

1 **Spoon-leaved Moss**

2 **Ontario Government Response Statement**

3 **Protecting and Recovering Species at Risk in Ontario**

4 Species at risk recovery is a key part of protecting Ontario's biodiversity. The
5 *Endangered Species Act, 2007* (ESA) is the Ontario government's legislative
6 commitment to protecting and recovering species at risk and their habitats.

7 Under the ESA, the government must ensure that a recovery strategy is prepared for
8 each species that is listed as endangered or threatened. A recovery strategy provides
9 science-based advice to government on what is required to achieve recovery of a
10 species.

11 Generally, within nine months after a recovery strategy is prepared, the ESA requires
12 the government to publish a statement summarizing the government's intended actions
13 and priorities in response to the recovery strategy. The response statement is the
14 government's policy response to the scientific advice provided in the recovery strategy.
15 In addition to the strategy, the government response statement considers (where
16 available) input from Indigenous communities and organizations, stakeholders, other
17 jurisdictions, and members of the public. It reflects the best available local and scientific
18 knowledge, including Indigenous Knowledge where it has been shared by communities
19 and Knowledge Holders, as appropriate, and may be adapted if new information
20 becomes available. In implementing the actions in the response statement, the ESA
21 allows the government to determine what is feasible, taking into account social, cultural
22 and economic factors.

23 The [Recovery Strategy for the Spoon-leaved Moss \(*Bryoandersonia illecebra*\) in](#)
24 [Ontario](#) was completed on September 6, 2022.

25 Spoon-leaved Moss is a medium-sized moss with colouring that varies from shiny-green
26 to greenish yellow-brown. Its cylindrical creeping stems have concave leaves,
27 resembling the bowl of a spoon. The species can be found on a variety of substrates
28 including bare mineral soils in wet depressions, slopes and hummocks, on tree bases,
29 exposed roots and decaying branches, or on calcium rich rocks.

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30 **Protecting and Recovering Spoon-leaved Moss**

31 Spoon-leaved Moss is listed as a threatened species under the ESA, which protects
32 both the plant and its habitat. The ESA prohibits harm or harassment of the species and
33 damage or destruction of its habitat without authorization or complying with the
34 requirements of a regulatory exemption.

35 Spoon-leaved Moss' global distribution is restricted to eastern North America. The
36 species range extends from Kansas to southern Ontario and to Massachusetts in the
37 north, and from Texas to Florida in the south. Within the United States (U.S.), species
38 occurrences have been documented in most of the eastern states. In Canada, Spoon-
39 leaved Moss is limited almost exclusively to southern Ontario's Carolinian Zone. The
40 only exception to this is an occurrence near Goderich, Ontario.

41 Spoon-leaved Moss is considered a common species throughout many parts of its
42 range, particularly in the southern U.S. In Ontario there are 29 known or presumed
43 extant subpopulations (geographically distinct colonies or groups in the population) of
44 Spoon-leaved Moss. These subpopulations are fairly evenly distributed throughout most
45 of the Carolinian Zone and span 22 lower-tier municipalities. In addition to the 29 extant
46 subpopulations, there are four previously documented subpopulations in three different
47 municipalities, that have been identified as possibly extirpated and a fifth that is believed
48 to be extirpated.

49 The habitat types occupied by Spoon-leaved Moss vary considerably as the species
50 has been found in deciduous forests (various stages of succession), plantations
51 (coniferous and deciduous), treed swamps, thickets, savannahs and meadows. The
52 species can occupy sites that differ in their light conditions (closed to open canopy),
53 moisture regimes (dry to seasonally wet), vegetation ground cover (none to dense) and
54 depth of leaf litter (none to 6 cm). Spoon-leaved Moss is frequently found on features
55 where mineral soil is exposed, such as on hummocks, small mounds, slopes or wet
56 depressions. It has also been found on calcium rich rocks, on tree roots, branches and
57 at the bases of trees.

58 Although Spoon-leaved Moss is found in a wide array of habitats, the habitats that many
59 of the subpopulations in Ontario occupy suggest that it may prefer second-growth
60 wooded areas (forest that has re-grown after being cleared), that are partially shaded
61 and have imperfectly drained soils (wet soils that drain slowly). It has also been noted
62 that many subpopulations seem to occur in sites that were previously used as
63 agricultural lands, within the last 30-50 years. The possible connection between prior
64 agricultural land use and Spoon-leaved Moss occurrence suggests that the species may

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65 benefit from minor disturbances; however, further research is needed. These minor
66 disturbances may include the use of agricultural or forestry equipment, which may act
67 as a vector for spore dispersal, or more likely, vegetative fragment dispersal.

68 Spoon-leaved Moss is capable of both sexual and asexual reproduction. Sexual
69 reproduction requires the fertilization of the egg contained within a female plant by
70 sperm from a male plant. This process often requires rain, dew or mist to facilitate the
71 transport of material. Once the egg is fertilized, a sporophyte forms, which eventually
72 releases spores. Spores must be released in a suitably moist site to enable successful
73 germination. It is thought that sexual reproduction occurs very rarely in Spoon-leaved
74 Moss, since no sporophytes or male plants have ever been documented in Ontario and
75 few have been documented elsewhere. Part of the explanation for this may be that
76 Spoon-leaved Moss is a dioicous species, meaning the male and female reproductive
77 structures occur on separate individuals, and it is thought that its sperm is typically
78 capable of traveling only very short distances (millimeters to a few centimeters). Thus, if
79 male and female plants do not exist in close proximity, sexual reproduction is unlikely to
80 occur. In these cases, Spoon-leaved Moss likely relies predominantly on asexual
81 reproduction for regeneration.

82 Asexual reproduction occurs in Spoon-leaves Moss when fragments of an individual's
83 vegetative structures break off, establish themselves in a suitable site and produce a
84 clone of the parent individual. Given the species' likely reliance on asexual reproduction,
85 it is suspected that some of the Spoon-leaved Moss colonies in Ontario are genetically
86 identical. It is thought that a lack of genetic diversity in Spoon-leaved Moss populations
87 may be a limiting factor in the species' recovery and its ability to adapt to threats;
88 however, this is an area of uncertainty as, to date, no research has been conducted to
89 investigate genetic diversity in Spoon-leaved Moss populations in either Ontario or the
90 U.S.

91 Habitat loss and habitat degradation represent the two most significant threats to
92 Spoon-leaved Moss. Habitat loss presents the greatest threat to the species, since it is
93 found in a region that experiences considerable development pressure. In addition to
94 causing habitat loss, the development of lands can also create barriers that prevent or
95 inhibit dispersal. Habitat degradation can also occur in a variety of ways. In forest
96 habitats, forest management activities (i.e. silviculture) may alter Spoon-leaved Moss
97 habitat by disturbing soil, increasing light levels and altering stand structure. The degree
98 to which these characteristics are altered and the way that Spoon-leaved Moss reacts to
99 them, likely depends on the type of silvicultural system being used (e.g. clearcut,
100 shelterwood, selection), among other things. However, the impacts of different
101 silvicultural systems on Spoon-leaved Moss are not well-understood. Where Spoon-

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102 leaved Moss is present in meadows or other grasslands, habitat may be impacted by
103 activities such as mowing or herbicide application. Finally, Spoon-leaved Moss habitat
104 may be indirectly affected by activities like tilling of cultivated fields and aggregate
105 extraction that occur adjacent to occupied areas and result in increases in air pollution,
106 the introduction of invasive species and alterations to drainage patterns and the mineral
107 composition of the soil. While there is a potential for both agricultural and forestry
108 activities to have negative impacts on Spoon-leaved Moss, it is not known that these
109 activities are incompatible with the occurrence of Spoon-leaved Moss. Forestry and
110 agricultural activities may actually act as dispersal agents for Spoon-leaved Moss since
111 the species has often been found in forest plantations and in areas adjacent to
112 agriculture fields. This suggests that vegetative fragments may have been transported
113 by the equipment used to carry out these activities. Further research should be
114 conducted to investigate the affect of forestry and agriculture on the species' dispersal,
115 the magnitude of the negative impacts from these activities and practices that minimize
116 them.

117 Additional possible threats to the species include incidental impacts or mortality,
118 ecological succession and climate change. While this species is relatively easy to
119 identify (unlike other moss species), many Ontario environmental professionals and
120 naturalists may not be familiar with it. This may lead to the species going undetected
121 and result in incidental harm. Incidental harm (i.e. direct but unintentional harm to
122 Spoon-leaved Moss) may occur as a result of activities such as development, forest
123 operations, herbicide applications, and recreational activities such as hiking. The effect
124 of ecological succession on Spoon-leaved Moss is not well-understood, but it has been
125 suggested that the species prefers mid-succession woodlands. If so, successional
126 progress towards more mature forest would negatively impact Spoon-leaved Moss.
127 Finally, the effect of climate change on Spoon-leaved Moss is also uncertain, but the
128 species' vulnerability to this threat is likely to be determined mainly by its cold tolerance.
129 The species seems to display some intolerance to low winter temperatures; however, it
130 has not been studied comprehensively.

131 The protection and recovery of Spoon-leaved Moss will require assessing threats to the
132 species and developing strategies to address them. Unfortunately, many of the threats
133 to the species are not currently well-understood. As such, additional monitoring and
134 research is needed to fill these knowledge gaps. The results of these efforts will inform
135 the implementation of subsequent recovery efforts for Spoon-leaved Moss. Finally,
136 raising awareness of Spoon-leaved Moss, its habitat and how to reduce threats to the
137 species will help promote and encourage the protection and recovery of the species.

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138 **Government's Recovery Goal**

139 The government's goal for the recovery of Spoon-leaved Moss is the long-term
140 persistence and viability of existing subpopulations in Ontario, including increases in
141 their size where biologically and technically feasible.

142 **Actions**

143 Protecting and recovering species at risk is a shared responsibility. No single agency or
144 organization has the knowledge, authority or financial resources to protect and recover
145 all of Ontario's species at risk. Successful recovery requires inter-governmental co-
146 operation and the involvement of many individuals, organizations and communities. In
147 developing the government response statement, the government considered what
148 actions are feasible for the government to lead directly and what actions are feasible for
149 the government to support its conservation partners to undertake.

150 **Government-led Actions**

151 To help protect and recover Spoon-leaved Moss, the government will directly undertake
152 the following actions:

- 153
- Continue to protect Spoon-leaved Moss and its habitat through the ESA.
 - 154 • Undertake communications and outreach to increase public awareness of
155 species at risk in Ontario (e.g. through Ontario Parks Discovery Program, where
156 appropriate).
 - 157 • Continue to monitor the population and mitigate threats to the species and its
158 habitat in provincially protected areas.
 - 159 • Educate other agencies and authorities involved in planning and environmental
160 assessment processes on the protection requirements under the ESA.
 - 161 • Continue to support conservation, agency, municipal and industry partners, and
162 Indigenous communities and organizations to undertake activities to protect and
163 recover Spoon-leaved Moss. Support will be provided where appropriate through
164 funding, agreements, permits and/or advisory services.
 - 165 • Work with all levels of government, communities and sectors to take action on
166 climate change, and to report on progress in reducing greenhouse gas
167 emissions.

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- 168 • Encourage the submission of Spoon-leaved Moss data to the Ontario’s central
169 repository through the [NHIC \(Rare species of Ontario\) project in iNaturalist](#) or
170 directly through the [Natural Heritage Information Centre](#).

- 171 • Conduct a review of progress toward the protection and recovery of Spoon-
172 leaved Moss within five years of the publication of this document.

173 **Government-supported Actions**

174 The government endorses the following actions as being necessary for the protection
175 and recovery of Spoon-leaved Moss. Actions identified as “high” may be given priority
176 consideration for funding under the Species at Risk Stewardship Program. Where
177 reasonable, the government will also consider the priority assigned to these actions
178 when reviewing and issuing authorizations under the ESA. Other organizations are
179 encouraged to consider these priorities when developing projects or mitigation plans
180 related to species at risk.

181	Focus Area:	Monitoring and Research
182	Objective:	Increase knowledge of the distribution, limiting factors, and habitat
183		preferences of Spoon-leaved Moss in Ontario.

184 There are several knowledge gaps concerning Spoon-leaved Moss including the total
185 number of existing Ontario subpopulations, their population viability, dynamics and
186 distribution, and how environmental, reproductive and genetic factors influence them.
187 There are also knowledge gaps concerning detectability and recovery approaches.
188 Filling these knowledge gaps may help determine the factors influencing the species’
189 ability to recover, and inform where protection and recovery efforts should be focussed.

190 **Actions:**

- 191 1. **(High)** Develop and implement standardized survey and long-term
192 monitoring protocols and undertake:
 - 193 i. targeted surveys in areas with high habitat suitability including areas
194 where there have been previous records of the species and in areas
195 where it has not been found, in order to improve understanding of its
196 distribution.
 - 197 ii. develop long-term monitoring protocols and establish monitoring
198 sites at all existing and newly identified Spoon-leaved Moss
199 subpopulations. It is recommended that monitoring be repeated
200 depending on resource availability. Monitoring information collected
201 may include: light conditions, substrate type, coverage by bare soil,

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- 202 coverage by leaf litter, coverage by other mosses and herbaceous
203 plants.
- 204 2. Conduct research on the biology and ecology of Spoon-leaved Moss
205 including:
- 206 i. **(High)** genetic relatedness of subpopulations and genetic diversity of
207 Ontario subpopulations relative to range-wide genetic diversity
 - 208 ii. **(High)** population viability, including meta-population dynamics
 - 209 iii. site conditions conducive to population viability (e.g. light and
210 moisture regimes) including soil properties (e.g. pH, texture, etc.)
 - 211 iv. colony response to changes in biophysical conditions (e.g. light
212 conditions, competition)
 - 213 v. winter hardiness
 - 214 vi. optimal techniques and feasibility of propagating or transplanting
215 Spoon-leaved Moss.
- 216 3. Develop habitat suitability and population viability models to direct future
217 surveys and further assess species vulnerability.

218	Focus Area:	Threat Mitigation
219	Objective:	Improve understanding of and mitigate threats to Spoon-leaved
220		Moss.

221 There is a considerable amount of uncertainty surrounding Spoon-leaved Moss and the
222 threats impacting the species and its habitat. The impacts and severity of threats may
223 also differ by colony. Undertaking localized threat assessments will improve
224 understanding of the specific threats affecting a location while also filling general
225 knowledge gaps surrounding threats. Addressing identified threats by implementing
226 mitigation measures or management techniques is important for species recovery.

- 227 **Actions:**
- 228 4. **(High)** In collaboration with landowners, land managers, municipal
229 governments, stewardship organizations, and Indigenous communities
230 and organizations, undertake site-specific threat assessments for Spoon-
231 leaved Moss and implement and evaluate mitigation measures or
232 management techniques to address assessed threats.
 - 233 5. If techniques for propagating or transplanting Spoon-leaved Moss are
234 successfully established and prove to be feasible, develop best
235 management practices (BMP) guidance for applying these techniques.

236	Focus Area:	Awareness
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237 Objective: Increase awareness of the species and ways to minimize its threats
238 to promote protection and recovery.

239 Spoon-leaved Moss is known to occur in protected areas like provincial parks and
240 conservation areas, as well as on private and municipal lands. As some of these lands
241 may be candidates for development activities, improving awareness of the species by
242 individuals likely to be surveying sites will help to ensure the species and its habitat are
243 not overlooked and incidentally harmed during activities. It is also important to improve
244 awareness of conservation partners who may be interested in undertaking stewardship
245 efforts.

246 **Actions:**

- 247 6. Promote awareness of Spoon-leaved Moss among environmental
248 professionals, naturalists, landowners, land users, land managers and
249 industry partners (e.g. forestry, development, agriculture) by sharing
250 information regarding:
- 251 i. how to identify the species
 - 252 ii. the species' distribution and habitat associations
 - 253 iii. protection afforded to the species and its habitat under the ESA
 - 254 iv. actions that can be taken to reduce threats to the species and its
255 habitat (e.g. by distributing best management practices).

256 **Implementing Actions**

257 Financial support for the implementation of actions may be available through the
258 Species at Risk Stewardship Program. Conservation partners are encouraged to
259 discuss project proposals related to the actions in this response statement with Ministry
260 of the Environment, Conservation and Parks staff. The Ontario government can also
261 provide guidance about the requirements of the ESA, whether an authorization or
262 regulatory exemption may be required for the project and, if so, the authorization types
263 and/or conditional exemptions for which the activity may be eligible.

264 Implementation of the actions may be subject to changing priorities across the multitude
265 of species at risk, available resources and the capacity of partners to undertake
266 recovery activities. Where appropriate, the implementation of actions for multiple
267 species will be coordinated across government response statements.

268 **Reviewing Progress**

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269 The ESA requires the Ontario government to conduct a review of progress towards
270 protecting and recovering a species no later than the time specified in the species'
271 government response statement, which has been identified as five years. The review
272 will help identify if adjustments are needed to achieve the protection and recovery of
273 Spoon-leaved Moss.

274 **Acknowledgement**

275 We would like to thank all those who participated in the development of the Recovery
276 Strategy and Government Response Statement for Spoon-leaved Moss
277 (*Bryoandersonia illecebra*) in Ontario for their dedication to protecting and recovering
278 species at risk.

279 **For Additional Information:**

280 Visit the species at risk website at ontario.ca/speciesatrisk
281 Contact the Ministry of the Environment, Conservation and Parks
282 1-800-565-4923
283 TTY 1-855-515-2759
284 www.ontario.ca/environment