

# Recovery Strategy for the Crumpled Tarpaper Lichen (*Collema coniophilum*) in Canada

## Crumpled Tarpaper Lichen



2021



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2

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9  
10 **Official version**

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

13  
14 **Non-official version**

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

17  
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19  
20 For copies of the recovery strategy, or for additional information on species at risk,  
21 including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)  
22 Status Reports, residence descriptions, action plans, and other related recovery  
23 documents, please visit the [Species at Risk \(SAR\) Public Registry](#)<sup>1</sup>.

24  
25  
26  
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29  
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<sup>1</sup> [www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html](http://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html)

45 RECOVERY STRATEGY FOR THE CRUMPLED TARPAPER  
46 LICHEN (*Collema coniophilum*) IN CANADA

47  
48 2021  
49

50 Under the Accord for the Protection of Species at Risk (1996), the federal, provincial,  
51 and territorial governments agreed to work together on legislation, programs, and  
52 policies to protect wildlife species at risk throughout Canada.  
53

54 In the spirit of cooperation of the Accord, the Government of British Columbia has given  
55 permission to the Government of Canada to adopt the *Recovery Plan for the Crumpled*  
56 *Tarpaper (Collema coniophilum) in British Columbia* (Part 2) under Section 44 of the  
57 *Species at Risk Act* (SARA). Environment and Climate Change Canada has included a  
58 federal addition (Part 1) which completes the SARA requirements for this recovery  
59 strategy.

60  
61  
62 The federal recovery strategy for the Crumpled Tarpaper Lichen in Canada consists  
63 of two parts:

64  
65 Part 1 – Federal Addition to the *Recovery Plan for the Crumpled Tarpaper (Collema*  
66 *coniophilum) in British Columbia*, prepared by Environment and Climate Change  
67 Canada.  
68

69 Part 2 – *Recovery Plan for the Crumpled Tarpaper (Collema coniophilum) in*  
70 *British Columbia*, prepared by the British Columbia Ministry of Environment and  
71 Climate Change Strategy.  
72

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Part 1 – Federal Addition to the *Recovery Plan for the Crumpled Tarpaper (Collema coniophilum) in British Columbia*, prepared by Environment and Climate Change Canada.

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**Part 1 – Federal Addition to the *Recovery Plan for the  
Crumpled Tarpaper (Collema coniophilum) in  
British Columbia*, prepared by Environment and  
Climate Change Canada**

122 **Preface**

123

124 The federal, provincial, and territorial government signatories under the [Accord for the](#)  
125 [Protection of Species at Risk \(1996\)](#)<sup>2</sup> agreed to establish complementary legislation and  
126 programs that provide for effective protection of species at risk throughout Canada.  
127 Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent  
128 ministers are responsible for the preparation of recovery strategies for listed Extirpated,  
129 Endangered, and Threatened species and are required to report on progress within  
130 five years after the publication of the final document on the Species at Risk Public  
131 Registry.

132

133 The Minister of Environment and Climate Change is the competent minister under  
134 SARA for the Crumpled Tarpaper Lichen and has prepared the federal component of  
135 this recovery plan (Part 1), as per section 37 of SARA. To the extent possible, it has  
136 been prepared in cooperation with the Province of British Columbia as per section 39(1)  
137 of SARA. SARA section 44 allows the Minister to adopt all or part of an existing plan for  
138 the species if it meets the requirements under SARA for content (sub-sections 41(1) or  
139 (2)). The Province of British Columbia provided the attached recovery plan for the  
140 Crumpled Tarpaper Lichen (Part 2) as science advice to the jurisdictions responsible for  
141 managing the species in British Columbia. It was prepared in cooperation with  
142 Environment and Climate Change Canada.

143

144 Success in the recovery of this species depends on the commitment and cooperation of  
145 many different constituencies that will be involved in implementing the directions set out  
146 in this strategy and will not be achieved by Environment and Climate Change Canada,  
147 or any other jurisdiction alone. All Canadians are invited to join in supporting and  
148 implementing this strategy for the benefit of the Crumpled Tarpaper Lichen and  
149 Canadian society as a whole.

150

151 This recovery strategy will be followed by one or more action plans that will provide  
152 information on recovery measures to be taken by Environment and Climate Change  
153 Canada and other jurisdictions and/or organizations involved in the conservation of the  
154 species. Implementation of this strategy is subject to appropriations, priorities, and  
155 budgetary constraints of the participating jurisdictions and organizations.

156

157 The recovery strategy sets the strategic direction to arrest or reverse the decline of the  
158 species, including identification of critical habitat to the extent possible. It provides all  
159 Canadians with information to help take action on species conservation. When critical  
160 habitat is identified, either in a recovery strategy or an action plan, SARA requires that  
161 critical habitat then be protected.

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<sup>2</sup> [www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2](http://www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2)

163 In the case of critical habitat identified for terrestrial species including migratory birds  
164 SARA requires that critical habitat identified in a federally protected area<sup>3</sup> be described  
165 in the *Canada Gazette* within 90 days after the recovery strategy or action plan that  
166 identified the critical habitat is included in the public registry. A prohibition against  
167 destruction of critical habitat under ss. 58(1) will apply 90 days after the description of  
168 the critical habitat is published in the *Canada Gazette*.

169  
170 For critical habitat located on other federal lands, the competent minister must either  
171 make a statement on existing legal protection or make an order so that the prohibition  
172 against destruction of critical habitat applies.

173  
174 For any part of critical habitat located on non-federal lands, if the competent minister  
175 forms the opinion that any portion of critical habitat is not protected by provisions in or  
176 measures under SARA or other Acts of Parliament, or the laws of the province or  
177 territory, SARA requires that the Minister recommend that the Governor in Council make  
178 an order to prohibit destruction of critical habitat. The discretion to protect critical habitat  
179 on non-federal lands that is not otherwise protected rests with the Governor in Council.

180

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<sup>3</sup> These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

181 **Acknowledgements**

182

183 Development of this recovery strategy was coordinated by Environment and Climate  
184 Change Canada, Canadian Wildlife Service (ECCC CWS) – Pacific Region staff:  
185 Kimberly Dohms, Megan Harrison, and Kella Sadler. Christopher Lewis and  
186 Duncan McColl (B.C. Ministry of Forests, Lands, Natural Resource Operations and  
187 Rural Development), Alana Nasadyk and Karen Stefanyk (B.C. Ministry of Environment  
188 and Climate Change Strategy), and Emma Pascoe (ECCC CWS-National Capital  
189 Region) provided helpful editorial advice and comment. Danielle Yu (ECCC  
190 CWS-Pacific Region) provided additional assistance with critical habitat identification,  
191 mapping and figure preparation.

192



## 193 Additions and Modifications to the Adopted Document

194  
195 The following sections have been included to address specific requirements of the  
196 federal *Species at Risk Act* (SARA) that are not addressed in the *Recovery Plan for the*  
197 *Crumpled Tarpaper (Collema coniophilum) in British Columbia* (Part 2 of this document,  
198 referred to henceforth as “the provincial recovery plan”) and/or to provide updated or  
199 additional information. This species is listed under SARA as Crumpled Tarpaper Lichen  
200 (*Collema coniophilum*) and is referred to as Crumpled Tarpaper (*Collema coniophilum*)  
201 provincially (as per [B.C. Conservation Data Centre](#)). Both refer to the same species.  
202

203 Under SARA, there are specific requirements and processes set out regarding the  
204 protection of critical habitat. Therefore, statements in the provincial recovery plan  
205 referring to protection of survival/recovery habitat may not directly correspond to federal  
206 requirements. Recovery measures dealing with the protection of habitat are adopted;  
207 however, whether these measures will result in protection of critical habitat under SARA  
208 will be assessed following publication of the final federal recovery strategy.  
209

### 210 1. Species Status Information

211  
212 This section replaces the information on SARA legal designations and conservation  
213 status for Crumpled Tarpaper Lichen in Canada in “Section 2: Species Status  
214 Information” in the provincial recovery plan.  
215

216 The legal designation of Crumpled Tarpaper Lichen on SARA Schedule 1 is Threatened  
217 (2017).  
218

219 **Table 1.** Conservation Status of Crumpled Tarpaper Lichen (from NatureServe 2020, and  
220 B.C. Conservation Data Centre 2020).

Global (G) Rank*	National (N) Rank*	Sub-national (S) Rank*	COSEWIC Status	B.C. List
G2 (2019)	Canada (N2)	British Columbia (S2) Alberta (SU) Northwest Territories (not ranked)	Threatened (2010)	Red List**

221 \*Rank 1– critically imperiled; 2– imperiled; 3- vulnerable to extirpation or extinction; 4- apparently secure; 5– secure;  
222 H– possibly extirpated; NR – status not ranked, SU – Under Review

223 \*\* Red List is [defined by the B.C. Conservation Data Centre](#) as “Any species or ecosystem that is at risk of being lost  
224 (extirpated, endangered or threatened).”  
225 \*\*

### 226 227 2. Species Population and Distribution

228 This section replaces the information summary for known populations of Crumpled  
229 Tarpaper Lichen in Canada (Table 1, Section 3.2) in the provincial recovery plan.  
230

231 The information summary below (Table 2) describes the updated distribution of  
232 Crumpled Tarpaper Lichen populations in Canada. Element occurrence (EO) numbers

233 indicated align with those provided in the provincial recovery plan, with the exception of  
 234 new occurrences discovered since the provincial recovery plan was written. Each  
 235 locality is considered a separate population as they are more than 1 km apart. Of the 18  
 236 recorded Crumpled Tarpaper Lichen populations, 16 are considered extant and two are  
 237 of unknown status. The current known population size is  $\geq 188$  thalli<sup>4</sup>. Two potential  
 238 populations of Crumpled Tarpaper Lichen have been recently reported from Alberta and  
 239 Northwest Territories, however their identification has not yet been formally verified, and  
 240 details regarding habitat associations and threats are currently unknown.

241 **Table 2.** Summary of Crumpled Tarpaper Lichen populations in Canada. Information for each  
 242 Element Occurrence (EO) number includes notes on status (N = new, not described in the  
 243 adopted B.C. recovery plan, U = updated thalli numbers relative to B.C. plan), site location  
 244 name, year of last observation (Last obs.), population size at year of last observation (NR = not  
 245 recorded), location uncertainty associated with the B.C. Conservation Data Centre EO data,  
 246 and/or estimated location error from Global Positioning System (GPS) units, and population  
 247 status.

Site Location Name	EO #	Last obs.	Population size (# thalli)	Location uncertainty (m)	Population Status <sup>a</sup>
Sugarbowl Creek	EO1 (U)	2017	3	15	Extant <sup>b</sup>
Tumtum Lake, Upper Adams River	EO2	1998	4	1000	Unknown
Kenneth Creek, Viking Ridge	EO3	1999	4	1000	Unknown
Hiyu Creek	EO4	2006	140	100	Extant
Robson Valley, Amanita Creek	EO5	2006	17	100	Extant
South of Huble Creek	EO6	2006	6	100	Extant
Southwest of Aleza Lake	EO7 (U)	2006	1	100	Extant
Upper Fraser Bridge, McGregor	EO8 (U)	2012	2	100	Extant
Dawson Falls, Wells Gray PP	EO9 (N)	2012	NR ( $\geq 1$ )	100	Extant
Northwest of Red Mountain Creek, Penny	EO10 (N)	2016	NR ( $\geq 1$ )	15	Extant
Southwest of Red Mountain Creek, Penny	EO11 (N)	2016	NR ( $\geq 1$ )	15	Extant
Muskwa River	EO12 (N)	2016	NR ( $\geq 1$ )	15	Extant
Driscoll Creek	EO13 (N)	2016	NR ( $\geq 1$ )	15	Extant
Table River	EO14 (N) <sup>c</sup>	2016	NR ( $\geq 1$ )	15	Extant
Hominka River	EO15 (N)	2016	NR ( $\geq 1$ )	15	Extant

<sup>4</sup> The “body” or “vegetative tissue” is called the thalli (singular: thallus)

Site Location Name	EO #	Last obs.	Population size (# thalli)	Location uncertainty (m)	Population Status <sup>a</sup>
Hungary Creek	EO16 (N)	2017	2	15	Extant
Caswell Creek	EO17 (N)	2017	NR (≥1)	15	Extant
Crooked River	EO18 (N)	2017	NR (≥1)	15	Extant

<sup>a</sup> The status of Crumpled Tarpaper Lichen occurrences is as follows: Extant - Occurrence has been recently verified (< 25 years); Unknown – sites were revisited within last 25 years, but population/occurrence was not relocated.

<sup>b</sup> Reported as extirpated in B.C. Strategy, but relocated in 2017 by C. Björk.

<sup>c</sup> UTM coordinates indicate two different locations ~400m apart were observed on the same day; lumped as a single EO by CDC.

### 3. Species Needs

Table 3 below provides a summary of “Section 3.3: Needs of Crumpled Tarpaper” in the provincial recovery plan.

**Table 3.** Summary of essential features, functions, and attributes of Crumpled Tarpaper Lichen habitat.

Life stage(s)	Function <sup>a</sup>	Feature(s) <sup>b</sup>	Attributes <sup>c</sup>
All life history stages	Establishment, growth, asexual reproduction, dispersal	Old-growth forests in wet subzones of the Interior- Cedar Hemlock and Sub-Boreal Spruce Biogeoclimatic zones	<p><i>Site context:</i></p> <p><i>Forest age:</i> &gt;100 years</p> <p><i>Elevation:</i> &lt;1000 m</p> <p><i>Moisture regime:</i> humid</p> <p><i>Light levels:</i> high, associated with relatively more open stand structure of older forests</p> <p><i>Substrate:</i> calcareous lake sediment or other high level of calcium enrichment in soil</p> <p><i>Air quality:</i> low levels of airborne pollutants</p> <p><i>Growing location:</i></p> <p><i>Host trees with partially-defoliated lower limbs:</i> Subalpine Fir (<i>Abies lasiocarpa</i> var. <i>lasiocarpa</i>), Western Hemlock (<i>Tsuga heterophylla</i>), Spruce species (<i>Picea</i> spp.), Willow species (<i>Salix</i> spp.), Mountain Alder (<i>Alnus incana</i> var. <i>tenuifolia</i>), Black Cottonwood (<i>Populus trichocarpa</i>), Western Red Cedar (<i>Thuja plicata</i>), or Trembling Aspen (<i>Populus tremuloides</i>).</p> <p><i>Deciduous overstory tree species for nutrient leaching in dripzone:</i> optimally Trembling Aspen or Black Cottonwood</p>

<sup>a</sup> Function: a life-cycle process of the species.

<sup>b</sup> Feature: the essential structural components of the habitat required by the species.

<sup>c</sup> Attribute: the building blocks or measurable characteristics of a feature.

264 **4. Threats**

265

266 **4.1 Threat Assessment**

267 Table 4 (below) replaces Table 2 of the "Threats Assessment" (Section 4.1) in the  
268 provincial recovery plan, to provide updated information on the threats to all known  
269 Crumpled Tarpaper Lichen populations in Canada.

270

271 The Crumpled Tarpaper threat assessment is based on the IUCN-CMP (World  
272 Conservation Union–Conservation Measures Partnership) unified threats classification  
273 system. Threats are defined as the proximate activities or processes that have caused,  
274 are causing, or may cause in the future the destruction, degradation, and/or impairment  
275 of the entity being assessed (population, species, community, or ecosystem) in the area  
276 of interest (global, national, or subnational). Limiting factors are not considered during  
277 this assessment process. Historical threats, indirect or cumulative effects of the threats,  
278 or any other relevant information that would help understand the nature of the threats  
279 are presented in the Description of Threats section.

280

281

282 **Table 4.** Threat classification table for Crumpled Tarpaper Lichen in Canada. IUCN Threat  
283 numbers are in accordance with the IUCN-CMP (International Union for Conservation of Nature  
284 – Conservation Measures Partnership) unified threats classification system  
285 (<https://www.iucnredlist.org/resources/threat-classification-scheme>).

Threat # <sup>a</sup>	Threat description	Impact <sup>b</sup>	Scope <sup>c</sup>	Severity <sup>d</sup>	Timing <sup>e</sup>
4	Transportation & service corridors	Medium	Restricted	Extreme	High
4.1	Roads & railroads	Medium	Restricted	Extreme	High
5	Biological resource use	Very High	Pervasive	Extreme	High
5.3	Logging & wood harvesting	Very High	Pervasive	Extreme	High
9	Pollution	Low	Restricted	Moderate	Moderate
9.5	Air-borne pollutants	Low	Restricted	Moderate	Moderate
11	Climate change & severe weather	Unknown	Unknown	Unknown	High-Moderate
11.2	Droughts	Not Calculated	Large	Unknown	Low
11.3	Temperature extremes	Unknown	Unknown	Unknown	High-Moderate

286 <sup>a</sup> Threat numbers are provided for Level 1 threats (i.e., whole numbers) and Level 2 threats (i.e., numbers with  
287 decimals).  
288 <sup>b</sup> **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in  
289 the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and  
290 future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an  
291 ecosystem. The median rate of population reduction or area decline for each combination of scope and severity  
292 corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and  
293 Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are  
294 unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is  
295 insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is  
296 negligible; Not a Threat: when severity is scored as neutral or potential benefit.  
297 <sup>c</sup> **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years.  
298 Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%;  
299 Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).  
300 <sup>d</sup> **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to  
301 be affected by the threat within a 10-year or 3-generation timeframe. Usually measured as the degree of reduction of  
302 the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%;  
303 Negligible < 1%; Neutral or Potential Benefit ≥ 0%).  
304 <sup>e</sup> **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [ $< 10$  years or  
305 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the  
306 long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and  
307 unlikely to return, or no direct effect but limiting.  
308  
309

## 310 **4.2 Description of Threats**

311 The information below replaces content of the “Description of Threats” (Section 4.2) in  
312 the provincial recovery plan to include updated threats information for all known  
313 Crumpled Tarpaper Lichen populations in Canada. Best available information on  
314 additional threats that are not described below are described in the provincial recovery  
315 plan (e.g. IUCN-CMP Threat 11.2 Drought). Current threats are listed in Table 4 and  
316 additional threats that are no longer deemed applicable are not included below.

317 The overall Threat Impact for this species is Very High. Threat descriptions are provided  
318 in decreasing order of Threat Impact levels, as per classification in Table 4 above.

### 319 **IUCN-CMP Threat 5.3 (Logging & Wood Harvesting)**

320  
321 Logging directly effects Crumpled Tarpaper lichen through removing or degrading  
322 populations and the habitat features that support them. Seven of the 18 populations  
323 (EOs 1-2, and 4-8) occur in Timber Supply Areas, where logging and wood harvesting  
324 activities are likely. An additional four populations (EOs 10-11, 14, and 18) are on land  
325 of unknown tenure, meaning that the threat of logging and forestry remains possible for  
326 these populations. The remaining seven populations (EOs 3, 7, 12-13, and 15-17) have  
327 some measure of protection from wood harvesting through the legal provisions of the  
328 *Parks Act* or the *Environment and Land Use Act*.

### 329 330 **IUCN-CMP Threat 4.1 (Roads & Railroads)**

331  
332 Roads that are developed for logging will directly affect Crumpled Tarpaper Lichen, in  
333 particular since both the species and mainline logging roads generally occur in level  
334 toe-slope<sup>5</sup> areas (Trevor Goward, personal communication 2020). Fragmentation of  
335 habitat by logging roads also decreases the amount of suitable habitat available for the  
336 species to colonize and may increase edge effects, changing required microhabitat  
337 characteristics such as moisture and air flow. Note that at one location (Hiyu Creek  
338 population (EO4)) a higher than normal number of thalli were originally found along  
339 gravel logging roads that were formerly subject to considerable calcareous road dust.  
340 It is possible that some populations may benefit from being located in close proximity to  
341 logging roads or other trails that produce calcareous dust.

### 342 343 **IUCN-CMP Threat 9.5 (Airborne Pollutants)**

344  
345 Lichens have demonstrated sensitivity to airborne pollutants from industry (Coxson et  
346 al. 2014), though this research has not been done for Crumpled Tarpaper Lichen. An  
347 approved plan to build a limestone quarry and smelter at Giscome, B.C. (Giscome  
348 Quarry and Lime Plant approved in 2016) could represent a large point source of acidic  
349 emissions immediately upwind of several Robson Valley populations (E05, 07, and 08).  
350 Depending on the fuel source, airborne pollutants could pose risks to Crumpled

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<sup>5</sup> Toe-slope: in the context, refers to a distinct topographic area of alluvial deposition.

351 Tarpaper Lichen populations in the region east of the smelter and in the upper Robson  
352 Valley (Coxson et al. 2014).

353  
354 **IUCN-CMP Threat (11.3 Temperature Extremes)**  
355

356 Lichens are sensitive indicators of climate change and are known to respond to extreme  
357 fluctuations in temperature (Benítez et al. 2018). However, not enough is understood  
358 about the physiology of Crumpled Tarpaper Lichen to understand how temperature  
359 extremes may impact this species.

360

361 **5. Population and Distribution Objectives**  
362

363 This section replaces “Section 5.1 Recovery (Population and Distribution) Goal” and  
364 “Section 5.2 Rationale for the Recovery (Population and Distribution) Goal”.

365

366 **Population and Distribution Objective**  
367

368 To increase the resilience<sup>6</sup> of Crumpled Tarpaper Lichen populations at all known  
369 extant sites throughout its range in Canada, including any new sites that may be  
370 discovered, by ceasing or mitigating human-caused threats causing decline in the area,  
371 extent, and quality of suitable habitat.

372

373 **Rationale**  
374

375 Crumpled Tarpaper Lichen is a Canadian endemic<sup>7</sup> species , that is found over a  
376 relatively large range, but sparsely within a specific habitat. The species is found in  
377 nutrient rich sites in humid old growth forests on a diverse range of host trees. Sixteen  
378 populations are currently known to be extant in British Columbia. As there is no  
379 historical population and distribution information for this species, it is unknown whether  
380 it was more widespread prior to impacts of human activity; as such, the focus of the  
381 objective is on increasing the resilience (population size) at extant sites through ceasing  
382 or mitigating human-caused threats, rather than attempting to deliberately increase  
383 population size via augmentation or restoration activities. Crumpled Tarpaper Lichen’s  
384 small overall population size ( $\geq 188$  mature individuals, as represented by number of  
385 thalli) has led to its assessment as Threatened<sup>8</sup> in Canada. The population size  
386 threshold separating designations of Threatened and Special Concern is  $>1000$  mature  
387 individuals. With the rediscovery of an extant population that was previously thought to  
388 be extirpated (EO1 – Sugarbowl Creek), and 11 new populations discovered in B.C.

---

<sup>6</sup> Resilience is a characteristic that contributes to a species’ likelihood of survival: a species that has a large enough population size(s) to rebound from periodic disturbance and avoid demographic and genetic collapse is more likely to survive over the long term.

<sup>7</sup> Native to and restricted to Canada

<sup>8</sup> Assessed as “Threatened” in 2010 based on COSEWIC criteria D1; may also meet C2a(i) criteria for EN based on inferred continuing decline in numbers of mature individuals, and no known population estimated to contain  $>250$  mature individuals.

389 since 2013, as well as the potential new observations in Alberta and the Northwest  
390 Territories, it is likely that the total number of mature individuals is significantly higher  
391 than previously known. If new populations continue to be found, it is possible the  
392 species could be reassessed as Special Concern as a consequence of improved and  
393 more comprehensive surveys.

394

## 395 **6. Critical Habitat**

396

397 This section replaces the entirety of “Section 7: Information on Habitat Needed to Meet  
398 Recovery Goal” in the provincial recovery plan.

399 Section 41 (1)(c) of SARA requires that recovery strategies include an identification of  
400 the species’ critical habitat, to the extent possible, as well as examples of activities that  
401 are likely to result in its destruction. More precise boundaries may be mapped, and  
402 additional critical habitat may be added in the future if additional research supports the  
403 inclusion of areas beyond those currently identified. A primary consideration in the  
404 identification of critical habitat is the amount, quality, and locations of habitat needed to  
405 achieve the population and distribution objectives.

406

407 Critical habitat for Crumpled Tarpaper Lichen is identified in this recovery strategy to the  
408 extent possible based on the best available information. It is recognized that the critical  
409 habitat identified below is insufficient to achieve the population and distribution  
410 objectives for the species. A schedule of studies (Section 6.2) has been developed to  
411 provide the information necessary to complete the identification of critical habitat that  
412 will be sufficient to meet population and distribution objectives. The identification of  
413 critical habitat will be updated in a revised recovery strategy when the information  
414 becomes available.

415

### 416 **6.1 Identification of the Species’ Critical Habitat**

417

418 Critical habitat for Crumpled Tarpaper Lichen is identified at known or presumed extant  
419 sites where the population has been observed within the last 25 years (i.e., since 1995)  
420 and where the location uncertainty distance is less than 100 m. The geospatial areas  
421 containing critical habitat for Crumpled Tarpaper Lichen (totalling 136.38 ha<sup>9</sup>) are  
422 presented in Figures 1-13. Within these geospatial areas, critical habitat is identified  
423 wherever the following biophysical attributes occur.

#### 424 **Biophysical attribute description:**

425

426 A description of the essential features and attributes of habitat for Crumpled Tarpaper  
427 Lichen that are required to support life history functions are provided in this document in  
428 Section 3 Species Needs. The geospatial areas containing critical habitat represent the  
429 minimum areas required to sustain both the suite of features that contribute to the

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<sup>9</sup> Critical habitat identified for Crumpled Tarpaper does not occur within any Federal Protected Areas.



430 broader site context (necessary to sustain the occurrence) as well as the very specific  
431 growing location(s). As such, within these geospatial polygons, critical habitat includes  
432 all natural features, including associated vegetation and substrates. Within these  
433 polygons, only unsuitable areas that do not possess any of the features and attributes  
434 required by Crumpled Tarpaper at any time are excluded from identification as critical  
435 habitat. Examples of these excluded areas include: existing buildings, roadways,  
436 parking lots, railways, gravel pits, as well as all non-forested or treeless areas. The  
437 1 km x 1 km universal transverse mercator (UTM) grid overlay shown on these figures is  
438 a standardized national grid system that highlights the general geographical area  
439 containing critical habitat for land use planning and/or environmental assessment  
440 purposes.

441

#### 442 **6.1.1 Information and methods used to identify critical habitat**

443 The geospatial area containing critical habitat for Crumpled Tarpaper Lichen is based  
444 on the following additive components:

- 445 (1) Point occurrences representing individuals or patches of lichen that were  
446 recorded within the last 25 years;
- 447 (2) An additional distance around each point to accommodate the potential location  
448 error associated with the occurrence (ranging from 5 m to 100 m uncertainty  
449 distance; Table 2); and
- 450 (3) A minimum critical function zone<sup>10</sup> of 100 m (beyond the point location of each  
451 occurrence and the associated potential location error), to support the production  
452 and maintenance of suitable microhabitat conditions required by Crumpled  
453 Tarpaper Lichen.

454 Crumpled Tarpaper Lichen requires humid old-growth forests to create suitable  
455 microhabitat conditions. While there is no species-specific information available  
456 regarding the threshold forest patch area that is required to maintain Crumpled  
457 Tarpaper Lichen at a site, recent research on epiphytic lichens in temperate rainforests  
458 of pacific British Columbia has shown that viability increased up to 120 m from forest  
459 edges (Gauslaa et al. 2018). Likewise, prior research on edge effects from Pacific  
460 Northwest forests have found that the influence of edge on microclimate, including  
461 humidity and solar and wind exposure, extended 100-150 m into intact forests  
462 (Kremsater and Bunnell 1999). Application of a 100 m critical function zone distance for  
463 Crumpled Tarpaper Lichen is consistent with best available information, as well as the  
464 approach taken for other lichen species (e.g., Boreal Felt Lichen, Environment and  
465 Climate Change Canada 2018).  
466

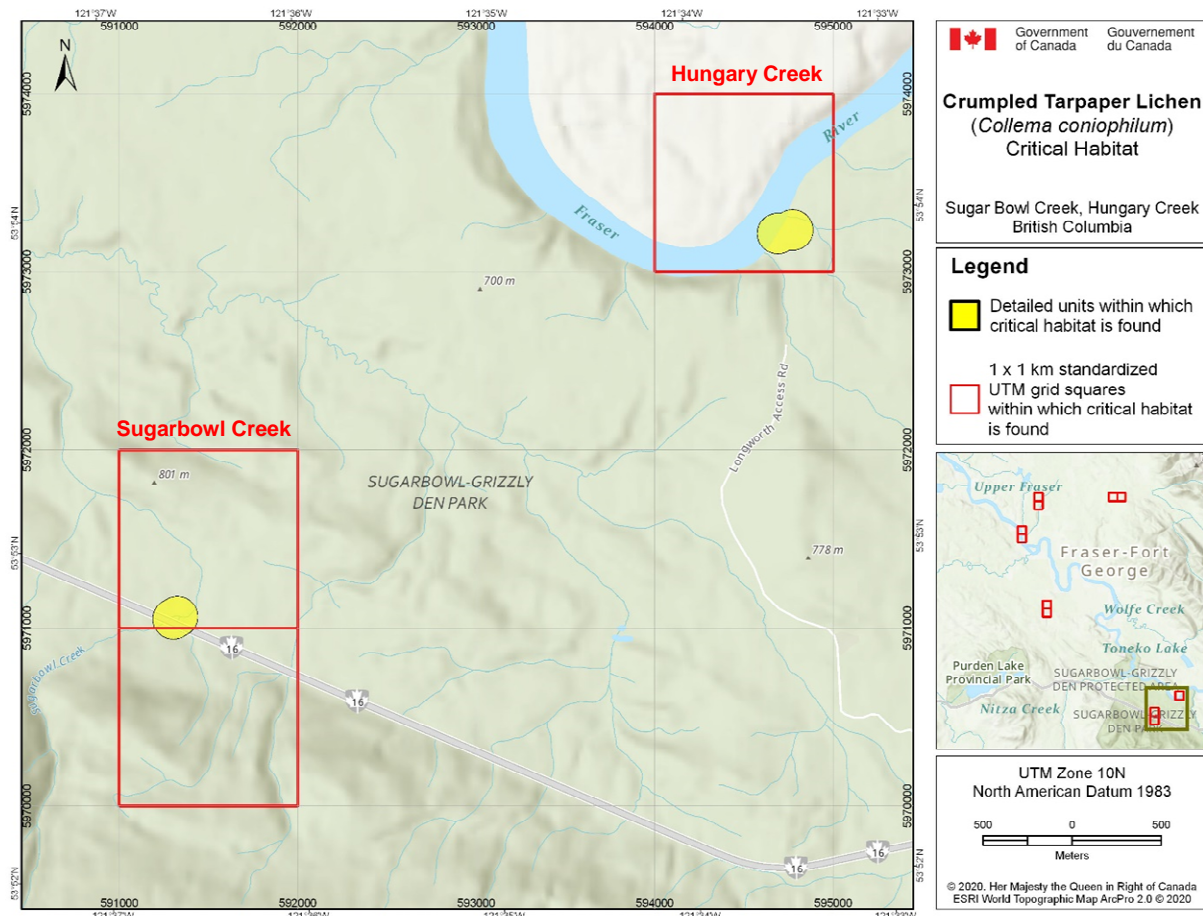
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<sup>10</sup> Critical function zone distance has been defined as the threshold habitat fragment size required for maintaining constituent microhabitat properties for a species (e.g., critical light, moisture and humidity levels necessary for survival).

467 **6.1.2 Geospatial Location of Areas Containing Critical Habitat**

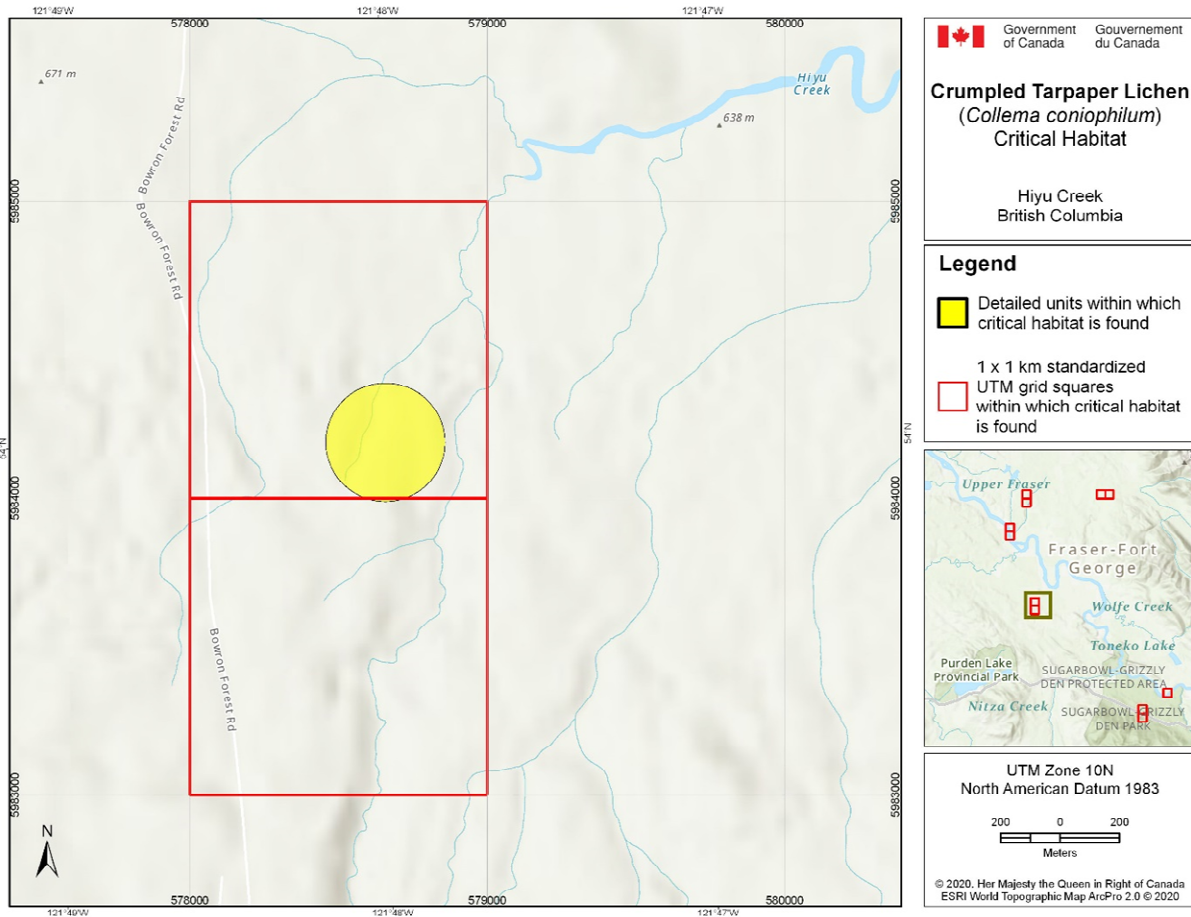
468 Critical habitat for Crumpled Tarpaper Lichen is identified for 16 confirmed populations  
469 in British Columbia (Figures 1-13); these are linked with the element occurrence  
470 numbers provided in Table 2:

- 471 • Sugarbowl Creek (EO1) - Figure 1
- 472 • Hiyu Creek (EO4) - Figure 2
- 473 • Robson Valley, Amanita Creek (EO5) - Figure 3
- 474 • Huble Creek (EO6) - Figure 4
- 475 • Aleza Lake (EO7) - Figure 5
- 476 • Upper Fraser Bridge, McGregor (EO8) - Figure 3
- 477 • Dawson Falls, Wells Gray Provincial Park (EO9) - Figure 6
- 478 • Northwest Red Mountain Creek, Penny (EO10) - Figure 7
- 479 • Southwest Red Mountain Creek, Penny (EO11) - Figure 7
- 480 • Muskwa River (EO12) - Figure 8
- 481 • Driscoll Creek (EO13) - Figure 9
- 482 • Table River (EO14) - Figure 10
- 483 • Hominka River (EO15) - Figure 11
- 484 • Hungary Creek (EO16) - Figure 1
- 485 • Caswell Creek (EO17) - Figure 12
- 486 • Crooked River (EO18) - Figure 13



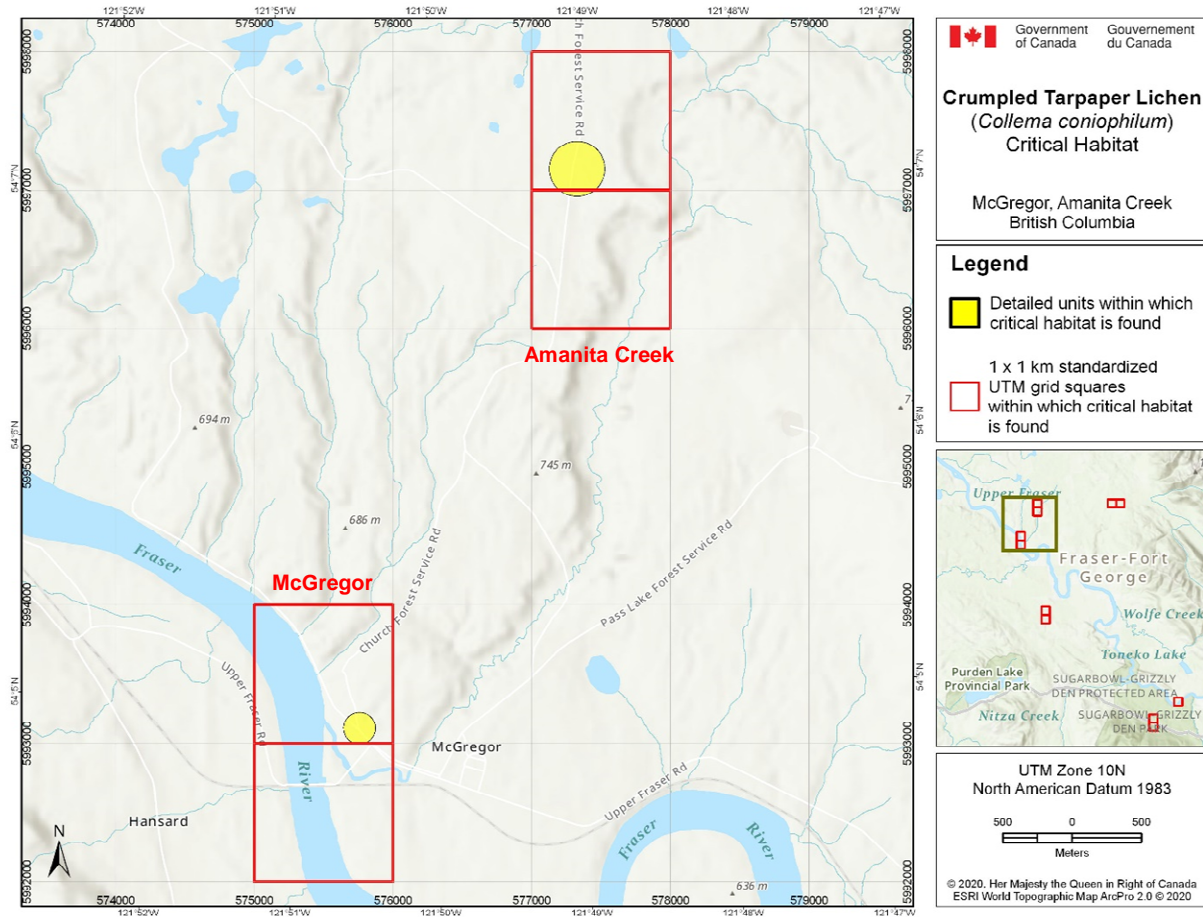
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**Figure 1.** Critical habitat for Crumpled Tarpaper Lichen at Sugarbowl Creek (EO1) and at Hungary Creek (EO16), B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.



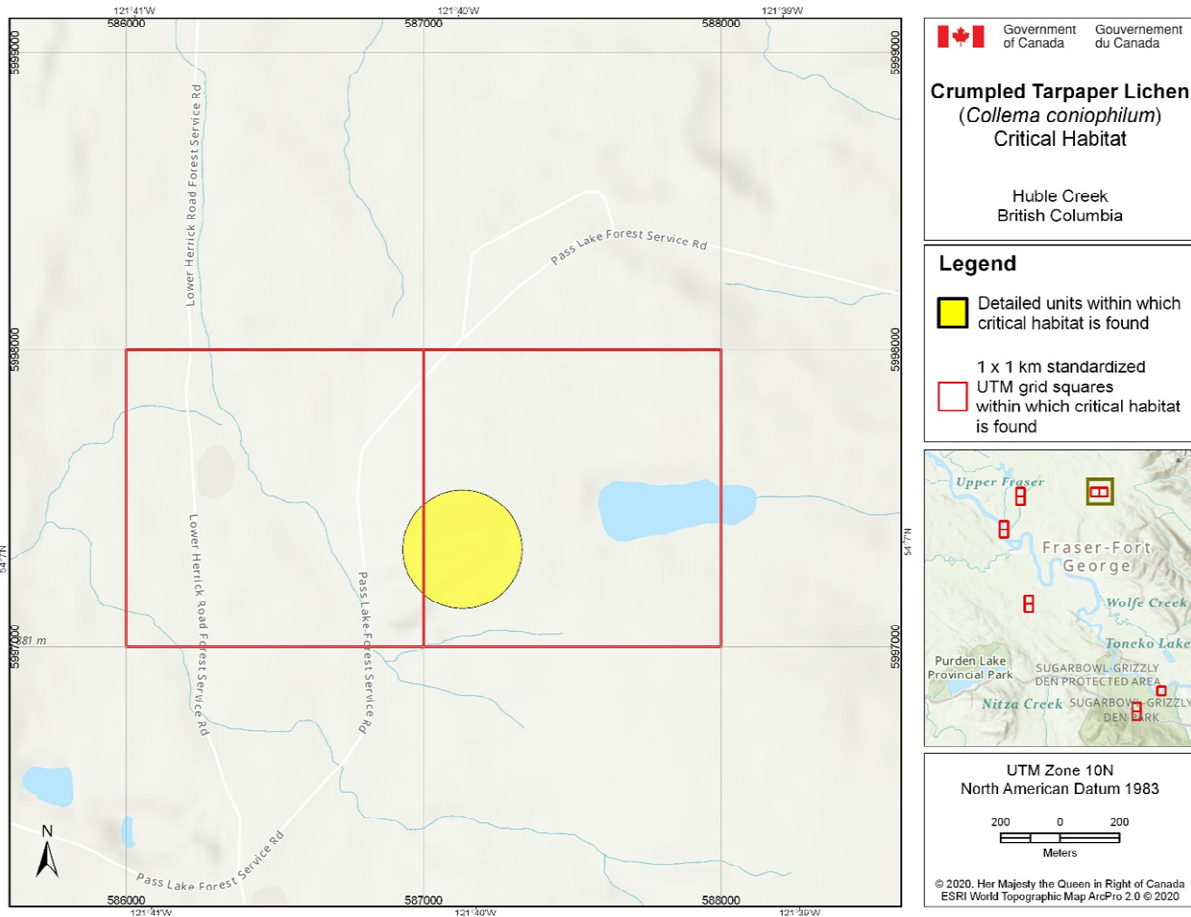
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**Figure 2.** Critical habitat for Crumpled Tarpaper Lichen at Hiyu Creek (EO4) east of Prince George, B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.

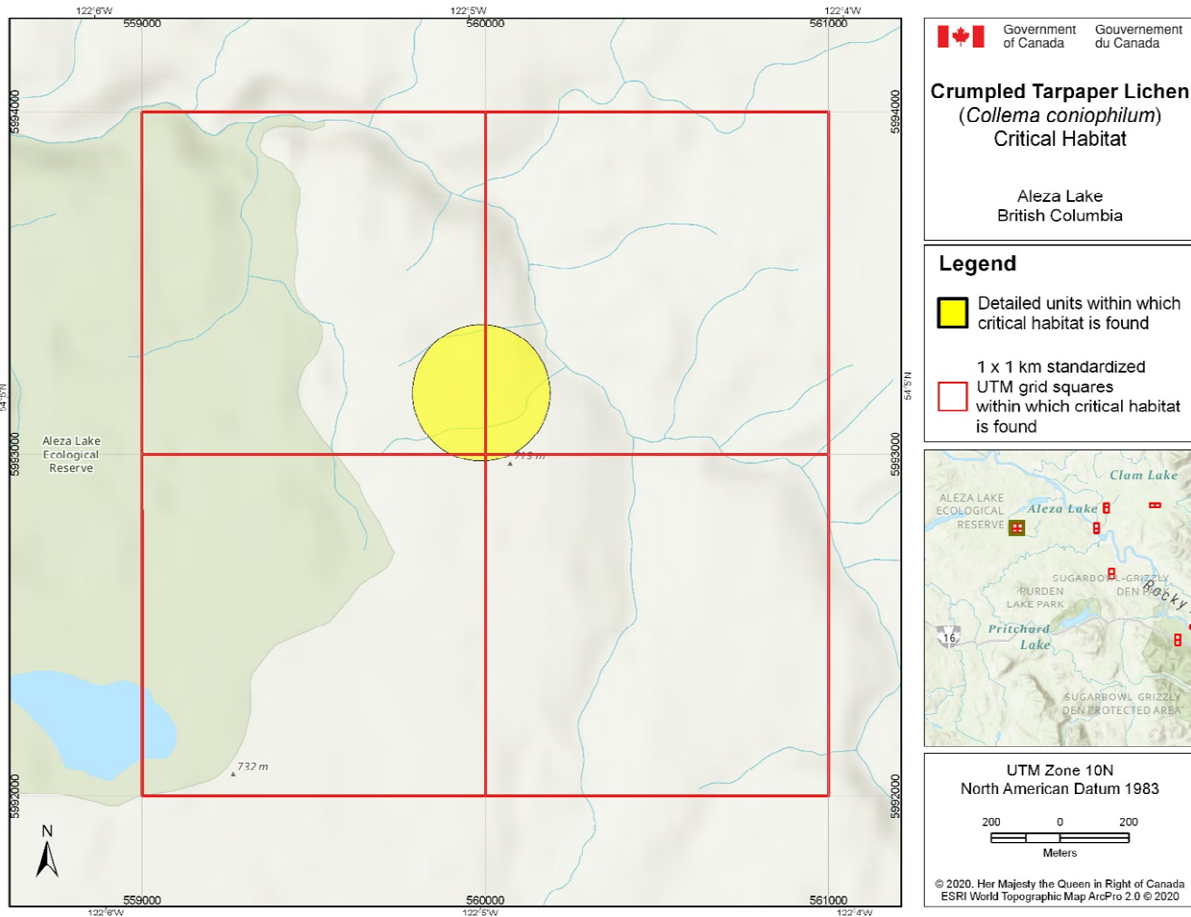


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**Figure 3.** Critical habitat for Crumpled Tarpaper Lichen at Upper Fraser Bridge, McGregor (EO8) and Robson Valley, Amanita Creek (EO5), B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.



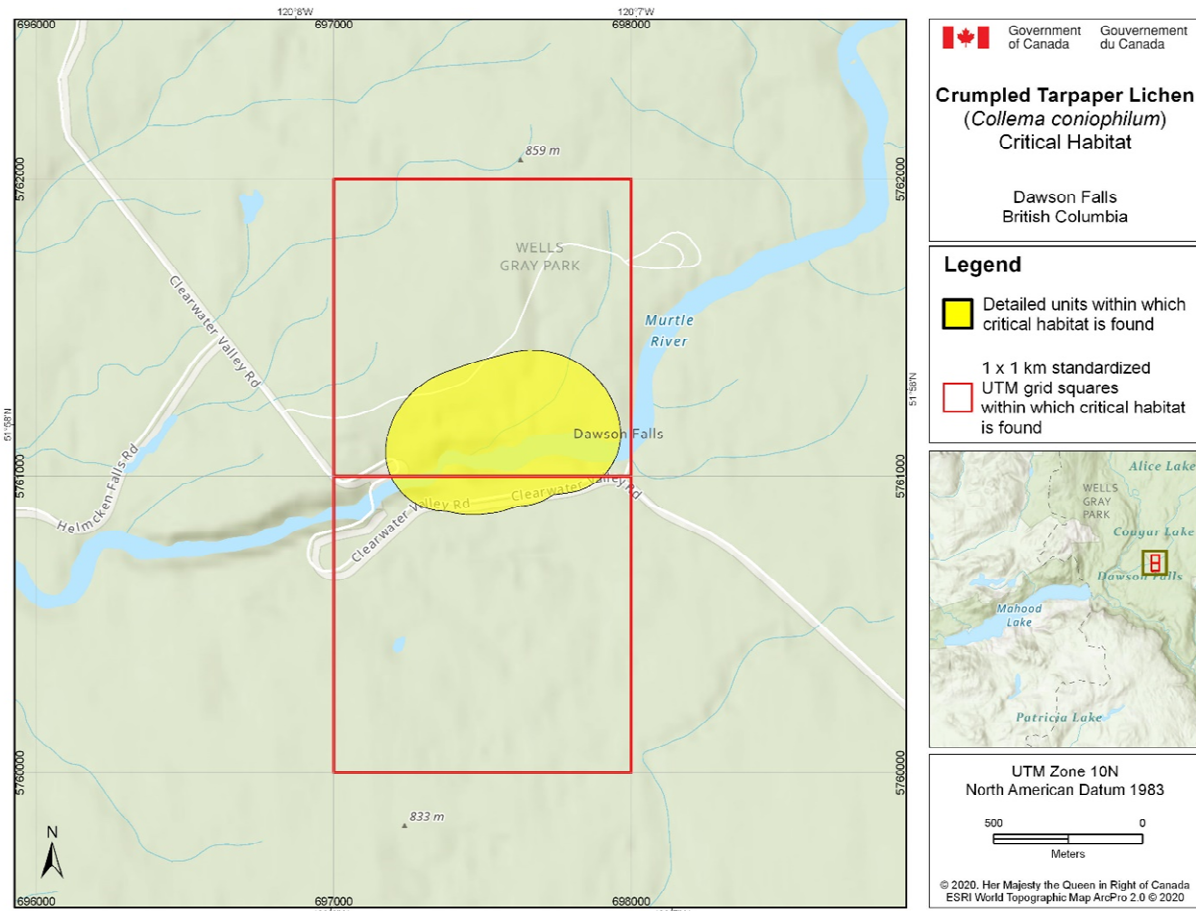
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 511 **Figure 4.** Critical habitat for Crumpled Tarpaper Lichen at Huble Creek (EO6), northeast of  
 512 Prince George, B.C., is represented by the shaded yellow polygons, except where excluded  
 513 areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red  
 514 outline) shown on this figure is part of a standardized national grid systems used to indicate the  
 515 general geographical area within which critical habitat is found. Areas outside of the shaded  
 516 yellow polygons do not contain critical habitat.



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**Figure 5.** Critical habitat for Crumpled Tarpaper Lichen at Aleza Lake (EO7) east of Prince George, B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.

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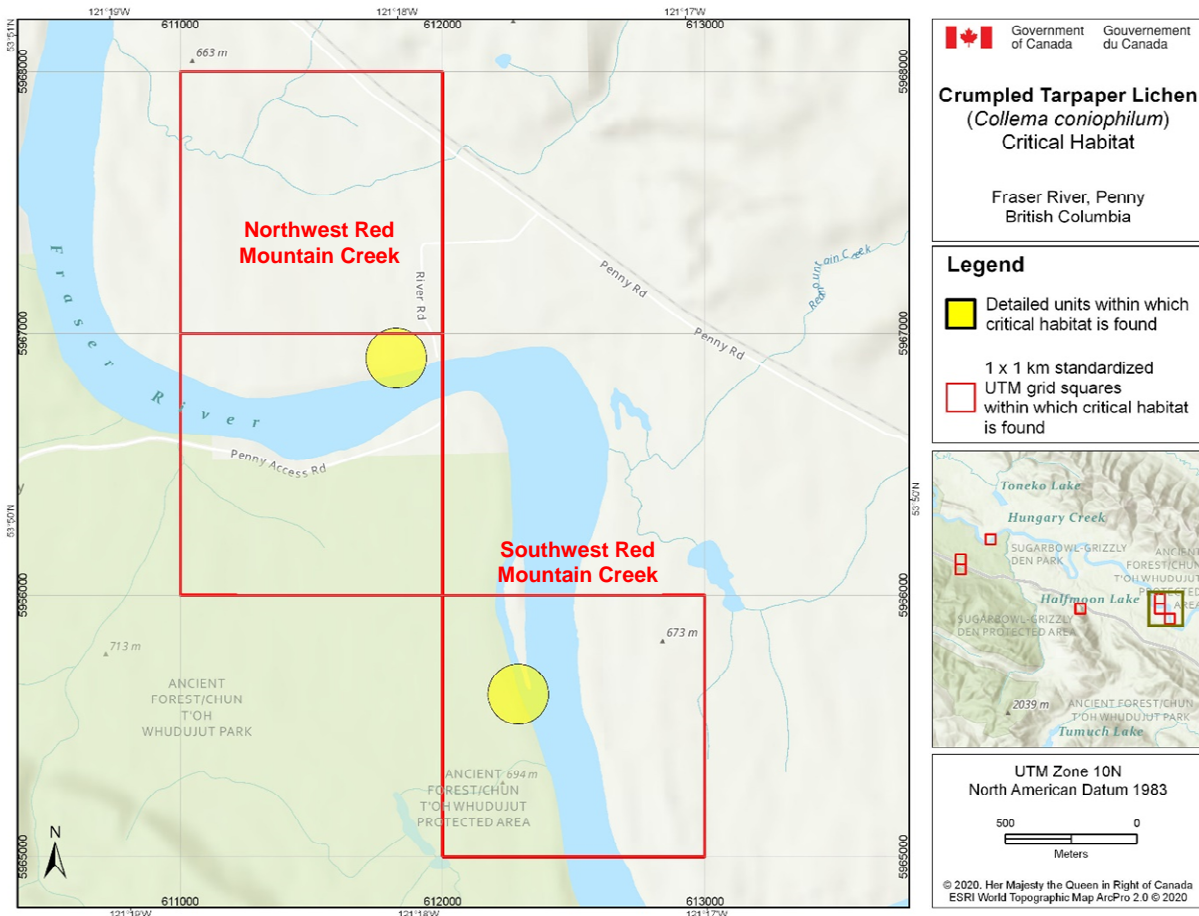


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**Figure 6.** Critical habitat for Crumpled Tarpaper Lichen at Dawson Falls (EO9) in Wells Gray Provincial Park, B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.

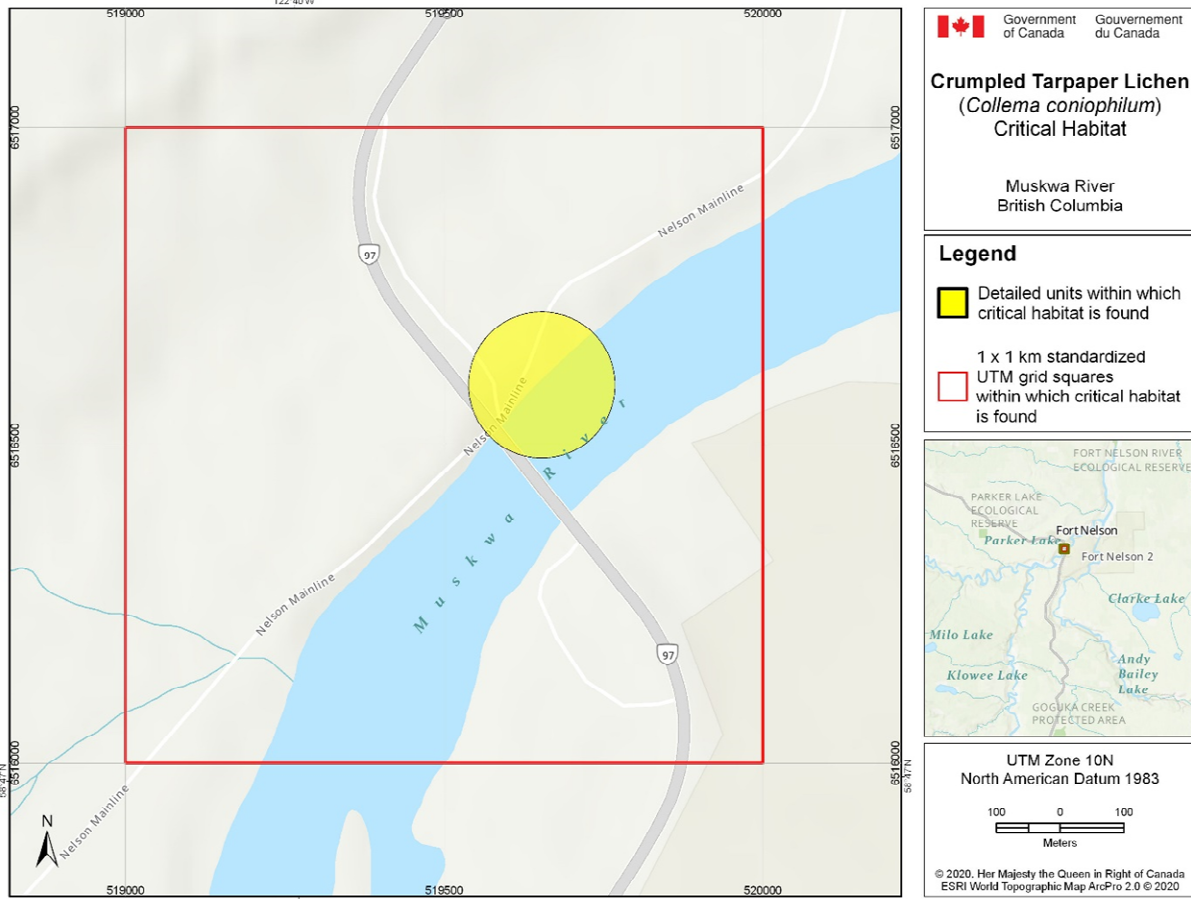


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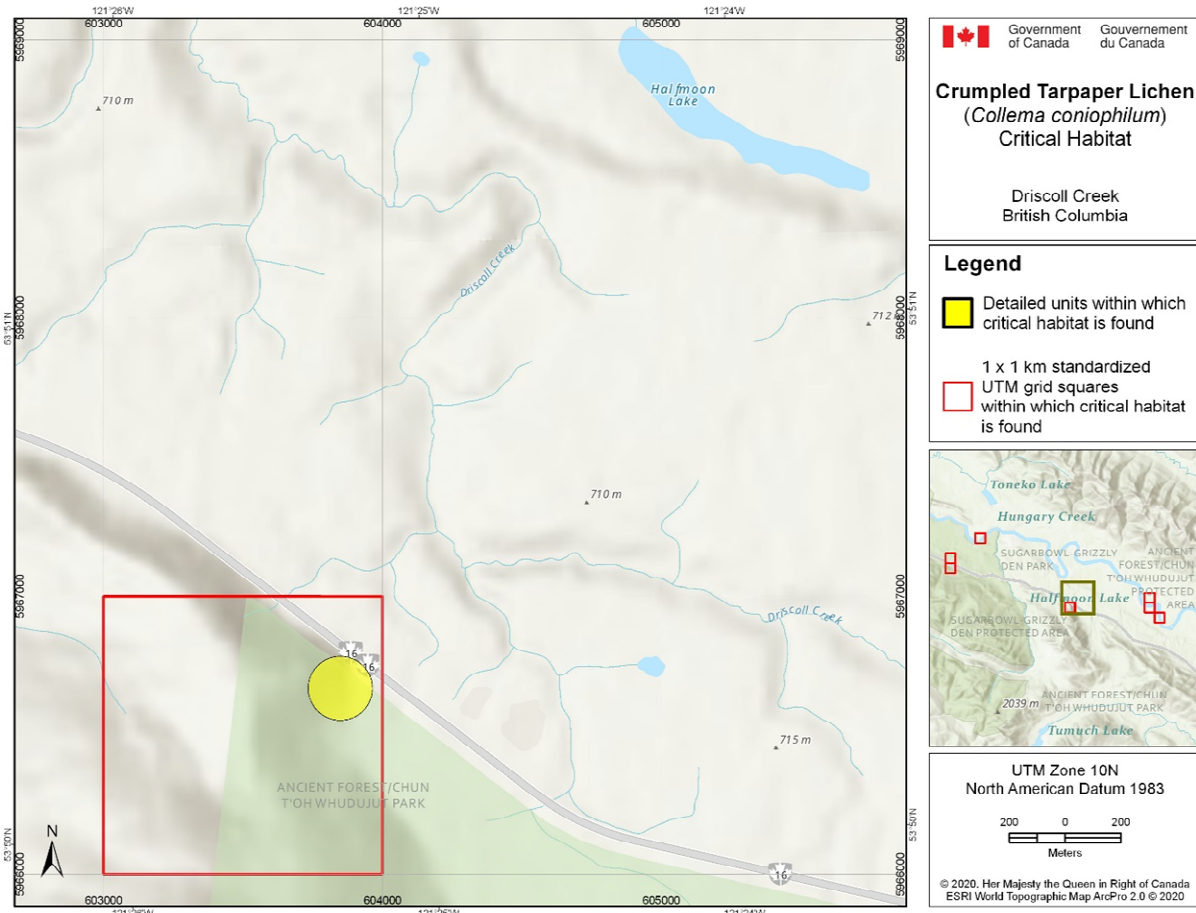


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**Figure 7.** Critical habitat for Crumpled Tarpaper Lichen at Northwest Red Mountain Creek (EO10) and Southwest Red Mountain Creek (EO11), near Penny, B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.

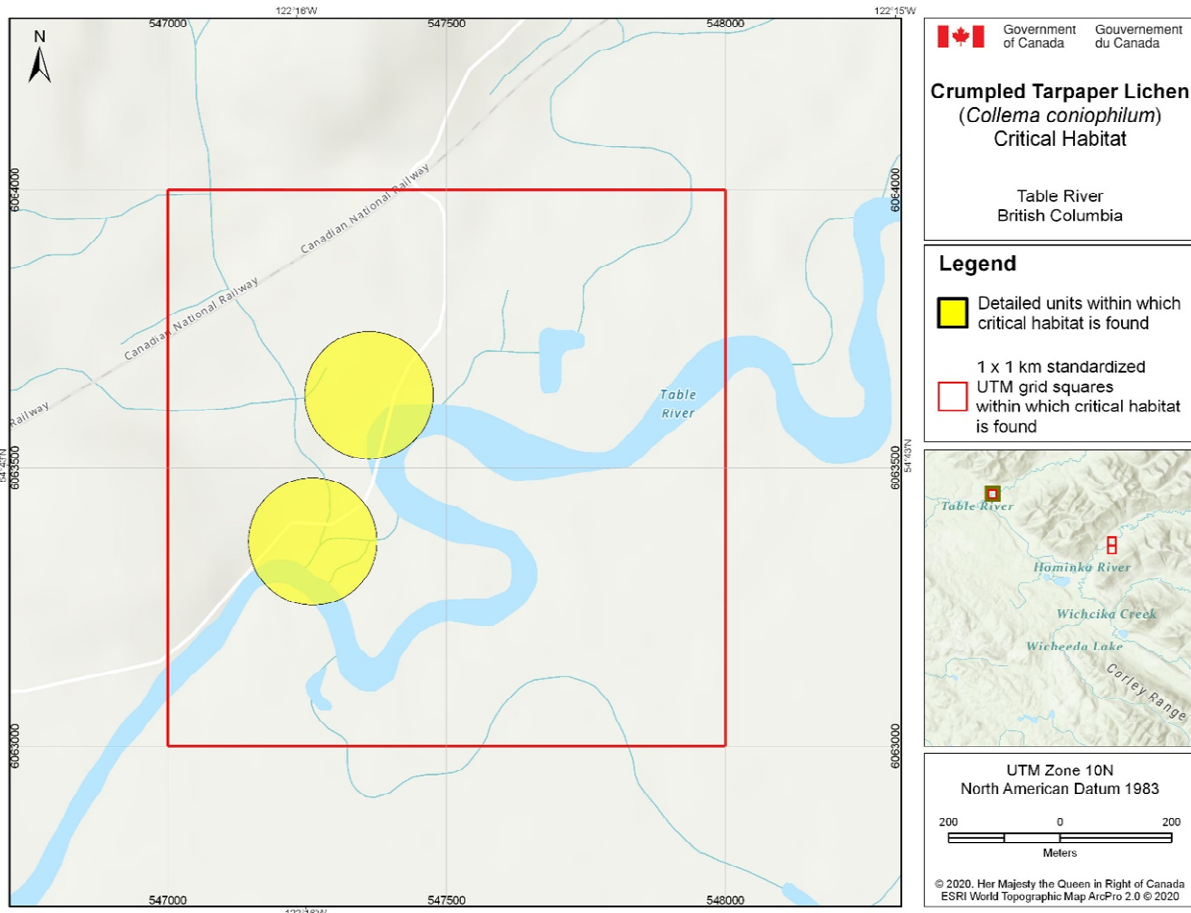


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 544 **Figure 8.** Critical habitat for Crumpled Tarpaper Lichen at Muskwa River (EO12) southeast of  
 545 Fort Nelson, B.C., is represented by the shaded yellow polygons, except where excluded areas  
 546 (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red  
 547 outline) shown on this figure is part of a standardized national grid systems used to indicate the  
 548 general geographical area within which critical habitat is found. Areas outside of the shaded  
 549 yellow polygons do not contain critical habitat.



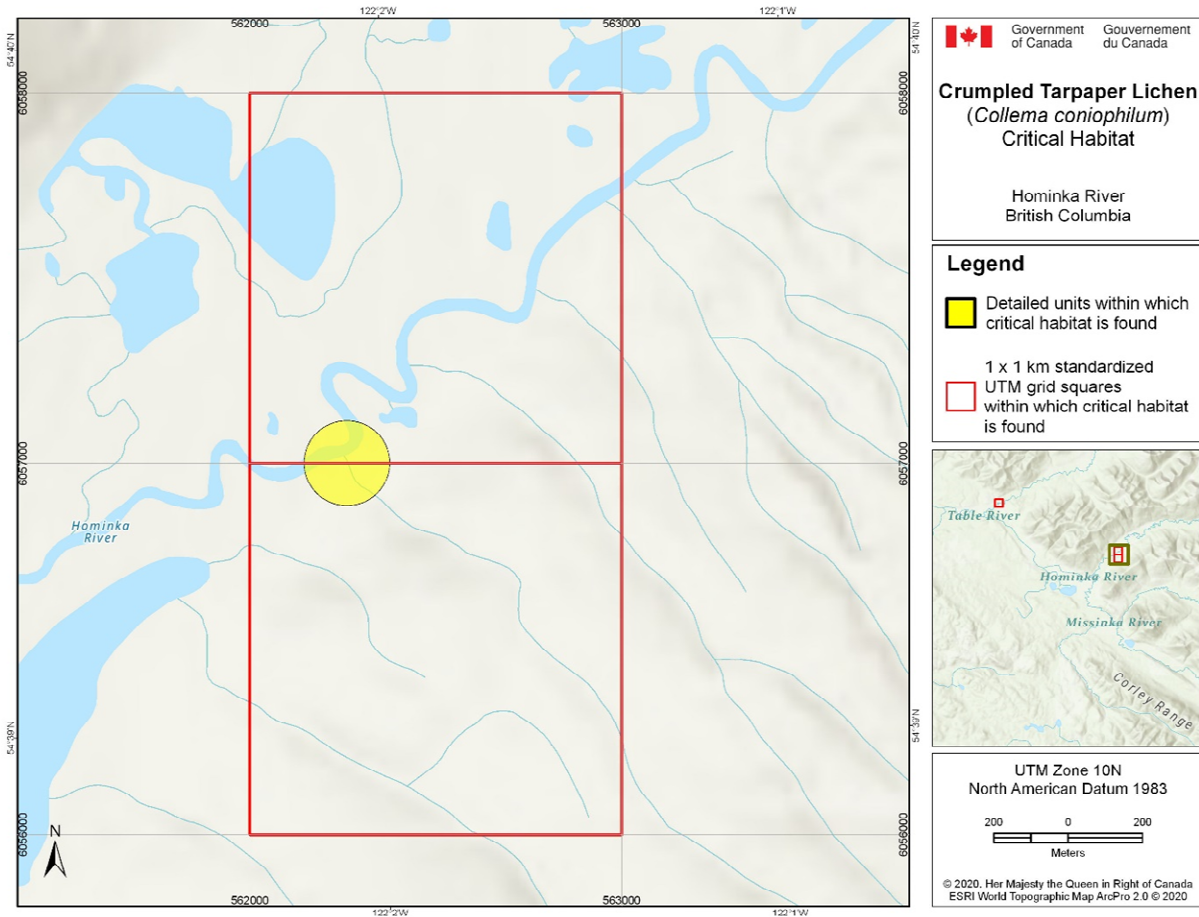
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**Figure 9.** Critical habitat for Crumpled Tarpaper Lichen at Driscoll Creek (EO13) in Ancient Forest/Chun T'oh Whudujut Provincial Park, B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.



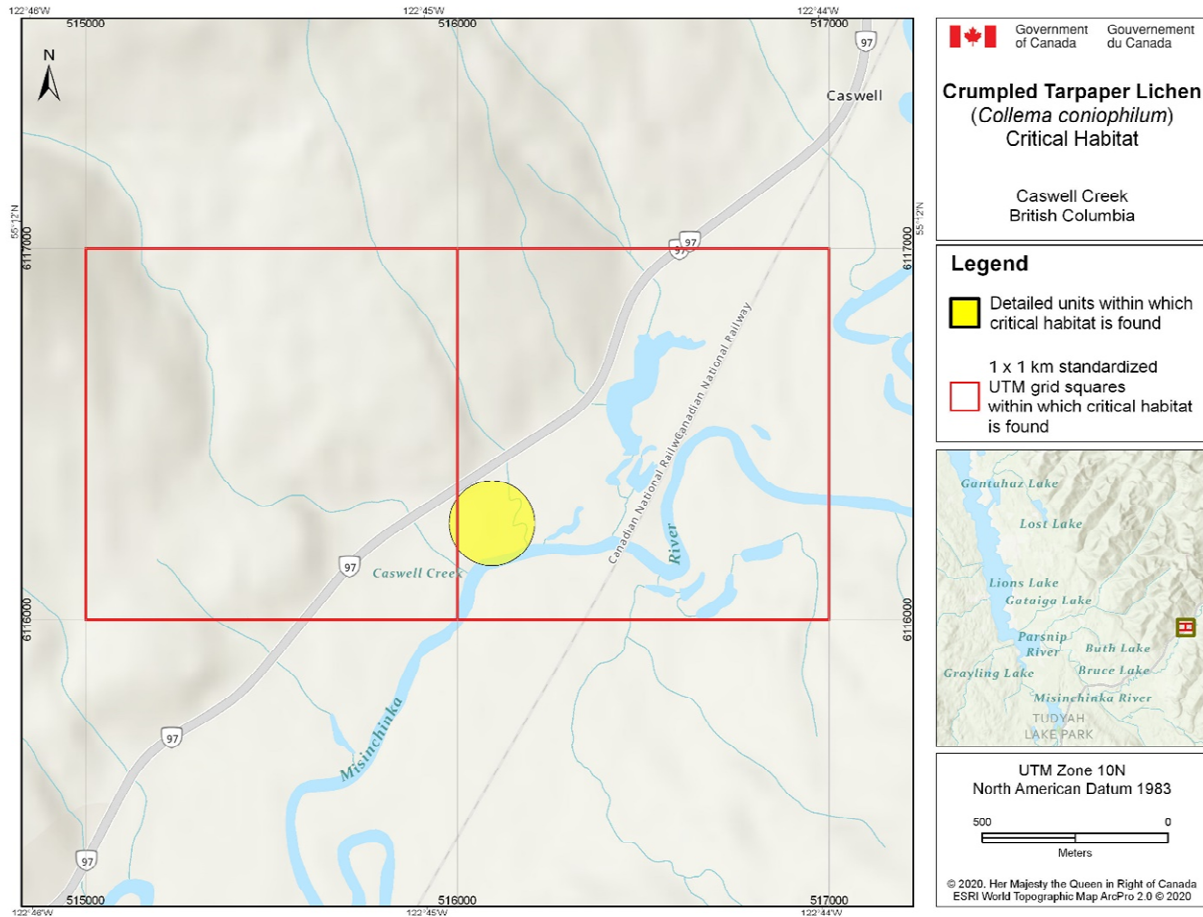
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**Figure 10.** Critical habitat for Crumpled Tarpaper Lichen at Table River (EO14) northeast of Prince George, B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.



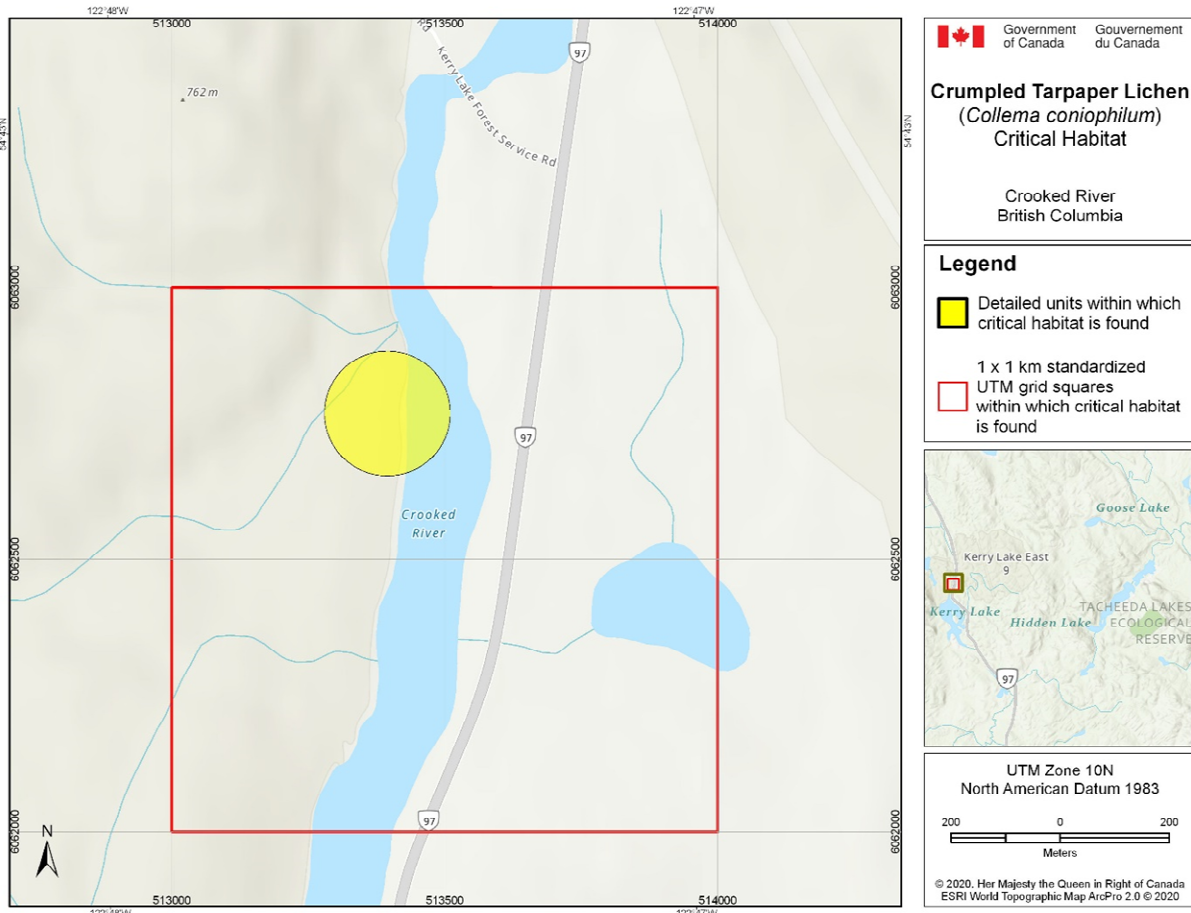
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**Figure 11.** Critical habitat for Crumpled Tarpaper Lichen at Hominka River (EO15) northeast of Prince George, B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.



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**Figure 12.** Critical habitat for Crumpled Tarpaper Lichen at Caswell Creek (EO17) southeast of Mackenzie, B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.



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**Figure 13.** Critical habitat for Crumpled Tarpaper Lichen at Crooked River (EO18) north of Prince George, B.C., is represented by the shaded yellow polygons, except where excluded areas (as described in section 6.1) occur. The 1 km x 1 km standardized UTM grid overlay (red outline) shown on this figure is part of a standardized national grid systems used to indicate the general geographical area within which critical habitat is found. Areas outside of the shaded yellow polygons do not contain critical habitat.

590 **6.2 Schedule of Studies to Identify Critical Habitat**

591  
592 The following schedule of studies (Table 5) outlines the activities required to complete  
593 the identification of critical habitat for the Crumpled Tarpaper Lichen.

594 **Table 5.** Schedule of studies to identify critical habitat for Crumpled Tarpaper Lichen.

Description of activity	Rationale	Timeline
Verify occurrence information reported for two populations of Crumpled Tarpaper Lichen in Alberta and one in Northwest Territories and obtain information about local habitat requirements and threats.	This activity is required to ensure that sufficient critical habitat is identified to meet the population and distribution objectives.	2021-2031

595

596 **6.3 Examples of Activities Likely to Result in the Destruction of**  
597 **Critical Habitat**

598 Understanding what constitutes destruction of critical habitat is necessary for the  
599 protection and management of critical habitat. Destruction is determined on a  
600 case-by-case basis. Destruction would result if part of the critical habitat were degraded,  
601 either permanently or temporarily, such that it would not serve its function when needed  
602 by the species. Destruction may result from a single or multiple activities at one point in  
603 time or from the cumulative effects of one or more activities over time. Section 4  
604 provides a description of the potential threats to Crumpled Tarpaper Lichen. Activities  
605 described in Table 6 include those likely to cause destruction of critical habitat for the  
606 species; destructive activities are not limited to those listed.

607



608 **Table 6.** Examples of activities likely to result in destruction of critical habitat for  
609 Crumpled Tarpaper Lichen.

Description of activity	Details of Effect on Attributes of Habitat	Additional Information including related IUCN-CMP threat <sup>a</sup>
Activities that result in removal or destruction of natural habitat features within the area containing critical habitat, e.g., logging and wood harvesting or construction of roads	The removal or destruction of natural habitat features (e.g., trees, branches, other substrates) can result in destruction of critical habitat through causing direct and permanent loss of the biophysical features and attributes required to sustain both the site context and specific growing locations that support Crumpled Tarpaper Lichen establishment, growth, reproduction and dispersal.	IUCN-CMP Threats #4.1, 5.3  Destruction of critical habitat by these activities can be caused at any time of year. Most likely to result in destruction when they occur within the boundaries of critical habitat; however, activities that result in significant changes to local light and moisture regimes may result in destruction of critical habitat when they occur in areas outside the bounds but adjacent to critical habitat. All site locations are potentially implicated.
Activities that result in the introduction or significant increase of airborne pollutants in critical habitat areas, e.g., via quarrying or smelting of minerals and other materials	Crumpled Tarpaper Lichen requires habitat that is free of airborne acidifying pollutants (e.g. acidic emissions, industrial outputs) for successful growth and reproduction. Lichens directly absorb solutes in airborne rainwater, cloud, and mist, and are thereby highly sensitive to pollutants, which may interfere with establishment, growth, reproduction and dispersal.	IUCN-CMP Threat #9.5  Destruction of critical habitat by this activity can be caused at any time of year. Most likely to cause destruction where pollution sources are located in close proximity to areas containing critical habitat.  Destruction of critical habitat by airborne pollutants is most likely to occur in site locations within the Robson Valley watershed (e.g. Amanita Creek, Aleza Lake, and Upper Fraser), if the approved Giscome smelter is constructed.

610 <sup>a</sup> Threat classification is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership)  
611 unified threats classification system (<https://www.iucnredlist.org/resources/threat-classification-scheme>).

612

## 613 **7. Measuring Progress**

614  
615 The provincial recovery plan (Part 2, section 8) contains a section on measuring  
616 progress toward meeting the three recovery objectives that are set out in that plan  
617 (Part 2, section 5.3). Environment and Climate Change Canada adopts “Section 8:  
618 Measuring Progress” with the addition of the following performance indicators that  
619 define and measure progress toward meeting the population and distribution objective  
620 as it is set out in this federal recovery strategy, i.e.,:

- 621 • The number of mature individuals for Crumpled Tarpaper Lichen is stable or  
622 increasing at all known extant sites over the next 10 years.
- 623 • Human-caused threats are managed such that the area, extent, and quality of  
624 forest habitat that is suitable for Crumpled Tarpaper is maintained in a way that  
625 allows for population resilience at all known extant sites.

## 626 **8. Statement on Action Plans**

627  
628  
629 One or more action plans for the Crumpled Tarpaper Lichen will be posted on the  
630 Species at Risk Public Registry within 10 years of the posting of the final recovery  
631 strategy.  
632

## 633 **9. Effects on the Environment and Other Species**

634  
635 A strategic environmental assessment (SEA) is conducted on all SARA recovery  
636 planning documents, in accordance with the [Cabinet Directive on the Environmental  
637 Assessment of Policy, Plan and Program Proposals](#)<sup>11</sup>. The purpose of a SEA is to  
638 incorporate environmental considerations into the development of public policies, plans,  
639 and program proposals to support environmentally sound decision-making and to  
640 evaluate whether the outcomes of a recovery planning document could affect any  
641 component of the environment or any of the [Federal Sustainable Development  
642 Strategy](#)'s<sup>12</sup> (FSDS) goals and targets.  
643

644 Recovery planning is intended to benefit species at risk and biodiversity in general.  
645 However, it is recognized that strategies may also inadvertently lead to environmental  
646 effects beyond the intended benefits. The planning process based on national  
647 guidelines directly incorporates consideration of all environmental effects, with a  
648 particular focus on possible impacts upon non-target species or habitats. The results of  
649 the SEA are incorporated directly into the strategy itself, but are also summarized in the  
650 statement below.  
651

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<sup>11</sup> [www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html](http://www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html)

<sup>12</sup> [www.fsds-sfdd.ca/index.html#/en/goals/](http://www.fsds-sfdd.ca/index.html#/en/goals/)

652 The provincial recovery plan for Crumpled Tarpaper Lichen contains a section  
653 describing the effects of recovery activities on other species (i.e., Section 9).  
654 Environment and Climate Change Canada adopts this section of the provincial recovery  
655 plan as the statement on effects of recovery activities on the environment and other  
656 species. Recovery planning activities for Crumpled Tarpaper Lichen will be  
657 implemented with consideration for all co-occurring species at risk, in order to avoid  
658 negative impacts to these co-occurring species or their habitats. Some management  
659 actions for Crumpled Tarpaper Lichen (e.g., inventory and monitoring, threat mitigation,  
660 habitat conservation, education, and research) may promote the conservation of other  
661 species at risk that overlap in distribution and rely on similar interior old-growth forest  
662 habitat attributes.  
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## 665 **10. References**

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**Part 2 – *Recovery Plan for the Crumpled Tarpaper*  
(*Collema coniophilum*) in *British Columbia*, prepared by the  
British Columbia Ministry of Environment and  
Climate Change Strategy**

## Recovery Plan for Crumpled Tarpaper (*Collema coniophilum*) in British Columbia



Prepared by B.C. Ministry of Environment



December 2013

## 1 **About the British Columbia Recovery Strategy Series**

2 This series presents the recovery documents that are prepared as advice to the Province of British  
3 Columbia on the general approach required to recover species at risk. The Province prepares  
4 recovery documents to ensure coordinated conservation actions and to meet its commitments to  
5 recover species at risk under the *Accord for the Protection of Species at Risk in Canada* and the  
6 *Canada–British Columbia Agreement on Species at Risk*.

## 7 **What is recovery?**

8 Species at risk recovery is the process by which the decline of an endangered, threatened, or  
9 extirpated species is arrested or reversed, and threats are removed or reduced to improve the  
10 likelihood of a species' persistence in the wild.

## 11 **What is a provincial recovery document?**

12 Recovery documents summarize the best available scientific and traditional information of a  
13 species or ecosystem to identify goals, objectives, and strategic approaches that provide a  
14 coordinated direction for recovery. These documents outline what is and what is not known  
15 about a species or ecosystem, identify threats to the species or ecosystem, and explain what  
16 should be done to mitigate those threats, as well as provide information on habitat needed for  
17 survival and recovery of the species. This information may be summarized in a recovery strategy  
18 followed by one or more action plans. The purpose of an action plan is to offer more detailed  
19 information to guide implementation of the recovery of a species or ecosystem. When sufficient  
20 information to guide implementation can be included from the onset, all of the information is  
21 presented together in a recovery plan.

22  
23 Information provided in provincial recovery documents may be adopted by Environment Canada  
24 for inclusion in federal recovery documents that the federal agencies prepare to meet their  
25 commitments to recover species at risk under the *Species at Risk Act*.

## 26 **What's next?**

27 The Province of British Columbia accepts the information in these documents as advice to  
28 inform implementation of recovery measures, including decisions regarding measures to protect  
29 habitat for the species.

30  
31 Success in the recovery of a species depends on the commitment and cooperation of many  
32 different constituencies that may be involved in implementing the directions set out in this  
33 document. All British Columbians are encouraged to participate in these efforts.

## 34 **For more information**

35 To learn more about species at risk recovery in British Columbia, please visit the B.C. Ministry  
36 of Environment Recovery Planning webpage at:

37 <<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>

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**Recovery Plan for Crumpled Tarpaper (*Collema coniophilum*)  
in British Columbia**

**Prepared by the B.C. Ministry of Environment**

**December 2013**



57 **Recommended citation**

58 B.C. Ministry of Environment. 2013. Recovery plan for crumpled tarpaper (*Collema*  
59 *coniophilum*) in British Columbia. B.C. Ministry of Environment, Victoria, BC. 16 pp.  
60

61 **Cover illustration/photograph**

62 Tim Wheeler  
63

64 **Additional copies**

65 Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning  
66 webpage at:

67  
68 <<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>  
69

70 **Publication information**

71 **ISBN:** 978-0-7726-6735-9  
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**75 Disclaimer**

76 This recovery plan has been prepared by the B.C. Ministry of Environment, as advice to the  
77 responsible jurisdictions and organizations that may be involved in recovering the species. The  
78 B.C. Ministry of Environment has received this advice as part of fulfilling its commitments  
79 under the *Accord for the Protection of Species at Risk in Canada*, and the *Canada–British*  
80 *Columbia Agreement on Species at Risk*.

81  
82 This document identifies the recovery strategies that are deemed necessary, based on the best  
83 available scientific and traditional information, to recover crumpled tarpaper populations in  
84 British Columbia. Recovery actions to achieve the goals and objectives identified herein are  
85 subject to the priorities and budgetary constraints of participatory agencies and organizations.  
86 These goals, objectives, and recovery approaches may be modified in the future to accommodate  
87 new objectives and findings.

88  
89 The responsible jurisdictions and all members of the recovery team have had an opportunity to  
90 review this document. However, this document does not necessarily represent the official  
91 positions of the agencies or the personal views of all individuals on the recovery team.

92  
93 Success in the recovery of this species depends on the commitment and cooperation of many  
94 different constituencies that may be involved in implementing the directions set out in this plan.  
95 The B.C. Ministry of Environment encourages all British Columbians to participate in the  
96 recovery of crumpled tarpaper.

97  
98

99 **ACKNOWLEDGEMENTS**

100 This document was completed by Brenda Costanzo (B.C. Ministry of Environment). Input on the  
101 threat assessment section was received from Stu Crawford (consultant) and Trevor Goward  
102 (consultant), with funding support from Environment Canada (Canadian Wildlife Service,  
103 Pacific-Yukon Region). Trevor Goward reviewed this document with funding support from the  
104 Land Based Investment Fund. Tim Wheeler is provided the cover image of crumpled tarpaper.  
105  
106

## 107 EXECUTIVE SUMMARY

108 Crumpled tarpaper (*Collema coniophilum*) is a gel lichen with a leafy thallus (1.5–2.5 wide)  
109 bearing several broad, mostly rounded lobes that are thickened towards the tips. Thalli have a  
110 dark olive green to blackish brown upper surface, and a dark olive green to pale olive beige  
111 lower surface. The upper surface is sparsely covered in low blisters that become networks of  
112 narrow folds. The lower surface may bear tufts of tiny white hairs.

113  
114 Crumpled tarpaper was designated as Threatened by the Committee on the Status of Endangered  
115 Wildlife in Canada (COSEWIC) as it is endemic to Canada, is restricted to trees in old-growth  
116 forests, and has a narrow distribution. Crumpled tarpaper is declining as a result of ongoing loss  
117 of old-growth forest. It is also expected to be listed as Threatened in Canada on Schedule 1 of the  
118 *Species at Risk Act* (SARA). In British Columbia, crumpled tarpaper is ranked S1 (critically  
119 imperiled) by the Conservation Data Centre and is on the provincial Red list. The B.C.  
120 Conservation Framework ranks crumpled tarpaper lichen as a priority 1 under goal 1 (contribute  
121 to global efforts for species and ecosystem conservation). Recovery is considered to be  
122 biologically and technically feasible.

123  
124 The recovery (population and distribution) goal is to maintain stable or increasing populations  
125 throughout the species' range in British Columbia.

126  
127 Recovery objectives for this species include:

- 128 1. To ensure long-term protection<sup>1</sup> for the known populations and habitat of crumpled tarpaper.
- 129 2. To conduct targeted inventory of suitable habitat (e.g., in Interior Cedar–Hemlock and Sub-  
130 Boreal Spruce biogeoclimatic zones).
- 131 3. To implement appropriate site management at all known locations.
- 132 4. To fill knowledge gaps on the environmental requirements and life history of the species (in  
133 particular lifespan, nutrient regime, and microclimatic requirements) for successful  
134 recolonization and maintenance of the species with respect to land management activities.

135

## 136 RECOVERY FEASIBILITY SUMMARY

137 The recovery of crumpled tarpaper in B.C. is considered technically and biologically feasible  
138 based on the criteria outlined by the Government of Canada (2009):

- 139  
140 1. Individuals of the wildlife species that are capable of reproduction are available now or in  
141 the foreseeable future to sustain the population or improve its abundance.

142

143 Yes, species reproduces asexually, although dispersal may be limiting.

144

---

<sup>1</sup> Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, sale by willing vendors on private lands, land use designations, and protected areas.

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

147

148 Yes, sufficient habitat is available or can be made available in the Interior Cedar–Hemlock  
149 (ICH) and Sub-Boreal Spruce (SBS) biogeoclimatic zones, though notably crumpled  
150 tarpaper requires highly nutrient-enriched microsites not likely to be widely distributed.

151

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

154

155 Yes. Crumpled tarpaper requires environmental conditions associated exclusively with old  
156 forests. The primary threat of logging and wood harvesting can be avoided to some extent,  
157 as 1 of the 7 known extant populations occur in a provincial park and another possibly  
158 occurs in an ecological reserve. These areas are protected from industrial resource  
159 extraction through provisions such as the *Parks Act* and the *Ecological Reserve Act*.  
160 Future provincial legislation may likewise minimize the threat of logging at other  
161 locations on provincial Crown land (e.g., if crumpled tarpaper is listed as a Species at Risk  
162 under the *Forest and Range Practices Act*).

163

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

166

167 Yes, best management practices can be developed for successful land management for this  
168 species. However, research will still be needed on its environmental requirements and life  
169 history, especially regarding generation time and the role of nutrients.

170

171

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 213

214 **1 COSEWIC\* SPECIES ASSESSMENT INFORMATION**

**Date of Assessment:** November 2010  
**Common Name (population):** Crumpled Tarpaper Lichen  
**Scientific Name:** *Collema coniophilum*  
**COSEWIC Status:** Threatened  
**Reason for Designation:** This foliose, tree-inhabiting cyanolichen is endemic to Canada where it occupies a narrow range restricted to trees in old-growth forests on calcareous soils in humid, inland British Columbia. The lichen is poorly adapted for dispersal since it has never been found with sexual reproductive structures and its vegetative propagules are not easily dispersed. The lichen has an apparently declining distribution, resulting from ongoing loss of old-growth forest through clear-cut logging. The factors underlying its rarity and narrow endemism are not well understood.  
**Canadian Occurrence:** British Columbia  
**COSEWIC Status History:** Designated as Threatened in November 2010.

215 \* Committee on the Status of Endangered Wildlife in Canada.  
 216 \*\*Common and scientific names reported in this management plan follow the naming conventions of the B.C. Conservation Data  
 217 Centre, which may be different from names reported by COSEWIC.  
 218

219 **2 SPECIES STATUS INFORMATION**

<b>crumpled tarpaper<sup>a</sup></b>		
<b>Legal Designation:</b>		
<a href="#">FRPA:</a> <sup>b</sup> No	B.C. <i>Wildlife Act</i> : <sup>c</sup> No	<a href="#">SARA:</a> Not currently listed <sup>d</sup>
<a href="#">OGAA:</a> <sup>b</sup> No		
<b>Conservation Status<sup>e</sup></b>		
B.C. List: Red	B.C. Rank: S1 (2010)	<a href="#">National Rank:</a> N1 (2009)      Global Rank: G1 (2009)
Other <a href="#">Subnational Ranks:</a> <sup>f</sup> None		
<b>B.C. Conservation Framework (CF)<sup>g</sup></b>		
Goal 1: Contribute to global efforts for species and ecosystem conservation.		Priority: <sup>h</sup> 1 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk.		Priority: 6 (2009)
Goal 3: Maintain the diversity of native species and ecosystems.		Priority: 1 (2009)
<a href="#">CF Action Groups:</a>	Compile Status Report; Planning; List under <i>Wildlife Act</i> ; Send to COSEWIC; Habitat Protection; Private Land Stewardship	

220 <sup>a</sup> Data source: B.C. Conservation Data Centre (2013) unless otherwise noted.  
 221 <sup>b</sup> No = not listed in one of the categories of wildlife that requires special management attention to address the impacts of forest and range activities  
 222 on Crown land under the *Forest and Range Practices Act* (FRPA; Province of British Columbia 2002) and/or the impacts of oil and gas activities  
 223 on Crown land under the *Oil and Gas Activities Act* (OGAA; Province of British Columbia 2008).  
 224 <sup>c</sup> No = not designated as wildlife under the B.C. *Wildlife Act* (Province of British Columbia 1982).  
 225 <sup>d</sup> It expected to be listed as Threatened in Canada on [Schedule 1](#) of the *Species at Risk Act* (SARA). The COSEWIC assessment has been provided  
 226 to the Minister of Environment and with the Governor in Council (GIC). The Minister, on the recommendation of the GIC, may amend the List and  
 227 add a wildlife species.  
 228 <sup>e</sup> S = subnational; N = national; G = global; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special  
 229 concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure; NA = not applicable;  
 230 NR = unranked; U = unrankable.  
 231 <sup>f</sup> Data source: NatureServe (2012).  
 232 <sup>g</sup> Data source: B.C. Ministry of Environment (2010).  
 233 <sup>h</sup> Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).  
 234

## 235 3 SPECIES INFORMATION

### 236 3.1 Species Description

237 Crumpled tarpaper is a small- to medium-sized foliose lichen with a leafy thallus 1.5–2.5 (-  
238 3) cm, which becomes gel-like when moistened. The thallus has several broad rounded lobes 2–  
239 4 (-5) mm wide and thickened towards the tips. The upper surface is dark olive green to black  
240 brown and sometimes appears blistered. The isidia (outgrowths, method of asexual reproduction)  
241 on upper surface are black and 0.05–0.2 mm across. The lower surface is a dark olive green to  
242 pale olive beige. There are no rhizines (fungal threads), though tufts of small white hairs are  
243 sometimes present on the undersurface. (See COSEWIC 2010 for full description; refer to cover  
244 photograph.)  
245

### 246 3.2 Populations and Distribution

247 Crumpled tarpaper is endemic to Canada where it is only known from 7 extant and 1 extirpated  
248 location in B.C. (Table 1; Figure 1). In the province, it is restricted to inland areas in humid old-  
249 growth forests mainly east of Prince George in the Rocky Mountain Trench. Only a few targeted  
250 searches in appropriate habitat have been conducted, thus there are potentially more localities to  
251 be found in the Sub-Boreal Spruce (SBS) and the Interior–Cedar Hemlock (ICH) biogeoclimatic  
252 zones within B.C. (COSEWIC 2010).  
253

254 The largest known population of crumpled tarpaper occurs at Hiyu Creek (EO4), which supports  
255 more than 70% of known thalli. Hiyu Creek is an artificially supported site due to the calcium  
256 from the logging road dust that resulted from gravel being deposited on the road. A decline in  
257 this population over the past decade has been observed, which may be due to a reduction in  
258 (calcareous) road dust due to less logging at the Hiyu site.  
259

260 The Hiyu Creek locality likely represents a major “source population” for the species, creating  
261 an on-going supply of diaspores that, when dispersed (e.g., by birds), help sustain it over a much  
262 larger area. The loss of crumpled tarpaper at this locality (e.g., to logging or other disturbances)  
263 could result in a gradual regional decline in this species over time because of a lack of dispersal  
264 to other areas (T. Goward, pers. comm., 2013). Each locality is considered a separate population  
265 as they are more than 1 km apart. As logging has been focused on the bottomland forest types  
266 that are characteristic for this species, it is likely that in the past 30 years this activity has resulted  
267 in a decline in locations and population size (COSEWIC 2010). This species is at the edge of its  
268 ecological capacity to exist (T. Goward, pers. comm., 2013) as its limited reproductive and  
269 dispersal capabilities may restrict its ability to re-establish, especially within small populations  
270 (see section 3.5).  
271

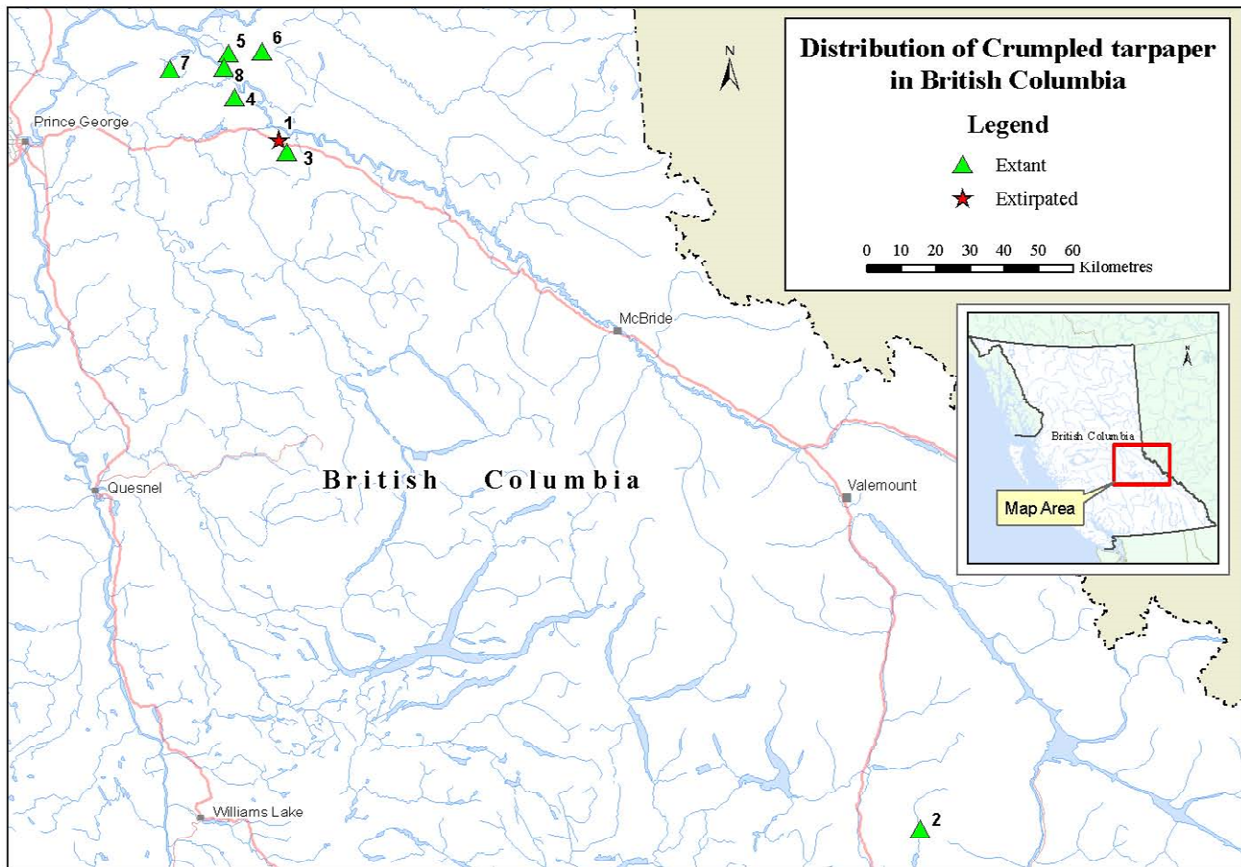


272 **Table 1.** Status and description of crumpled tarpaper populations in British Columbia.

<b>Population (numbering refers to B.C. Conservation Data Centre “CDC Element Occurrence data”)</b>	<b>Date last observed and number of thalli (if documented)</b>	<b>Land tenure</b>
EO1. Sugarbowl Creek; 5 km west of Hungary Creek	Extirpated in 2000 <sup>a</sup>	Crown land: Sugarbowl Grizzly Den Provincial Park
EO2. Upper Adams River; 7 km north of Tumtum Lake	1998: <sup>b</sup> 4 thalli	Crown land (potential Old Growth Management Area) <sup>c</sup>
EO3. Kenneth Creek; Viking Ridge	1999: <sup>d</sup> 4 thalli	Crown land: Sugarbowl Grizzly Den Provincial Park
EO4. Hiyu Creek; km 20 on Bowron Road	2006: 140 thalli	Crown land
EO5. Robson Valley; km 3.5 on North Fraser Road	2006: 17 thalli	Crown land
EO6. South of Huble Creek; km 1.5 on Herrick Road	2006: 6 thalli	Crown land
EO7. SW of Aleza Lake; km 1.5 on Aleza Lake Forest Road	2006: 6 thalli	Crown land under lease to Aleza Lake Research Society with the University of Northern BC; Crown land: Aleza Lake Ecological Reserve <sup>e</sup>
EO8. Upper Fraser Bridge	2007: 6 thalli	Crown land

273 <sup>a</sup> Habitat was removed as a result of shake cutting then by clearcut logging.274 <sup>b</sup> Attempts to relocate in 2006 unsuccessful (T. Goward, pers. comm., 2010).275 <sup>c</sup> Due to the uncertainty of the location information, it is unknown whether this population occurs within the boundaries of the Old Growth Management Area.276 <sup>d</sup> Attempts to relocate in 2004 unsuccessful (T. Goward, pers. comm., 2010).277 <sup>e</sup> Due to the uncertainty of the location information, it is unknown whether this population occurs within the ecological reserve.

278



279  
 280 **Figure 1.** Crumpled tarpaper distribution in British Columbia (B.C. Conservation Data Centre 2013).  
 281

### 282 **3.3 Needs of Crumpled Tarpaper**

283 Crumpled tarpaper is a pioneer species that colonizes young twigs and branches through asexual  
 284 reproduction (via the production of isidia) in humid old-growth forests that are over 100 years  
 285 old. As this species requires high light levels and is restricted to older forest types (which allow  
 286 more light than younger forests), stand structure is important to its survival. As well, the  
 287 nutrients that are leached from higher in the canopy, in particular from trembling aspen (*Populus*  
 288 *tremuloides*) and black cottonwood (*Populus trichocarpa*), supply crumpled tarpaper with  
 289 nutrients for establishment on the lower, partly defoliated branches of adjacent conifer host trees  
 290 (T. Goward, pers. comm., 2013).

291  
 292 As crumpled tarpaper requires a high level of calcium enrichment for establishment, it is  
 293 restricted to valley-bottom forests established over calcareous lake sediments deposited during  
 294 deglaciation; it is not known to occur above about 1000 m elevation. The species is only capable  
 295 of establishing within the wettest subzones of the Interior Cedar–Hemlock and Sub-Boreal

296 Spruce biogeoclimatic zones where it inhabits trees that grow on calcareous soils (COSEWIC  
297 2010).

298  
299 Trees that crumpled tarpaper inhabit include subalpine fir (*Abies lasiocarpa* var. *lasiocarpa*),  
300 western hemlock (*Tsuga heterophylla*), Engelmann spruce (*Picea engelmannii*), trembling aspen,  
301 and to a lesser western redcedar (*Thuja plicata*) and black cottonwood. In one location (Hiyu  
302 Creek), a higher than normal number of thalli grows along gravel logging roads that were  
303 formerly subject to considerable calcareous road dust. The species is known to require nutrient-  
304 rich or nutrient-enriched substrates (COSEWIC 2010).

305

### 306 **3.4 Ecological Role**

307 Crumpled tarpaper is not known to serve a critical or keystone ecological function. However, as  
308 lichens are known to be indicators of environmental change, it may be one of several lichen  
309 species that could be used to monitor environmental health.

310

### 311 **3.5 Limiting Factors**

312 **Habitat specificity:** Crumpled tarpaper distribution is limited by its specific habitat  
313 requirements (see section 3.3).

314

315 **Limited reproduction and dispersal capability:** Crumpled tarpaper is not known to produce  
316 sexual fruiting bodies (apothecia), but instead reproduces via asexual outgrowths (isidia).  
317 Although it is relatively short-lived, probably completing its life cycle within about three decades  
318 (T. Goward, pers. comm., 2013), it is thought to take approximately 10 years after establishment  
319 of the isidia for the lichen to be reproductively mature. Dispersal occurs exclusively via isidia  
320 that are presumably too large for effective wind dispersal; likely this species is transported on the  
321 feet of animals, especially birds. This limiting factor is more apparent within small populations  
322 as the frequency of individuals producing/dispersing via isidia is less.

323

## 324 4 THREATS

325 Threats are defined as the proximate activities or processes that have caused, are causing, or may  
326 cause in the future the destruction, degradation, and/or impairment of the entity being assessed  
327 (population, species, community, or ecosystem) in the area of interest (global, national, or  
328 subnational) (Salafsky *et al.* 2008). For purposes of threat assessment, only present and future  
329 threats are considered.<sup>2</sup> Threats do not include limiting factors, which are presented in section  
330 3.5.<sup>3</sup>

331  
332 For the most part, threats are related to human activities, but they can be natural. The impact of  
333 human activity may be direct (e.g., destruction of habitat) or indirect (e.g., invasive species  
334 introduction). Effects of natural phenomena (e.g., fire, hurricane, flooding) may be especially  
335 important when the species or ecosystem is concentrated in one location or has few occurrences,  
336 which may be due to human activity (Master *et al.* 2009). As such, natural phenomena are  
337 included in the definition of a threat, though should be applied cautiously. These stochastic  
338 events should only be considered a threat if a species or habitat is damaged from other threats  
339 and has lost its resilience, and is thus vulnerable to the disturbance (Salafsky *et al.* 2008) such  
340 that these types of events would have a disproportionately large effect on the  
341 population/ecosystem compared to the effect it would have had historically.  
342

### 343 4.1 Threat Assessment

344 The threat classification below is based on the IUCN-CMP (World Conservation Union–  
345 Conservation Measures Partnership) unified threats classification system and is consistent with  
346 methods used by the B.C. Conservation Data Centre and the B.C. Conservation Framework. For  
347 a detailed description of the threat classification system, see the [CMP website](#) (CMP 2010).  
348 Threats may be observed, inferred, or projected to occur in the near term. Threats are  
349 characterized here in terms of scope, severity, and timing. Threat “impact” is calculated from  
350 scope and severity. For information on how the values are assigned, see [Master \*et al.\* \(2009\)](#) and  
351 table footnotes for details. Threats for crumpled tarpaper were assessed for the entire province  
352 (Table 2).  
353

---

<sup>2</sup> Past threats may be recorded but are not used in the calculation of Threat Impact. Effects of past threats (if not continuing) are taken into consideration when determining long-term and/or short-term trend factors (Master *et al.* 2009).

<sup>3</sup> It is important to distinguish between limiting factors and threats. Limiting factors are generally not human induced and include characteristics that make the species or ecosystem less likely to respond to recovery/conservation efforts (e.g., inbreeding depression, small population size, and genetic isolation; or likelihood of regeneration or recolonization for ecosystems).

354 **Table 2.** Threat classification table for crumpled tarpaper in British Columbia.

Threat # <sup>a</sup>	Threat description	Impact <sup>b</sup>	Scope <sup>c</sup>	Severity <sup>d</sup>	Timing <sup>e</sup>	Population(s)
5	Biological resource use	Very High	Pervasive	Extreme	High	
5.3	Logging & wood harvesting	Very High	Pervasive	Extreme	High	Hiyu Creek (EO4); Robson Valley (EO5); Huble Creek (EO6); Upper Fraser Bridge (EO8)
7	Natural system modifications	Low	Small	Extreme	Moderate	
7.2	Dams & water management/use	Low	Small	Extreme	Moderate	No known populations; possible within suitable habitat within range
11	Climate change & severe weather	Unknown	Negligible	Unknown	Moderate	
11.2	Droughts	Not Calculated	Large	Unknown	Low	All

<sup>a</sup> Threat numbers are provided for Level 1 threats (i.e., whole numbers) and Level 2 threats (i.e., numbers with decimals).

<sup>b</sup> **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.

<sup>c</sup> **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%).

<sup>d</sup> **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 3-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%).

<sup>e</sup> **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.

355  
356  
357  
358  
359  
360  
361  
362  
363  
364  
365  
366  
367

## 368 4.2 Description of Threats

369 The overall province-wide Threat Impact for this species is Very High.<sup>4</sup> The greatest threat is  
370 logging and wood harvesting (Table 2). Details are discussed below under the Threat Level 1  
371 headings.

### 373 IUCN-CMP Threat 5 - Biological resource use

#### 375 5.3 Logging & wood harvesting

376 Crumpled tarpaper occurs on trees that grow in nutrient-enriched localities such as old lake  
377 bottoms and river mud. If trees growing in these habitats are harvested, there may be a loss of  
378 host trees and crumpled tarpaper populations could be eliminated. As well, forest harvesting  
379 could increase the isolation of crumpled tarpaper populations and decrease dispersal of the  
380 species through removal of host trees and subsequent diaspora reduction. Populations can also  
381 decline due to the removal of non-host trees, such as trembling aspen and black cottonwood, that  
382 support this species indirectly (i.e., by enriching the twigs and branches of host trees). As a result  
383 of logging, smaller and more scattered populations of crumpled tarpaper would likely be more  
384 vulnerable to natural stand-replacing events such as windthrow from severe storms, and disease  
385 and insect outbreaks. In addition, the microclimate required for establishment of crumpled  
386 tarpaper may be disrupted at the edge of clearcuts.

387  
388 Approximately 97% of the known individuals occur in either a timber supply area (TSA) or in a  
389 tree farm licence (TFL). As such, there is potential for the habitat of crumpled tarpaper to be  
390 greatly reduced through logging and wood harvesting activities. If, for example, the only  
391 currently known source population at Hiyu Creek (EO4) was removed through tree harvesting,  
392 the ability of crumpled tarpaper to disperse to other areas would be severely reduced. This in turn  
393 could be expected to result in a gradual decline over the next 40–50 years, potentially leading to  
394 this species' extirpation in this portion of its range, and the species would be lost (T. Goward,  
395 pers. comm., 2013).

396  
397 The Upper Adams River population (EO2) is not within a provincial park (contrary to assertions  
398 in the status report<sup>5</sup>), but rather in the Kamloops TSA. It is uncertain whether this population  
399 falls within an Old Growth Management Area (OGMA), which is afforded protection from wood  
400 harvesting through the legal provisions of the *Forest and Range Practices Act*. The population at  
401 Kenneth Creek (EO3) is protected from wood harvesting in Sugarbowl Grizzly Den Provincial  
402 Park through the legal provisions of the *Parks Act*. The population southwest of Aleza Lake  
403 (EO7) is potentially situated in the Aleza Lake Ecological Reserve. If so, then it would be

---

<sup>4</sup> The overall threat impact was calculated following Master *et al.* (2009) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate, included 1 Very High, 1 Low, and 1 Unknown (Table 2). The overall threat considers the cumulative impacts of multiple threats.

<sup>5</sup> The geospatial data for this location have been corrected in the B.C. Conservation Data Centre database.

404 protected from all extractive activities including wood harvesting through the legal provisions of  
405 the *Ecological Reserves Act*.  
406

#### 407 **IUCN-CMP Threat 7 - Natural system modification**

408

##### 409 7.2 Dams & water management

410 Due to the species preference for nutrient-rich floodplains and former lake beds, crumpled  
411 tarpaper is potentially located within BC Hydro Site C Dam Local Assessment Area (BC Hydro  
412 2013; Environment Canada 2013). Therefore, host trees could be flooded out and/or removed if  
413 the project proceeds.

414

#### 415 **IUCN-CMP Threat 11 - Climate change and severe weather**

416

##### 417 11.2 Droughts

418 Crumpled tarpaper is restricted to the wettest subzones of the Interior Cedar–Hemlock and Sub-  
419 Boreal Spruce biogeoclimatic zones, hence a considerable increase in summer drought would be  
420 required to affect it directly. The most likely threat would be indirect (e.g., through an increase in  
421 fire frequency as the region dried out). However, this is not predicted within the next 3  
422 generations so impact has not been calculated for this threat.

423

424 As crumpled tarpaper occurs in wet areas, fires do not occur frequently. If drought increased  
425 over time due to climate change, the fire frequency could also increase. Any natural fires that  
426 may occur could potentially damage host trees; however, this is unlikely to be a threat at any of  
427 the sites in the next 10 years.

428

## 429 **5 RECOVERY GOAL AND OBJECTIVES**

### 430 **5.1 Recovery (Population and Distribution) Goal**

431 The population and distribution goal is to maintain stable or increasing populations throughout  
432 its range in British Columbia.

433

### 434 **5.2 Rationale for the Recovery (Population and Distribution) Goal**

435 The overall goal is to maintain stable or increasing populations. This includes the known extant  
436 populations as well as any populations that are found in the future. It is likely that the species  
437 will always be Threatened due to its naturally rare occurrence in specialized habitats in old-  
438 growth forests on calcareous soils in humid, inland British Columbia. However, protecting  
439 known locations, as well as protecting the species more broadly at the ecosystem level (i.e.,  
440 preserving the suitable habitats that provide context and connectivity between populations),

441 could prevent this species from becoming Endangered. This approach may enable continued  
442 dispersal of isidia from the Hiyu Creek site to the other extant sites (including any new sites that  
443 may be discovered), such that the populations remain stable and/or are increasing throughout its  
444 range.  
445

### 446 **5.3 Recovery Objectives**

447 Recovery will be considered significantly advanced if the following short-term (5–10 years)  
448 objectives have been met:

- 449 1. To ensure long-term protection<sup>6</sup> for the habitat of known populations as well as any  
450 potential habitat likely to support the species.
- 451 2. To conduct targeted inventory of suitable habitat (e.g., in the wettest subzones of the  
452 Interior Cedar–Hemlock and Sub-Boreal Spruce zones).
- 453 3. To conduct research into the environmental requirements and life history of the  
454 species (in particular lifespan, nutrient regime, and microclimatic requirements) for  
455 its successful recolonization and maintenance with respect to land management  
456 activities.  
457

## 458 **6 APPROACHES TO MEET OBJECTIVES**

### 459 **6.1 Actions Already Completed or Underway**

460 The following actions have been categorized by the action groups of the B.C. Conservation  
461 Framework (B.C. Ministry of Environment 2010). Status of the action group for this species is  
462 given in parentheses.  
463

#### 464 **Compile Status Report (complete)**

- 465 • COSEWIC report completed (COSEWIC 2010). Update due 2020.

466

#### 467 **Send to COSEWIC (complete)**

- 468 • Crumpled tarpaper assessed as Threatened (COSEWIC 2010). Re-assessment due 2020.

469

#### 470 **Planning (complete)**

- 471 • B.C. Recovery Plan completed (this document, 2013).

472

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<sup>6</sup> Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, sale by willing vendors on private lands, land use designations, and protected areas.



473 **Habitat Protection and Private Land Stewardship (in progress)**

474

475 **Table 3.** Existing mechanisms that afford habitat protection for crumpled tarpaper populations.

476

Existing mechanisms that afford habitat protection	Threat <sup>a</sup> or concern addressed	Population
Provincial <i>Parks Act</i>	5.3	Sugarbowl Creek (EO1) in Grizzly Den Provincial Park
Provincial <i>Ecological Reserves Act</i>	5.3	SW of Aleza Lake (EO7), possibly in Aleza Lake Ecological Reserve
Provincial <i>Forest and Range Practices Act</i> (OGMAs)	5.3	Possibly Upper Adams River (EO2)

477 <sup>a</sup> Threat numbers according to the IUCN-CMP classification (see Table 2 for details).

478 **6.2 Recovery Planning Table**479 **Table 3.** Recovery planning table for crumpled tarpaper.

Objective	Actions to meet objectives	Threat <sup>a</sup> or concern addressed	Priority <sup>b</sup>
1	Obtain more precise location data and land tenure for each population.	5.3	Essential
	Assess impacts of threats at all sites.	5.3	Essential
	Determine appropriate measures to protect habitat using an ecosystem-level approach. When the species is recorded on Crown lands, initiate protection measures under existing legislation and government policy.	5.3	Essential
	Recommend crumpled tarpaper be listed as a Species at Risk under B.C. <i>Forest and Range Practices Act</i> .	5.3	Essential
	Develop Best Management Practices (BMPs) for the species.	5.3	Essential
	Educate landowners (use BMPs) about the importance of the species and its habitat at the ecosystem level.	5.3	Necessary
	Manage known occurrences of the species in a way that minimizes impact (BMPs and uses an ecosystem-level habitat management).	5.3	Necessary
	Monitor locations to assess the status of populations and the effects of any management activities taken to protect habitat at the ecosystem level.	5.3	Necessary
2	Determine suitable habitat localities for targeted inventory.	5.3	Necessary
	Advise appropriate landowners of the potential for the species to be present on their lands.	5.3	Necessary
3	Study the environmental requirements and life history of the species (in particular the role of nutrients, longevity, and requirements for successful recolonization) to determine the links to land management activities that will allow the maintenance and protection of the species.	Knowledge gaps	Beneficial

480 <sup>a</sup> Threat numbers according to the IUCN-CMP classification (see Table 2 for details).481 <sup>b</sup> Essential (urgent and important, needs to start immediately); Necessary (important but not urgent, action can start in 2–5 years); or Beneficial  
482 (action is beneficial and could start at any time that was feasible).

### 484 **6.3 Narrative to Support Recovery Planning Table**

485 Protecting the habitat of known locations should be approached from a larger ecosystem-level  
 486 perspective and should also protect the suitable (connective) habitat between the populations.  
 487 This approach may enable dispersal of isidia from the Hiyu Creek site, which is considered the  
 488 only source population and therefore very important to protect.  
 489

## 490 **7 INFORMATION ON HABITAT NEEDED TO MEET RECOVERY GOAL**

491 Threats to crumpled tarpaper habitat have been identified. To help meet the recovery (population  
 492 and distribution) goal for this species, it is recommended that specific habitat attributes be  
 493 described for crumpled tarpaper. In addition, it is recommended that locations of  
 494 survival/recovery habitat be geospatially modeled on the landscape to facilitate the actions for  
 495 meeting the recovery (population and distribution) goal.  
 496

### 497 **7.1 Description of Survival/Recovery Habitat**

498 A description of the habitat needs for crumpled tarpaper has been provided in section 3.3.1 based  
 499 on current knowledge of the habitat occupied by this species. Although some aspects of the  
 500 species' habitat requirements require further study, the following describes the biophysical  
 501 attributes of survival/recovery habitat based on our best available information:

- 502 • humid inland old-growth forests that are over 100 years old;
- 503 • valley-bottom forests occurring below 1000 m;
- 504 • within the wettest subzones of the Interior Cedar–Hemlock and Sub-Boreal Spruce zones
- 505 • host trees (as described above) that grow on calcium-rich or calcium-enriched soils and
- 506 are usually within the dripzones of trembling aspen or black cottonwood; and
- 507 • host tree species include subalpine fir, western hemlock, Engelmann spruce, and to a
- 508 lesser extent black cottonwood, trembling aspen, and western redcedar.
- 509

### 510 **7.2 Studies Needed to Describe Survival/Recovery Habitat**

511 It is recommended that survival/recovery habitat be geospatially described. A schedule of studies  
 512 outlining the work necessary to further describe survival/recovery habitat is provided in Table 4.  
 513

514 **Table 4.** Studies needed to describe survival/recovery habitat to meet the recovery (population and  
 515 distribution) goal for crumpled tarpaper.

Description of activity	Outcome/rationale	Timeline
Conduct surveys:		
• Map occupied (survival) habitat using established mapping techniques.	Known locations are mapped	2014–2015
• Describe and record condition of occupied (survival) habitat as well as surrounding habitat required for survival (including calcium and nutrient availability and supply).	Additional information on biophysical attributes determined	2015–2016
• Add any new habitat information derived from additional inventory for the species.	Additional information on biophysical attributes determined	2015–2016

## 516 **8 MEASURING PROGRESS**

517 The following performance indicators provide a way to define and measure progress toward  
518 achieving the recovery (population and distribution) goal and objectives over the next 5 years.  
519 Performance measures are listed below for each objective.

520

### 521 **Measurables for Objective 1:**

- 522 • Mechanisms have been initiated to protect the habitat of locations, including the suitable  
523 (connecting) habitat between locations, at a minimum of 5 populations by 2016.
- 524 • Best management practices have been developed and will be applied in 5 locations for the  
525 species within protected areas by 2015.

526

### 527 **Measurable for Objective 2:**

- 528 • An inventory program in suitable habitat within B.C. has been prioritized and will be  
529 initiated by 2015.

530

### 531 **Measurable for Objective 3:**

- 532 • Research will be initiated by 2016 to fill knowledge gaps on the environmental  
533 requirements and life history of the species (in particular the role of nutrients, longevity,  
534 and requirements) for successful recolonization.

535

## 536 **9 EFFECTS ON OTHER SPECIES**

537 This species occurs in inland old-growth forests. Negative impacts to other species are not  
538 anticipated. Actions to conserve and manage crumpled tarpaper (e.g., threat mitigation, habitat  
539 conservation, education, monitoring) will promote the conservation of other species using those  
540 habitats (e.g., cryptic paw [*Nephroma occultum*], a SARA-listed species), including at least one  
541 additional, as yet unnamed gel lichen species potentially worthy of SARA listing (T. Goward,  
542 pers. comm., 2013).

543

544

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