of large gold deposits in bedrock quartz veins in the Klondike region, large areas have been staked for hard rock exploration and mining. As of October 2022, there are approximately 30,000 active or pending placer claims and over 37,000 hardrock (“quartz”) claims in the Dawson Mining Region of the Yukon, which includes all of the range of Spiked Saxifrage (Yukon Energy, Mines and Resources 2022).

While mineral exploration and mining may not affect creeks as extensively as placer mining, potential for riparian habitat degradation exists due to road building, toxic spills, and creation of tailings ponds (Yukon Chamber of Mines 2010).

In 2022, four subpopulations representing about 32 percent of plants are on active claims (Yukon Conservation Data Centre 2022) and a further three subpopulations are immediately downstream of active claims. All subpopulations are within areas that are

available to be mined (i.e., none fall within areas withdrawn from mining) and where there continues to be considerable mining interest.

IUCN-CMP Threat 11. Climate change and severe weather

Climate change is predicted to bring warmer, wetter conditions to the southern Yukon. Ryan *et al.* (2022) summarize the latest projections for the south-central Yukon. Mean annual precipitation in the region is projected to increase by 20-22% by the 2050s; winter, spring and summer precipitation is projected to increase 11-26%, and fall precipitation is projected to increase 35-36%. Precipitation by snow is expected to increase 11-12%. Temperatures are projected to increase 2.5-3.1°C in the summer and fall, and 2.1-2.6°C in the winter and spring. The number of frost-free days is expected to rise by 24-26 days, a 22-24% increase.

Not only is Spiked Saxifrage a species associated with very cool microhabitats that may be affected directly by this climate change, but increased temperatures may be correlated with an increase of extreme weather events (e.g. severe thunderstorms that cause local flash floods) and increased incidence of wildfires, both of which are potential threats to the species. In addition, the moist mountain habitats currently occupied by Spiked Saxifrage are under the threat of habitat shift resulting from climate change, which is predicted to gradually transform mountain plant communities (e.g., Myers-Smith 2011; Myers-Smith *et al.* 2011; Dullinger *et al.* 2012; Gottfried *et al.* 2012) potentially making this limited habitat less viable over the long term. The shade tolerance of Spiked Saxifrage may mitigate this risk somewhat, but the fact remains that the species is not found in abundance in the tall shrub zone below its alpine populations.

Natural habitat disturbances that can adversely affect Spiked Saxifrage include flooding, wildfire, and landslides. Flooding may be seasonal or from flash floods following heavy rainfall, which may uproot plants or possibly even eliminate an entire subpopulation. Some stream valleys surveyed for Spiked Saxifrage have recently sustained intensive flooding and creekbed scouring, possibly as a result of heavy summer thunderstorms (Cannings 2010).

Wildfires are common in the Klondike Plateau Ecoregion (Smith *et al.* 2004), and can adversely affect microclimate and other critical habitat factors for Spiked Saxifrage. Fire intensity and frequency across arctic and boreal regions is expected to increase over the next century as climate change lengthens the fire season (Stocks *et al.* 1998; Higuera *et al.* 2009; Johnstone *et al.* 2010). Abrupt shifts in forest cover are expected in response to changing climate and fire regime, particularly at sites linked to moisture availability (Stocks *et al.* 1998; Higuera *et al.* 2009; Johnstone *et al.* 2010). Loss of vegetation due to fire on slopes bordering creeks can cause thawing of permafrost, which may result in landslides (Lipovsky *et al.* 2006), which in turn may cause flooding, dam or alter creek flow, increase siltation load, or directly destroy subpopulations of Spiked Saxifrage.

5. Management Objective

- To ensure the long-term persistence of all extant subpopulations in Canada, including any newly discovered or rediscovered subpopulations.

The subpopulations along the Yukon River corridor are few and isolated, and their numbers have probably been reduced by past placer mining and human-caused fires (COSEWIC 2015). Therefore, the long-term persistence of each of those remaining is important. The subpopulations near Beaver Creek are concentrated in a small area, and some of them are by far the largest in Canada.

Continuing presence of apparently stable subpopulations at known sites for the long term (at least 50-100 years) both requires continued habitat integrity. At some sites, continued habitat integrity⁵ (in this case, shady, cold, sediment-free creeks) may require mitigation measures (see Land Management in Table 4 and Section 6.4). A more detailed description of the habitat requirements of Spiked Saxifrage can be found in Section 3.3.

6. Broad Strategies and Conservation Measures

6.1. Actions Already Completed or Currently Underway

- 2010-2015: Extensive surveys (Yukon and Stewart River corridors, Klondike goldfields, and Beaver Creek region) by Canadian Wildlife Service (CWS) and Environment Yukon staff, contractors and volunteers (Cannings 2010; COSEWIC 2015; Dar 2013, 2016). These were designed primarily to locate new sites; numbers of plants were estimated and habitat was documented to the extent possible within time constraints.
- 2014-2015: Microclimate monitoring at selected sites by CWS staff (Dar 2016).

6.2. Broad Strategies

In order to achieve the management objective, conservation measures are organized under five broad strategies (from Conservation Measures Partnership's (2016) Conservation Actions Classification v. 2.0).

1. Land management
2. Awareness raising
3. Conservation designation and planning
4. Legal and policy frameworks
5. Research and monitoring.

⁵ Habitat integrity can be defined as "the system's capacity to sustain native biological and physical properties that have adapted to an area with natural events and processes" (Wiken *et al.* 2003).

6.3 Conservation Measures

Table 4. Conservation Measures and Implementation Schedule.

Broad Strategies are taken from the Conservation Measures Partnership's (2016) Conservation Actions Classification v. 2.0.

Conservation Measure	Priority ^e	Threats or Concerns Addressed	Timeline
Broad Strategy			
Land management			
Habitat mitigation in the vicinity of placer mining in occupied stream valleys and mining exploration in alpine sites: document impacts and determine management strategies where necessary; promote best practices at key sites	High	Mining; Threat 3	2023-2027, ongoing
Awareness raising			
Develop communication strategy for stakeholders and public to build awareness and encourage stewardship of Spiked Saxifrage; produce and distribute educational materials	Medium	Mining: Threat 3; Roads: Threat 4	2023-2027, ongoing
Promote public awareness of the vulnerability of alpine and permafrost-based ecosystems to climate change.	Medium	Climate Change: Threat 11	2023-2027, ongoing
Conservation designation and planning			
Ensure that Spiked Saxifrage is considered within the Dawson Regional Land Use Plan, and subsequent land use planning initiatives; evaluate existing tool(s) for protecting occurrences	High	Mining and mineral exploration: Threat 3	2023-2024
Legal and policy frameworks			
Canada meets its climate targets as outlined in the Paris Agreement.	High	Climate Change: Threat 11	2023-2032
Yukon meets its climate targets.	High	Climate Change: Threat 11	2023-2032
Research and monitoring			
Continue searching for additional populations; map subpopulations and refine/continue counts	High	Knowledge gaps regarding distribution and trends	2023-2027; ongoing
Continue monitoring of microhabitat variables at key sites	Medium	Knowledge gaps regarding habitat trends	2026-2027

Study microhabitat needs of Spiked Saxifrage (e.g. analyze temperature and humidity data) and responses to disturbance	Medium	Knowledge gaps; Mining: Threat 3; Climate Change: Threat 11	2023-2027
More detailed genetic analysis of subpopulations to determine if any geographic pattern of genetic differentiation exists	Medium	Knowledge gaps	2023-2027
Identify pollinator species	Low	Knowledge gaps	2023-2032
Research into longevity, seed viability and germination requirements, sexual maturity, generation time, and individual fertility	Low	Knowledge gaps	2023-2027

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

6.4 Narrative to Support Conservation Measures and Implementation Schedule

Land Management

In order to ensure the long-term viability of the species in Canada, the continued integrity of its habitat must be addressed (see Section 5: Management Objective). To this end, there is a need to develop mitigation advice for placer mining in occupied stream valleys and mining exploration in alpine sites. Destruction of known plants should be avoided and downstream impacts in creek valleys should be minimized as part of best management practices. The Dawson Regional Land Use Plan may identify sites for the conservation of this species; existing tools for protecting occurrences should be assessed.

Raising Awareness

Increased communications are needed to ensure the success of conservation efforts, given the limited awareness of the public and many stakeholders of the existence and conservation of Spiked Saxifrage. The public and stakeholders could help locate new sites and implement best management practices in mining and road-building activities.

Legal and policy frameworks

Because climate warming may be a key future threat to both alpine and creek subpopulations of Spiked Saxifrage, it needs to be addressed at all levels in order to slow down and minimize the habitat shifts that will result. Under the Paris Agreement, Canada committed to reducing its greenhouse gas emissions by 30% below 2005 levels by 2030. In 2019, the 2005 level was estimated at 730 Mt CO₂ eq (Environment and Climate Change Canada 2020). Similarly, the Government of the Yukon has pledged to reduce the Territory's greenhouse gas emissions by 30% by 2030 (Government of Yukon 2020).

Research and monitoring

Baseline measurement of distribution and abundance is critical to monitoring progress. Detailed mapping and population inventory is still needed for a number of occurrences.

With regards to research, the habitat and other needs of Spiked Saxifrage require further study and analysis; these studies would greatly assist future conservation and management efforts for this species. Further analysis of the temperature and humidity data recorded at several creek and alpine sites is needed. More research is needed understand the basic biology of this species, including longevity, age at maturity, pollinators, and fertility.

Initial genetic analysis of Spiked Saxifrage indicates that Canadian plants may possess genetic diversity absent in those growing in central and coastal Alaska (BOLD 2022, B.A. Bennett pers. comm. 2022). More genetic work would be beneficial in determining whether there is a geographic pattern of genetic differentiation.

7. Measuring Progress

The performance indicators presented below provide a way to measure progress towards achieving the management objectives and monitoring the implementation of the management plan.

Progress toward meeting management objectives will be considered on track if:

- There is a stable or increasing population of Spiked Saxifrage. Population trends will be inferred by repeated surveys of Spiked Saxifrage at known sites.
- There is persistence or even increase of present distribution of Spiked Saxifrage, as measured using reconnaissance surveys.

Monitoring mitigation measures need to be undertaken to understand the maintainance of habitat (i.e. creeks remain shady, cold, and sediment-free) at sites occupied by Spiked Saxifrage that are being mined or otherwise developed. Reconnaissance surveys indicating consistent distribution of the Spiked Saxifrage in Canada (all known sites, and any additional sites discovered in the future) would indicate that the integrity of inhabited sites has been maintained.

Monitoring the development and implementation of best management practices for mining and other operations will be important to measure conservation efforts for the conservation of Spiked Saxifrage. Progress in the development and distribution of outreach products would also be a good indicator for conservation efforts.

8. References

- Barcode of Life Data System (BOLD). 2022. Data portal.
<http://boldsystems.org/index.php>. Accessed 5 October 2022.
- Bennett, B.A. 2012. Personal communication to Rhonda Rosie by email, September-October 2012. Coordinator, Yukon Conservation Data Centre, Whitehorse, Yukon.
- Bennett, B.A. 2020. Personal communication by telephone to Syd Cannings, June 2020. Coordinator, Yukon Conservation Data Centre, Whitehorse, Yukon.
- Bennett, B.A. 2022. Personal communication by email to Syd Cannings, October 2022. Coordinator, Yukon Conservation Data Centre, Whitehorse, Yukon.
- Brouillet, L., and P.E. Elvander. 2009. *Micranthes*. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 12+ vols. New York and Oxford. Vol. 8, p. 57.
- Cannings, S. 2010. Canadian Wildlife Service Field Survey for Spiked Saxifrage (*Saxifraga spicata* D. Don). Unpublished report; Environment Canada, Canadian Wildlife Service, Whitehorse, Y.T. October 4, 2010.
- Conservation Measures Partnership. 2016. Conservation Actions Classification (v2.0). Available at: https://cmp-openstandards.org/using-cs/tools/_actions/. Accessed 19 August 2020.
- COSEWIC. 2015. COSEWIC assessment and status report on the Spiked Saxifrage *Micranthes spicata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 38 pp. Available at: https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Spiked%20Saxifrage_2015_e.pdf
- Dar, S. 2013. Spiked Saxifrage: 2013 Environment Canada Surveys. Unpublished report, Canadian Wildlife Service, Whitehorse, YT. 3 pages.
- Dar, S. 2016. Spiked Saxifrage: 2014-2016 Canadian Wildlife Service Surveys. Unpublished report, Canadian Wildlife Service, Whitehorse, YT. 5 pages.
- Dullinger, S., A. Gattringer, W. Thuiller, T. Moser, N.E. Zimmermann, A. Guisan, W. Willner, C. Plutzer, M. Leitner, T. Mang, M. Caccianiga, T. Dirnböck, S. Ertl, A. Fischer, J. Lenoir, J.-C. Svenning, A. Psomas, D.R. Schmatz, U. Silc, P. Vittoz, and L. Hülber. 2012. Extinction debt of high-mountain plants under twenty-first-century climate change. *Nature Climate Change*. 2: 619-622.

- Environment and Climate Change Canada. 2020. Canadian Environmental Sustainability Indicators: progress towards Canada's greenhouse gas emissions reduction target. Available at: <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/progress-towards-canada-greenhouse-gas-emissions-reduction-target.html>. Accessed 26 January 2021.
- Government of Yukon. 2020. Our clean future: A Yukon strategy for climate change, energy and a green economy. Available at: <https://yukon.ca/en/our-clean-future-yukon-strategy-climate-change-energy-and-green-economy>. Accessed 26 January 2021.
- Gottfried, M., H. Pauli, A. Futschik, M. Akhalkatsi, P. Barančok, J.L. Benito Alonso, et al. 2012. Continent-wide response of mountain vegetation to climate change. *Nature Climate Change*, 2:111-115.
- Gilbert, G.W. 1989. A brief history of placer mining in the Yukon. Department of Indian Affairs and Northern Development, Whitehorse, Yukon.
- Higuera, P.E., L.B. Brubaker, P.M. Anderson, F.S. Hu, and T.A. Brown. 2009. Vegetation mediated the impacts of postglacial climate change on fire regimes in the south-central Brooks Range, Alaska. *Ecological Monographs*, 79(2): 201-219.
- Johnstone, J.F., F.S. Chapin III, T.N. Hollingsworth, M.C. Mack, V. Romanovsky, and M. Turetsky. 2010. Fire, climate change, and forest resilience in interior Alaska. *Canadian Journal of Forest Research* 40:1302-1312.
- Lipovsky, P.S., J. Coates, A.G. Lewkowicz, and E. Trochim. 2006. Active-layer detachments following the summer 2004 forest fires near Dawson City, Yukon. In: *Yukon Exploration and Geology 2005*, D.S. Emond, L.H. Weston, G.D. Bradshaw and L.L. Lewis (eds.), Yukon Geological Survey.
- Myers-Smith, I. H. 2011. Shrub encroachment in arctic and alpine tundra: patterns of expansion and ecosystem impacts. Ph.D. Thesis, University of Alberta, Edmonton, AB.
- Myers-Smith, I.H., B.C. Forbes, M. Wilmking, M. Hallinger, T. Lantz, D. Blok, K.D. Tape, M. Macias-Fauria, U. Sass-Klaassen, E. Levesque, S. Boudreau, P. Ropars, L. Hermanutz, A. Trant, L. Siegwart Collier, S. Weijers, J. Rozema, S.A. Rayback, N.M. Schmidt, G. Schaepman-Strub, S. Wipf, C. Rixen, C.B. Menard, S. Venn, S. Goetz, L. Andreau-Hayles, S. Elmendorf, V. Ravolainen, J. Welker, P. Grogan, H.E. Epstein, and D.S. Hik. 2011. Shrub expansion in tundra ecosystems: dynamics, impacts and research priorities. *Environ, Res. Lett.* 6(4):1-15.
- NatureServe. 2020. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available at <https://explorer.natureserve.org/>. [Accessed 24 June 2020]

- Smith, C.A.S., J.C. Meikle, and C.F. Roots, (editors). 2004. Ecoregions of the Yukon Territory: Biophysical properties of Yukon landscapes. Agriculture and Agri-food Canada, PARC Technical Bulletin No. 04-01, Summerland, B.C. 313 p.
- Stocks, B.J., M.A. Forberg, T.J. Lynham, L. Mearns, B.M. Wotton, Q. Yang, J-Z. Jin, K. Lawrence, G.R. Hartley, J.A. Mason, and D.W. McKenney. 1998. Climate change and forest fire potential in Russian and Canadian boreal forests. *Climate Change* 38: 1-13.
- Wiken, E., W.G.B. Smith, J. Cinq-Mars, C.Latsch, and D. Gauthier. 2003. Habitat integrity in Canada: wildlife conservation. Background paper for the National Conference on Guidelines and Tools for the Evaluation of Natura 200 Sites in France. March 3-5, 2003--Montpellier, France.
- Yukon Chamber of Mines. 2010. Yukon mineral and coal exploration best management practices and regulatory guide. Yukon Chamber of Mines, Whitehorse, Yukon.
- Yukon Conservation Data Centre. 2022. Yukon Conservation Data Centre, Biotics database. Environment Yukon, Whitehorse.
- Yukon Department of Energy, Mines and Resources. 2022. Find maps and records for mining claims and tenure. Available at: <https://yukon.ca/en/science-and-natural-resources/mining/find-information-mineral-tenure>. Accessed 10 October 2022.

Appendix A: 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](#)⁶. 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](#)'s⁷ (FSDS) goals and targets.

Conservation planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of management plans 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 management plan itself, but are also summarized below in this statement.

This management plan will clearly benefit the environment by promoting the conservation of the Spiked Saxifrage. The potential for the plan to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this plan will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: description of the species' needs, ecological role, and limiting factors; and the conservation actions.

⁶ www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html

⁷ www.fsds-sfdd.ca/index.html#/en/goals/