Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Batwing Vinyl Lichen (*Leptogium platynum*) in Canada

Batwing Vinyl Lichen

2019

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

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

Preface

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

The Minister of Environment and Climate Change is the competent minister under SARA for the Batwing Vinyl Lichen and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Province of British Columbia as per section 39(1) of SARA.

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

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

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

In the case of critical habitat identified for terrestrial species, including migratory birds, SARA requires that critical habitat identified in a federally protected area[3] be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against

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

[3] 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.

destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

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

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone, or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

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

Acknowledgments

Development of this recovery strategy was coordinated by Environment and Climate Change Canada, Canadian Wildlife Service (ECCC CWS) – Pacific Region staff: Kella Sadler, Jamie Leathem, and Matt Huntley. Stuart Crawford and Trevor Goward prepared the first draft of this recovery strategy, and Curtis Björk and Ryan Batten provided photographs of the species. Data for recent species observations (2012–2013; 2017) were provided by Andrea Schiller (Natural Resources Canada), Ryan Batten, Curtis Björk, Hans Roemer and Robin Annschild. Specimens were provided to Trevor Goward for species confirmation by David Giblin from the University of Washington herbarium and Rick Phillippe and Andrew Miller from University of Illinois herbarium. Leah Westereng, Karen Stefanyk and Brenda Costanzo (B.C. Ministry of Environment and Climate Change Strategy), Andrea Schiller and James Miskelly (Natural Resources Canada), Tracy Cornforth (Department of National Defence), and Manon Dubé, Veronique Brondex and Paul Johanson (ECCC CWS-National Capital Region) provided helpful editorial advice and comment. Danielle Yu, Meaghan Leslie-Gottschligg, and Chris Adamson (ECCC CWS-Pacific Region) provided additional assistance with mapping and figure preparation.

Executive Summary

Batwing Vinyl Lichen (*Leptogium platynum*) is classified as Endangered by the Committee on the Status of Endangered Wildlife in Canada and is listed as Endangered on Schedule 1 of the *Species At Risk Act*. In Canada, this species has been documented at 18 sites on southeastern Vancouver Island and the southern Gulf Islands. Fourteen sites are known or presumed to be extant. The total known population size is about 600 individuals.

Batwing Vinyl Lichen is a leafy lichen with a dark bluish jelly-like upper surface bearing few to many sunken, button-like fruiting bodies (apothecia) and occasional vegetative propagules (lobules). The species has very specific microhabitat requirements and grows on exposed, south-facing rocky outcrops not subject to prolonged snow cover. It also requires periodic water seepage, either supplied by small rills in the cliff face or by the slow release of water by surrounding mosses. It does not grow on acidic rocks or in nitrogen enriched environments. It occurs at low elevation (below 400 m) in the Coastal Douglas-fir and neighbouring Coastal Western Hemlock Biogeoclimatic Zones.

The Canadian populations are at the northern edge of the species' range which makes them particularly vulnerable to climatic perturbation. Because of this, the most significant threat to the Batwing Vinyl Lichen in Canada appears to be climate change although other lesser threats can be identified. Five populations may be threatened by residential development, wood harvesting, or agricultural development. Two populations might be directly impacted by visitor traffic in Regional Parks. Feasibility of recovery is unknown at this time due to the complexity of mitigating climate change effects on this species.

Three historical populations of Batwing Vinyl Lichen are thought to be extirpated. One of these was probably extirpated by nitrogen enrichment from nearby intensive livestock production. The cause of the extirpation of the other two populations is unknown, and may be a result of climate change or natural fluctuation in the populations.

The population and distribution objective for the Batwing Vinyl Lichen is to maintain the distribution, and to maintain or (where appropriate) increase the abundance of all extant populations of this species in Canada, including any populations which may be identified or re-established in the future. Broad strategies to address threats to the survival and recovery of the Batwing Vinyl Lichen are presented below. Critical habitat is identified for 13 of the 14 known extant populations. A schedule of studies is included to identify critical habitat for the other known extant population.

One or more action plans for the Batwing Vinyl Lichen will be posted on the Species at Risk Public Registry by 2024.

Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Batwing Vinyl Lichen. In keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible. This recovery strategy addresses the unknowns surrounding the feasibility of recovery.

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

   Yes. There are 14 known extant populations, all of which contain thalli[4] that are capable of reproduction.

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

   Yes. There is sufficient suitable habitat to support the existing populations in Canada, and there appears to be additional suitable habitat that has not been colonized by this species.

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

   Unknown. Human activities causing direct damage to the species and its habitat can be avoided or mitigated using identified recovery techniques. However, climate change is a primary threat to this species. The specific impacts of climate change on this species are not known, and it is unknown whether these impacts can be avoided or mitigated.

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

   Unknown. Recovery techniques such as public communication and promotion of stewardship and restoration can help avoid or mitigate human activities causing direct damage to the species and its habitat. However, climate change is a primary threat to this species. It is unknown whether recovery techniques can be developed to mitigate impacts of climate change within a reasonable timeframe.

[4] Thalli (or thallus, singular) are the main bodies of lichen.

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1. COSEWIC* Species Assessment Information

Date of Assessment: May 2011

Common Name (population): Batwing Vinyl Lichen

Scientific Name: *Leptogium platynum*

COSEWIC Status: Endangered

Reason for Designation: This leafy lichen occurs in western North America reaching the northern limit of its range in coastal southwestern British Columbia where it commonly occurs at three, possibly four, locations on Vancouver Island.[5] The lichen grows on calcium/magnesium-rich rock outcrops and more than 80% of individuals occur at one location. It has been extirpated from three other locations. This lichen is vulnerable to stochastic events, competition from mosses and liverworts, pollution from industrial/agricultural activities, and increasingly frequent summer drought resulting from climate change.

Canadian Occurrence: British Columbia

COSEWIC Status History: Designated Endangered in May 2011

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

2. Species Status Information

Legal Designation: listed as Endangered on Schedule 1 of the *Species at Risk Act* (2017).

Table 1. Conservation status ranks for Batwing Vinyl Lichen (NatureServe 2018; B.C. Conservation Framework 2018; B.C. Conservation Data Centre 2018).

Global (G) Rank[a]	National (N) Rank[a]	Sub-national (S) Rank[a]	COSEWIC Status	B.C. Conservation Framework
G3G4 (2013)	Canada: N1N2 (2017) United States: N3N4	British Columbia: S3S4 (2018) Oregon: S2	Endangered (2011)	Priority 1 (highest) for Goal 3[b]

B.C. = British Columbia; COSEWIC = Committee on the Status of Endangered Wildilfe in Canada
[a]Rank 1– critically imperiled; 2– imperiled; 3- vulnerable to extirpation or extinction; 4- apparently secure.
[b] Goal 3 = Maintain the diversity of native species and ecosystems

[5] NOTE: Since the publication of the COSEWIC Species Assessment (COSEWIC 2011), an additional eleven populations of Batwing Vinyl Lichen have been recorded.

Within Canada, Batwing Vinyl Lichen is found exclusively in coastal British Columbia (B.C.), where it is at the northern edge of its range. Using the alpha-hull technique recommended by Master et al. (2012) for determining the range extent of a species, it is estimated that approximately 1% of the range of Batwing Vinyl Lichen is within Canada. The majority of this species' range is within Oregon and California, with a few scattered occurrences in Washington, New Mexico, and Mexico.

3. Species Information

3.1 Species Description

Batwing Vinyl Lichen is a loosely attached foliose 'jellyskin' lichen about 4–5 (up to 7) cm across (Figure 1). The lobes are 4–6 mm wide, rounded to rather elongate, usually down-turned at the extreme tips. The upper surface is bluish grey or sometimes brown, shiny, hairless, finely wrinkled when dry, and bears few to many small lobules (small lobes that can break off and form new individuals) that are also down-turned at the tips. The upper surface also bears few to many, partly sunken, button-like apothecia (fruiting bodies) 0.2–0.5 mm across. The internal portions of the thallus, or main body of the lichen, are dark, rather translucent and rubbery when moist. The lower surface is paler than the upper surface and is either hairless or bears scattered tufts of white hairs.

Figure 1. Batwing Vinyl Lichen showing apothecia and lobules. Photo by Ryan Batten.

Illustrations of this lichen can be found in Goward et al. (1994: p. 66) and Brodo et al. (2001: p. 408). A more detailed description of the species can be found in the latter reference, as well as Sierk (1964) and COSEWIC (2011).

Like all 'jellyskin' lichens, Batwing Vinyl Lichen is a cyanolichen which means it has cyanobacteria instead of green algae as a symbiont.[6] It is easily differentiated from other gel lichens by its combined leafy habit, sharply wrinkled lobes, numerous

[6] In simple terms, lichens are the result of a symbiotic relationship between a fungal partner (mycobiont) and a photosynthesizing algal or bacterial partner (photobiont). Either may be referred to generically as a "symbiont."

partly-immersed button-like apothecia, and, especially, its production of small lobules with down-turned tips. In Canada, Batwing Vinyl Lichen is restricted to rocks in coastal areas which differentiates it from the similar-looking Peacock Vinyl Lichen (*Leptogium polycarpum*; only on trees in Canada) and California Vinyl Lichen (*L. californicum*; only in inland areas in Canada).

3.2 Species Population and Distribution

Batwing Vinyl Lichen is considered endemic to western North America (COSEWIC 2011) where it ranges from southern coastal B.C. south through coastal Washington and Oregon to southern California, as well as east and southeast to New Mexico (Sierk 1964), and the Chihuahua region of Mexico (Jørgensen and Nash 2004). The global distribution of all known records of Batwing Vinyl Lichen are shown in Figure 2. These include historical records that have not been revisited for over 25 years (some for well over a century), and several populations that are thought to be extirpated. Of the 51 recorded populations of Batwing Vinyl Lichen documented globally to date, 18 occur in Canada (Figure 3; Table 2), notwithstanding that Canada accounts for about 1% of its range. This may reflect a more sustained search effort in Canada.

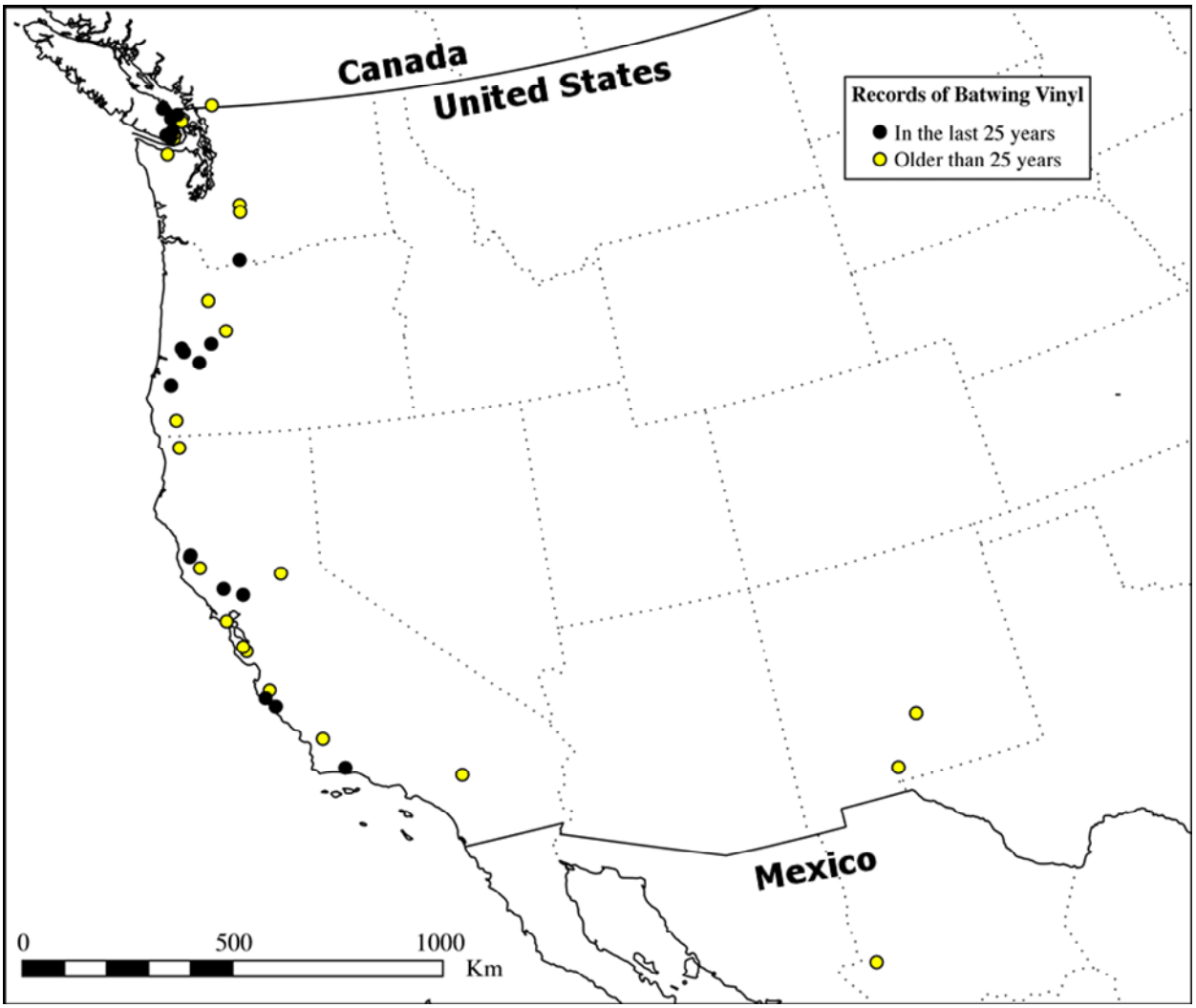

Figure 2. Global distribution of all known records of Batwing Vinyl Lichen.

Batwing Vinyl Lichen has been found in Canada at 18 locations, representing 18 populations[7], one of which has two subpopulations (Figure 3;Table 2). Eleven of these populations are documented here for the first time (Batten and Björk pers. obs. 2012-2013; Natural Resources Canada 2014; Björk pers. obs. 2017), two were first documented in the Batwing Vinyl Lichen COSEWIC Assessment and Status Report (2011), and the remaining five records are historical and date from 1968–1975. Four of the five historical population locations were revisited in 2009, one was found to still support a population of Batwing Vinyl Lichen. Although the number of known extant populations has increased since the 2011 COSEWIC report, the known range extent in Canada has not been extended.

[7] "Populations" are characterized as being separated by >1 km, and "sub-populations" represent records of individuals, or patches of individuals, that are within 1 km of each other unless otherwise noted.

Currently this species is known in Canada exclusively from coastal B.C., where it is apparently further restricted to southeast Vancouver Island and the southern Gulf Islands, south of approximately 49°N (Figure 3).

There are 14 confirmed extant populations of Batwing Vinyl Lichen: thirteen populations are in the Capital Regional District, including three on Saltspring Island and one on Galiano Island, as well as one population (consisting of 2 subpopulations) in the Woodley Range in the Cowichan Valley Regional District (Table 2).

Nine of the fourteen known extant populations, representing about 80% of known Canadian individuals, are located in the Moist Maritime subzone of the Coastal Douglas-fir (CDF) Biogeoclimatic Zone (Meidinger and Pojar 1991). Here climatic conditions may be characterized as mediterranean with warm, dry summers and mild, wet winters. Effectively this subzone represents a northern outlier of the Mediterranean-type climate more characteristic of coastal Oregon and California (Noble 1982). This subzone occupies a very small area, roughly about 0.3% of the B.C. land base. Within this range, Batwing Vinyl Lichen appears to be restricted to open, mostly south-facing, base-enriched outcrops subject to periodic seepage.

Three extant populations of Batwing Vinyl Lichen lie just within the Coastal Western Hemlock (CWH) Biogeoclimatic Zone (Meidinger and Pojar 1991) in the Sooke region of Vancouver Island, and one population in the Langford area occupies the transition between the CWH Zone with the CDF Zone. One historical record from Sumas Mountain in the lower Fraser Valley, which probably has been extirpated, also occurs in the Coastal Western Hemlock Zone.

There is inadequate data to determine trends among the extant Canadian populations of Batwing Vinyl Lichen. Of the four historical populations on southeast Vancouver Island and the Gulf Islands, only one of these could be relocated. Even so, it is unknown whether this points to overall population decline or simply reflects naturally occurring fluctuation within the population. It is likely that Batwing Vinyl Lichen is part of a cyclic succession of co-occurring species, discussed below in Section 3.3, and may cycle through periods of presence/absence in a given location.

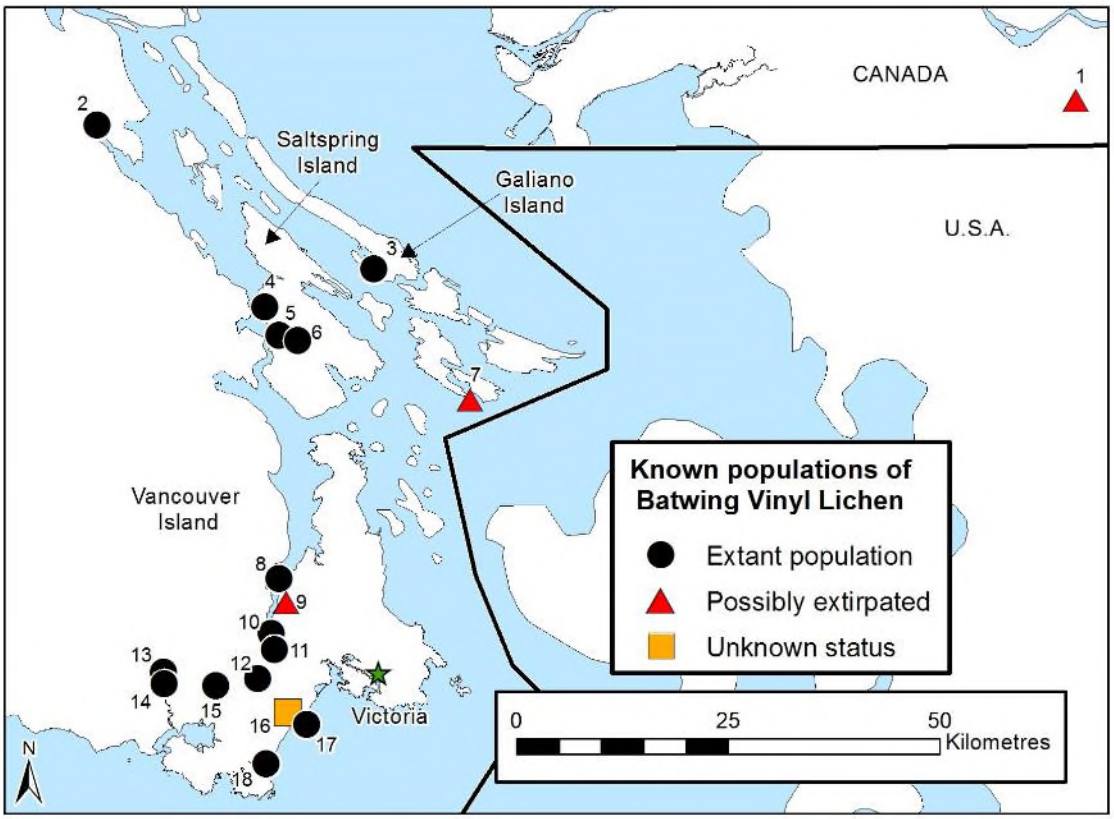

Figure 3. Location of Batwing Vinyl Lichen populations in Canada.

Table 2. Known Batwing Vinyl Lichen populations in Canada.

Population # [a]	Location Name (General Area)	Land tenure	Year first observed	Last population count; # thalli (year)	Population status[b]
1	Sumas Mountain (lower Fraser Valley)	Non-federal land	1968	0 (2009)	Extirpated
2	Woodley Range (Cowichan Valley)	Non-federal land	1975	35 (2009)	Extant
3	Sutil Mountain (Galiano Island)	Non-federal land	2013	11–25 (2013)	Extant
4	Mt. Erskine (Saltspring Island)	Non-federal land	2012	11–25 (2012)	Extant
5	Mt. Maxwell West (Saltspring Island)	Non-federal land	2012	1–10 (2012)	Extant
6	Mt. Maxwell East (Saltspring Island)	Non-federal land	2013	20–30 (2013)	Extant
7	Bedwell Harbour (North Pender Island)	Non-federal land	1974	0 (2009)	Extirpated
8	Jocelyn Hill (Capital Regional District Highlands)	Non-federal land	2013	51–100 (2013)	Extant
9	Lone Tree Hill (Capital Regional District Highlands)	Non-federal land	1975	0 (2009)	Extirpated
10	Mt. Finlayson (Langford)	Federal land, Non-federal land	2009	300 (2009)	Extant
11	Skirt Mountain (Langford)	Non-federal land	2012	11–25 (2012)	Extant
12	Mt. McDonald (Langford)	Non-federal land	2012	51–100 (2012)	Extant
13	Upper Sooke Potholes (Sooke)	Non-federal land	2012	1–10 (2012)	Extant
14	Lower Sooke Potholes (Sooke)	Non-federal land	2009	35 (2009)	Extant
15	Camp Thunderbird (Sooke)	Non-federal land	2012	1–10 (2012)	Extant
16	Metchosin Mountain (Metchosin)	Non-federal land	1975	Unknown	Unknown[c]
17	Albert Head (Metchosin)	Federal land	2013	50 (2013)	Extant
18	Mary Hill (Metchosin)	Federal land	2017	3 (2017)	Extant

[a] Population numbers as per Table 2, Figure 3 and referenced elsewhere in the text.
[b] The status of Batwing Vinyl Lichen population/subpopulations is as follows: Extant – Population has been recently verified (<25 years); Historical – Recent information verifying the continued existence of the population is lacking (i.e. records are >25 years
[c] Not revisited, unable to access

3.3 Needs of the Batwing Vinyl Lichen

Habitat requirements

In southern Canada, Batwing Vinyl Lichen is at the northern limit of its global range, and is restricted to the Coastal Douglas-fir (CDF mm) and nearby Coastal Western Hemlock (CWH xm1, CWH xm2, and CWH mm) Biogeoclimatic Subzones on southeastern Vancouver Island and the southern Gulf Islands. Within this area, it is only found below 400 m in elevation in microhabitats with very specific biophysical attributes.

This species occurs exclusively on sloping rocky outcrops subject to some degree of periodic seepage. It seems to be absent from habitats exposed to frequent drying. In some cases it inhabits small runnels on cliff faces, while in others it appears to benefit from the prolonged, slow release of water by mosses after rain. The habitat must have topography (microcatchment) that directs rain water towards the occurrence.

In common with other “jellyskin” lichen having *Nostoc* spp. as photobiont (its symbiotic, photosynthesizing cyanobacterial partner), Batwing Vinyl Lichen is restricted to substrates with a pH higher than around 5.0 (Gauslaa 1985, 1995; COSEWIC 2011). Its most frequent habitat in Canada is base-rich (or base-enriched) sandstones or conglomerate; acidic bedrock appears not to support this species. It is often found on calcium/magnesium-rich rock.

All known populations of Batwing Vinyl Lichen in Canada are found on exposed, south-facing slopes (southwest to southeast) that are well-lit and generally have sparse canopy cover. It is often associated with bryophytes (mosses and liverworts). This species does not appear to tolerate deep shade, but the requirement for periodic seepage appears to be integral to its distributional ecology in Canada. It appears to be intolerant of prolonged snow cover.

Limiting factors

One limitation of Batwing Vinyl Lichen is its dispersal abilities. Although it is well-adapted for dispersal over distances of a few meters, it is probably poor at long-distance dispersal because of its relatively large spore size and ground-dwelling habit (Tibell 1994). It is probable that the species persists at a given location through vegetative reproduction and infrequently reproduces sexually via long-distance spore dispersal to new locations.

No data are available on generation time but research on other cyanolichens suggests it may be in the range of 10–20 years (Larsson and Gauslaa 2011). Populations tend to be highly vulnerable because of their small size and area of occupancy (usually less than 100 individuals over less than a few square metres), and, due to the species’ limited dispersal ability they are unlikely to be rescued by recruits from other populations. The main populations of Batwing Vinyl Lichen outside of southeast Vancouver Island and the Gulf Islands are in coastal Oregon and California. If the majority of the populations in B.C. are extirpated, rescue from an outside population will

be unlikely. In contrast to vascular plants, lichens appear not to have a seed bank from which they can reestablish.

Another limitation of the species stems from its frequent association with mat-forming bryophytes in seepage areas (such as genera which include *Scleropodium*, *Porella*, *Anacolia,* and *Plagiomnium*). While this association likely buffers the lichen against rapid and prolonged drying, the bryophytes have a competitive advantage and can eventually overgrow the lichen and exclude it from a particular habitat. Then, over time, the mosses may eventually slough off the rock surface and expose new habitat for Batwing Vinyl Lichen. This pattern of cyclic succession may determine the presence or absence of this lichen at a particular location at a given time, and suggests a strong dependency on metapopulation dynamics for long-term persistence.

4. Threats

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (Salafsky et al. 2008). For purposes of threat assessment, only present and future threats are considered.[8]

For the most part, threats are related to human activities, but they can also be natural. The impact of human activity may be direct (e.g., destruction of habitat) or indirect (e.g., introduction of invasive species). Effects of natural phenomena (e.g., fire, flooding) may be especially important when the species is concentrated in one location or has few occurrences, which may be a result of human activity (Master et al. 2012). As such, natural phenomena are included in the definition of a threat, though they should be considered cautiously. These stochastic events should only be considered a threat if a species or habitat is damaged from other threats and has lost its ability to recover. In such cases, the effect on the population would be disproportionately large compared to the effect experienced historically (Salafsky et al. 2008).

Threats presented in Table 3 and Section 4.2 do not include biological features of the species or population which are considered limiting factors (e.g., inbreeding depression, small population size, genetic isolation, and/or likelihood of regeneration or recolonization).[9]

[8] 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. 2012).

[9] 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.

4.1 Threat Assessment

The threat assessment below is based on the International Union for Conservation of Nature–Conservation Measures Partnership (IUCN-CMP) unified threats classification system and is consistent with the methods used by the B.C. Conservation Data Centre and the B.C. Conservation Framework. For a detailed description of the threat classification system, see the Open Standards website (Open Standards 2014). Threats may be observed, inferred, or projected to occur in the near term. Threats are characterized in terms of scope, severity, and timing. Threat "impact" is calculated from scope and severity. For information on how the values are assigned, see Master et al. (2012) and table footnotes for details. Threats for the Batwing Vinyl Lichen were assessed for the entire Canadian population (Table 3).

Limiting factors are not considered during this assessment process. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in Section 4.2 (Description of Threats).

Table 3. Threat Assessment Table for the Batwing Vinyl Lichen in Canada

Threat #[a]	Threat Description	Impact[b]	Scope[c]	Severity[d]	Timing[e]	Causal Certainty[f]	Population(s)[g]
1	Residential & commercial development	Medium	Restricted	Serious	Moderate to Low	Low	
1.1	Housing & urban areas	Medium	Restricted	Serious	Moderate to Low	Low	2, 4, 5, 15, 16
2	Agriculture & aquaculture	Medium	Restricted	Serious	Moderate to Low	Low	
2.3	Livestock farming & ranching	Medium	Restricted	Serious	Moderate to Low	Low	2, 4, 5, 15, 16
5	Biological resource use	Medium	Restricted	Serious	Moderate to Low	Low	
5.3	Logging & wood harvesting	Medium	Restricted	Serious	Moderate to Low	Low	2, 4, 5, 15, 16
6	Human intrusions & disturbance	Low	Small	Moderate	Moderate	Medium	
6.1	Recreational activities	Low	Small	Moderate	Moderate	Medium	14 and potentially 12
9	Pollution	Not calculated	Restricted	Extreme	Insignificant /Negligible	Medium	
9.5	Air-borne pollutants	Not calculated	Restricted	Extreme	Insignificant /Negligible	Medium	1 (extirpated)
11	Climate change & severe weather	Very high	Pervasive	Extreme	High to Moderate	Medium	
11.2	Droughts	Very high	Pervasive	Extreme	High to Moderate	Medium	All
11.4	Storms & flooding	Very high	Pervasive	Extreme	High to Moderate	Medium	All

[a] Threat numbers are provided for Level 1 threats (whole numbers) and Level 2 threats (numbers with decimals).

[b] ***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.*

[c] ***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%).*

[d] ***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%).*

[e] ***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.*

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

[g] *Population numbers correspond with those provided in Table 2.*

4.2 Description of Threats

The overall Threat Impact[10] for the Batwing Vinyl Lichen is Very High, meaning the species is currently facing, or is expected to face, in the medium-term, a median rate of population decline of 75%. The generation time of this lichen is about 10–20 years, hence the medium term (defined as three generations for purposes of an IUCN threat assessment) is 30–60 years.

Known threats to the Batwing Vinyl Lichen are described below, with the most significant threat identified as climate change and associated severe weather (Threat 11; Table 3).

Threat 11. Climate change and severe weather (Very High impact)

The most significant threat to all populations of Batwing Vinyl Lichen in Canada over the medium to long term is climate change, including associated severe weather such as drought, storms, and flooding.

There is inadequate data to determine whether the extant Canadian populations of Batwing Vinyl Lichen are currently in decline and, if so, whether this decline has been caused by climate change. The environmental specificity of Batwing Vinyl Lichen is very narrow in Canada, where it is at the extreme northern edge of its range. Both factors increase its intrinsic vulnerability to climate change. The relatively warm, summer-dry climate of southeast Vancouver Island and the Gulf Islands has favoured its establishment well north of its main range in coastal Oregon and California. Though the precise physiological requirements of Batwing Vinyl Lichen are largely unknown, it seems clear that climate change could render existing locations unable to support the species in Canada.

Threat 11.2. Droughts (Very High impact)

Increases in summer drought frequency and severity predicted with climate change (Rodenhuis et al. 2009; Mote and Salathe Jr. 2010) will likely have a negative impact on Batwing Vinyl Lichen, as the species appears intolerant to habitats exposed to frequent drying. Drought could increase drying events in currently occupied habitat by reducing or eliminating necessary seepage.

Threat 11.4. Storms and flooding (Very High impact)

Batwing Vinyl Lichen also is threatened by the increased magnitude of storms and flooding associated with climate change (Walker and Sydneysmith 2008). Physical

[10] The overall threat impact was calculated following Master et al. (2012) using the number of Level 1 Threats assigned to this species where timing = High or Moderate. It included 1 Very High, 0 High, 3 Medium, and 1 Low Threats (The overall threat impact considers the cumulative impacts of multiple threats).

damage to individuals can be caused by excessive runoff, and flood-caused erosion or reduction in rock stability can lead to direct loss of growing substrate. Storm- and flood-caused alteration in hydrologic regimes can change water seepage patterns and cause population decline due to unsuitable water supply (too much or too little). Excessive water may allow associated mosses and liverworts to overgrow Batwing Vinyl Lichen.

Threat 1.1. Housing and urban areas (Medium impact)

Residential development can impact the Batwing Vinyl Lichen through physical removal or alteration of the lichen's growing substrate, tree and/or vegetation removal, changes in hydrologic regimes that in turn change seepage patterns, and changes in light availability, humidity and mean or maximum temperature. Four known extant populations of Batwing Vinyl Lichen, which include Woodley Range in the Cowichan Valley, Mt. Erskine and Mt. Maxwell West on Saltspring Island, and Camp Thunderbird in Sooke (populations 2, 4, 5, and 15, respectively), and one population (16) of unknown status are on private lands with rural land use designations. This zoning currently prohibits extensive residential development, but some residential development is possible.

Threat 2.3. Livestock farming and ranching (Medium impact)

Livestock farming threatens the species by potentially changing humidity, temperatures, light availability, and hydrologic regimes through the large-scale landscape change and vegetation removal associated with grazing and ranching. Extant populations at Woodley Range in the Cowichan Valley, Mt. Erskine and Mt. Maxwell West on Saltspring Island, Camp Thunderbird in Sooke, and Metchosin Mountain (populations 2, 4, 5, 15, and 16, respectively) have rural land use designations that permit some agricultural development and, as such, could face threats from farming and ranching.

Threat 5.3. Logging and wood harvesting (Medium impact)

Timber removal threatens the Batwing Vinyl Lichen through possible changes in humidity, temperature, light availability, and hydrologic regimes it may cause. Extant populations 2, 4, 5, and 15, and population 16 (unknown status) have rural land use designations that permit some wood harvesting and, as such, could face threats from this activity.

Threat 6.1. Recreational activities (Low impact)

The thalli (main bodies) of Batwing Vinyl Lichen are relatively delicate and susceptible to trampling. The population at the Sooke Potholes Regional Park (population 14, and possibly 13) is in an area that receives a large number of visitors each year. Although this population is not directly on a pathway, it is common for visitors at this park to go scrambling on the rocks. Given the small areal extent of this population, a single trampling event could have a significant impact. Erosion due to trail construction or rock scrambling may lead to direct loss of growing substrate. Mt. McDonald (population 12)

is in a regional park reserve and also could be at risk from disturbance due to recreational activities such as hiking.

Threat 9.5. Airborne pollutants (Impact not calculated)

Nitrogen enrichment has been shown to significantly alter lichen communities (van Herk 1999; Fenn et al. 2003), and, in particular, has a strong negative effect on cyanolichens (Nohrstedt et al. 1988, cited in WHO 2000). The only known population of Batwing Vinyl Lichen from the lower Fraser Valley (population 1) has been extirpated. This most likely was caused by nitrogen enrichment from agricultural activities in the area. High concentrations of nitrogenous aerosols (e.g., from poultry and pig farms) are detrimental to all but a small number of nitrophilous lichens (van Herk 1999). Several of these nitrophilous lichens appeared to have replaced Batwing Vinyl Lichen at the Fraser Valley location in 2009 (COSEWIC 2011). Should a new population of Batwing Vinyl Lichen be discovered in the lower Fraser Valley, nitrogen enrichment would certainly constitute a significant threat. However, the likelihood that this species still occurs in this extreme portion of its range is considered extremely low.

There is no large-scale agriculture adjacent to the known extant populations of Batwing Vinyl Lichen on Vancouver Island and the Southern Gulf Islands. Therefore, the remaining extant populations of this lichen are unlikely to be impacted by nitrogen enrichment.

5. Population and Distribution Objectives

The population and distribution objective for this species is:

To maintain the distribution, and to maintain or (where appropriate) increase the abundance of all extant populations of this species in Canada, including any populations which may be identified or re-established in the future.

Rationale:

There are currently fourteen known extant populations of Batwing Vinyl Lichen in Canada, all of which are located on southeast Vancouver Island and the Southern Gulf Islands. Approximately 600 individuals are known, about half of which are at Mt. Finlayson in the Langford area (population 10). Additional populations are likely to exist within the known range of this lichen, and may be discovered with a continued survey effort. Such populations may be essential for the persistence of the species at its known locations in Canada, and a reasonable effort should be made to find them.

Batwing Vinyl Lichen is naturally rare within Canada, and the downlisting of this species is unlikely. In order for this species to remain viable within Canada, it is important to maintain the fourteen known extant populations, as well as any additional populations that may be discovered. Although one population at Metchosin Mountain (population 16)

has not been visited since 1975, there has not been any significant development in that area, and it still may be extant.

This species was previously more widespread in Canada. There was one known population in the lower Fraser Valley (population 1) that has been extirpated. Nitrogen pollution from agricultural development has rendered the area unsuitable for this species. Restoration of this portion of Batwing Vinyl Lichen's historical range is impractical; therefore, the focus of the recovery strategy is to maintain extant populations on southeast Vancouver Island and the Gulf Islands. Where, through long-term monitoring, populations are shown to be in decline, the objective to deliberately increase the number of individuals through augmentation and/or restoration is considered appropriate.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

Research and inventory

A survey of Batwing Vinyl Lichen populations in B.C. was conducted in 2009 as part of the compilation of the COSEWIC (2011) Assessment and Status Report on this species; three populations known from 1968 and 1975 were searched for, but not found, and are considered to be extirpated. A fourth historical population was found to still exist.
Two additional populations were discovered in 2009, ten new populations in 2012/2013 (Batten and Björk pers. obs. 2012-2013; Natural Resources Canada 2014) and one new population in 2017 (Björk pers. obs. 2017). There are likely more populations and more surveys are needed to locate them.

Stewardship and conservation

Six populations of Batwing Vinyl Lichen are located in Regional Parks (population 14), Regional Park Reserves (populations 12 and 13) or Provincial Parks (populations 6, 8 and 11) (Table 2). Management Plans are in place for these areas, and, although not species-specific to the Batwing Vinyl Lichen, these plans address the conservation of natural habitats. Sutil Mountain on Galiano Island (population 3) is on Nature Conservancy of Canada-owned land with a designation of “Nature Protection”.
Four known extant populations located at Woodley Range (Cowichan), Mt. Erskine and Mt. Maxwell West on Saltspring Island, and Camp Thunderbird in Sooke (populations 2, 4, 5, and 15, respectively), and one of unknown status at Metchosin Mountain (population 16) are on private land, but, because they are in rural land use zones, they are excluded from extensive residential development.

6.2 Strategic Direction for Recovery

Table 4. Recovery planning table for the Batwing Vinyl Lichen in Canada

Threat # or Limitation	Priority[a]	Broad Strategy to Recovery	General Description of Research and Management Approaches
1.1 Housing and urban areas 2.3 Livestock farming and ranching 5.3 Logging and wood harvesting	High	Stewardship and conservation	Communicate with First Nations and private landowners to promote stewardship and conservation of populations on private land. Work with the Provincial Government to place land designations on Crown Land that will prevent development that would impact this lichen.
6.1 Recreational activities	Medium	Public outreach and education	Develop and implement signage program to raise public awareness and encourage caution when climbing on rocks in sites with Batwing Vinyl Lichen populations.
Knowledge Gap - Population size and distribution	High	Research and inventory	Survey for additional populations to determine the extent of Batwing Vinyl Lichen populations within its range in B.C.
Knowledge Gap - Population ecology	Medium	Research and inventory	Re-survey extant and historical populations to determine trends and investigate natural population fluctuations and ecological succession in occupied habitats.
Knowledge Gap - Response to environmental change and habitat disturbance	High	Research and inventory	Conduct research to investigate physiological requirements of the species.

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

6.3 Narrative to Support the Recovery Planning Table

Climate change is the most significant threat identified for Batwing Vinyl Lichen in Canada. However, it is not yet possible to predict how climate change will impact this species because of the lack of knowledge about its physiological requirements. A better understanding of the impacts of climate change as a threat is essential.

It is likely that many Batwing Vinyl Lichen populations undergo a pattern of cyclic succession where they are periodically excluded from an area by mosses and become re-established after those mosses slough off the rock face. As this species is probably relatively poor at long-distance dispersal, a population of Batwing Vinyl Lichen may require nearby populations in order to persist over time. This could be an important limiting factor for the species, and a better understanding of its population ecology is required.

It is highly probable that there are additional populations of Batwing Vinyl Lichen within the known range extent of this species in Canada. These undiscovered populations may be essential for the persistence of the known populations (e.g., by providing vegetative propagules for recolonization during the pattern of cyclic succession).

7. Critical Habitat

7.1 Identification of the Species' Critical Habitat

Section 41(1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. This recovery strategy identifies critical habitat to the extent possible, based on the best available information for the Batwing Vinyl Lichen. More precise boundaries may be mapped, and additional critical habitat may be added in the future if additional research supports the inclusion of areas beyond those currently identified. Considerations in the identification of critical habitat are the amount, quality, and locations of habitat required to achieve the population and distribution objective.

Critical habitat can be identified only partially at this time. Critical habitat cannot be identified for Jocelyn Hill population (population 8; Table 2) because the precise locations of several subpopulations are not available. The population on Metchosin Mountain (population 16; Table 2) is of unknown status, and must be re-visited to confirm it is still extant before critical habitat can be identified. The critical habitat identified here is necessary, but not sufficient to achieve the Population and Distribution objectives for the Batwing Vinyl Lichen in Canada. A schedule of studies (Section 7.2) has been developed to provide the information necessary to complete the identification of critical habitat.

Geospatial location of areas containing critical habitat

Critical habitat for the Batwing Vinyl Lichen is identified for 13 of the 14 extant populations: at nine sites on south Vancouver Island, and at four sites on the southern Gulf Islands, B.C. (Figures 4-13):

- Woodley Range (population 2; Figure 4)
- Sutil Mountain (population 3; Figure 5)
- Mt. Erskine (population 4; Figure 6)
- Mt. Maxwell West (population 5; Figure 7)
- Mt. Maxwell East (population 6; Figure 7)
- Mt. Finlayson (population 10; Figure 8)
- Skirt Mountain (population 11; Figure 8)
- Mt. McDonald (population 12; Figure 9)
- Upper Sooke Potholes (population 13; Figure 10)
- Lower Sooke Potholes (population 14; Figure 10)
- Camp Thunderbird (population 15; Figure 11)
- Albert Head (population 17; Figure 12)
- Mary Hill (population 18; Figure 13)

The geospatial area containing critical habitat for the Batwing Vinyl Lichen is based on the following additive components:

1. The area occupied by individual thalli or patches of thalli, including the associated potential location error from Global Positioning System (GPS) units (up to 100 m uncertainty distance);
2. An additional 50 m distance (i.e., critical function zone[11]) to encompass immediately adjacent areas;
3. The entire portion of distinct ecological features[12] which are associated with, and are integral to, maintaining the periodic water seepage required by the Batwing Vinyl Lichen. Distinct ecological features for the Batwing Vinyl Lichen are the "microcatchment" habitat[13] comprised by local seepage slopes

[11] Critical function zone distance has been defined as the minimum threshold habitat fragment size required for maintaining constituent microhabitat properties for a species (e.g., critical light, moisture, and humidity levels necessary for survival). Existing research provides a logical basis for including a minimum critical function zone distance of 50 m as part of critical habitat for rare plant and lichen species occurrences (see: http://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=6A845288-1#_Toc285808423).

[12] "Distinct" ecological features are here referred to as those features that are distinguishable at a scale relevant to the critical habitat identification (through use of detailed ecosystem mapping or aerial photos), which, at that scale, appear as ecologically contiguous features that comprise the context for a species' occurrence. Batwing Vinyl Lichen has been identified at a "site" level scale (1:15,000 scale of reference).

[13] The microcatchment area surrounding the microhabitats may be large and complex and composed of numerous features that could influence water flow, some of which may be underground. The above-ground delineation of microcatchment area component of critical habitat is identified to the extent possible and based on the best available information.

and drainage pathways that influence the hydrological processes in the occupied and critical function zone areas;

4. Connective critical habitat is maintained between subpopulations where they are in close proximity (less than 50 m apart) and there is consistent intermediate habitat.

Additional habitat is required for the species to persist at the site-level (i.e., between and among patches of critical habitat as identified above). Over time, mosses may eventually slough off the rock surface and expose new habitat for the Batwing Vinyl Lichen. This pattern of cyclic succession may determine the presence or absence of this lichen at a particular location at any one time, and suggests a strong dependency on metapopulation dynamics for long-term persistence. Although the exact amount and configuration of habitat needed for this purpose is unknown, this habitat will be adjacent to, or between, patches of critical habitat identified, and will possess habitat requirements described in the species' needs Section 3.3. This knowledge gap is to be addressed in the schedule of studies (Section 7.2; Table 5), and is not incorporated into the identification of areas containing critical habitat at this time.

Biophysical Attributes of Critical Habitat

Within the geospatial areas identified as containing critical habitat, critical habitat is identified wherever the following biophysical attributes occur:

- rocky outcrops or cliffs on south-facing slopes (southwest to southeast) subject to some degree of periodic seepage
- forest openings with short or sparse vegetation composed of mosses and liverworts
- base-rich substrates of pH >5 generally composed of sandstone or conglomerate

The areas containing critical habitat for the Batwing Vinyl Lichen (totalling 28.6 ha) are presented in Figures 4-13. Critical habitat for the Batwing Vinyl Lichen in Canada occurs within the shaded yellow polygon(s) (unit(s)) shown on each map, where the biophysical attributes described in the above section are present. Within these polygons, features and structures that do not contain the biophysical attributes described above (e.g., roads, buildings, rivers and ocean), are not identified as critical habitat. The 1 km × 1 km UTM grid overlay shown on these figures is a standardized national grid system that highlights the general geographic area containing critical habitat for land use planning and/or environmental assessment purposes.

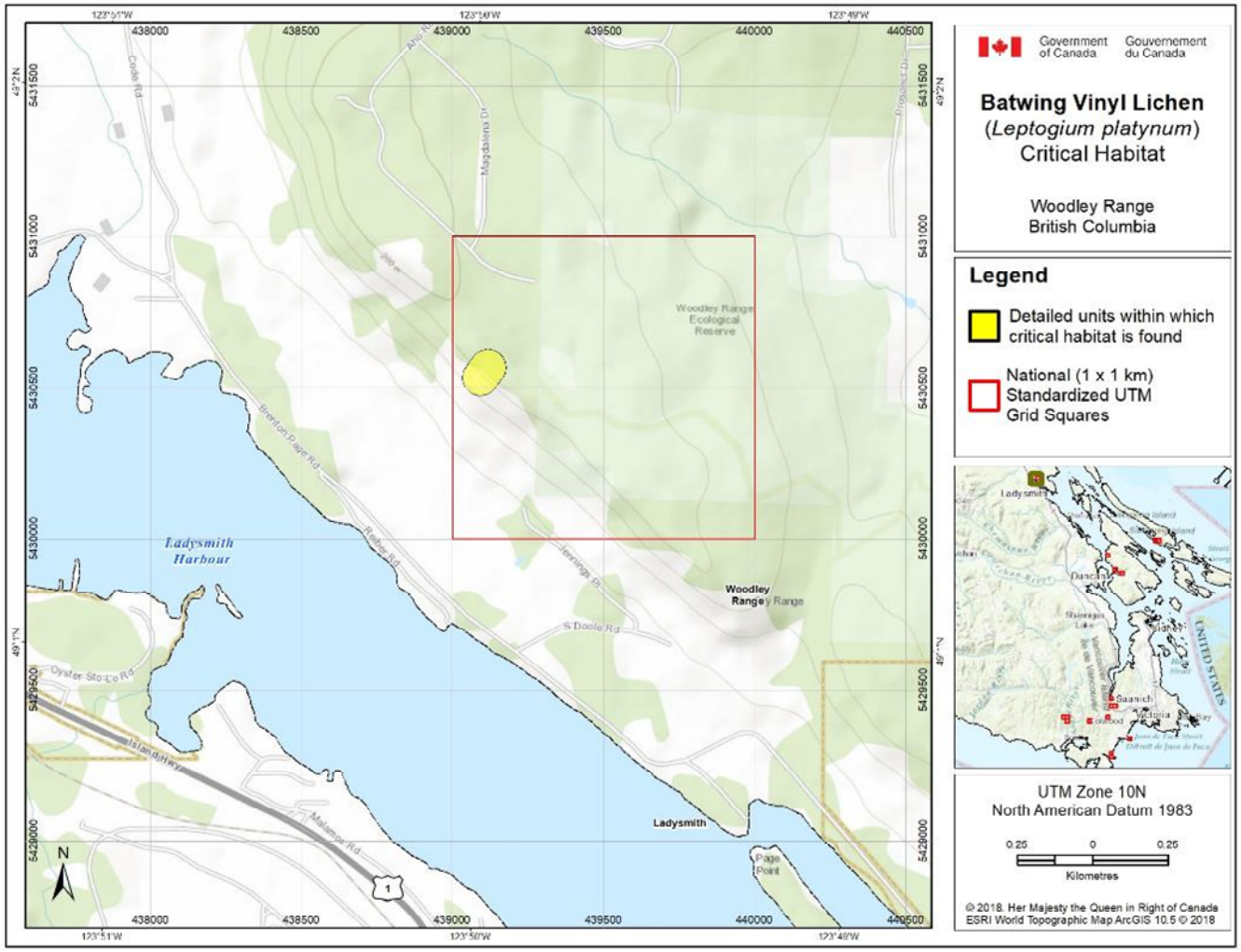

Figure 4. Critical habitat for Batwing Vinyl Lichen at Woodley Range, B.C. (population 2; Table 2) is represented by the shaded yellow polygon (unit) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygon do not contain critical habitat.

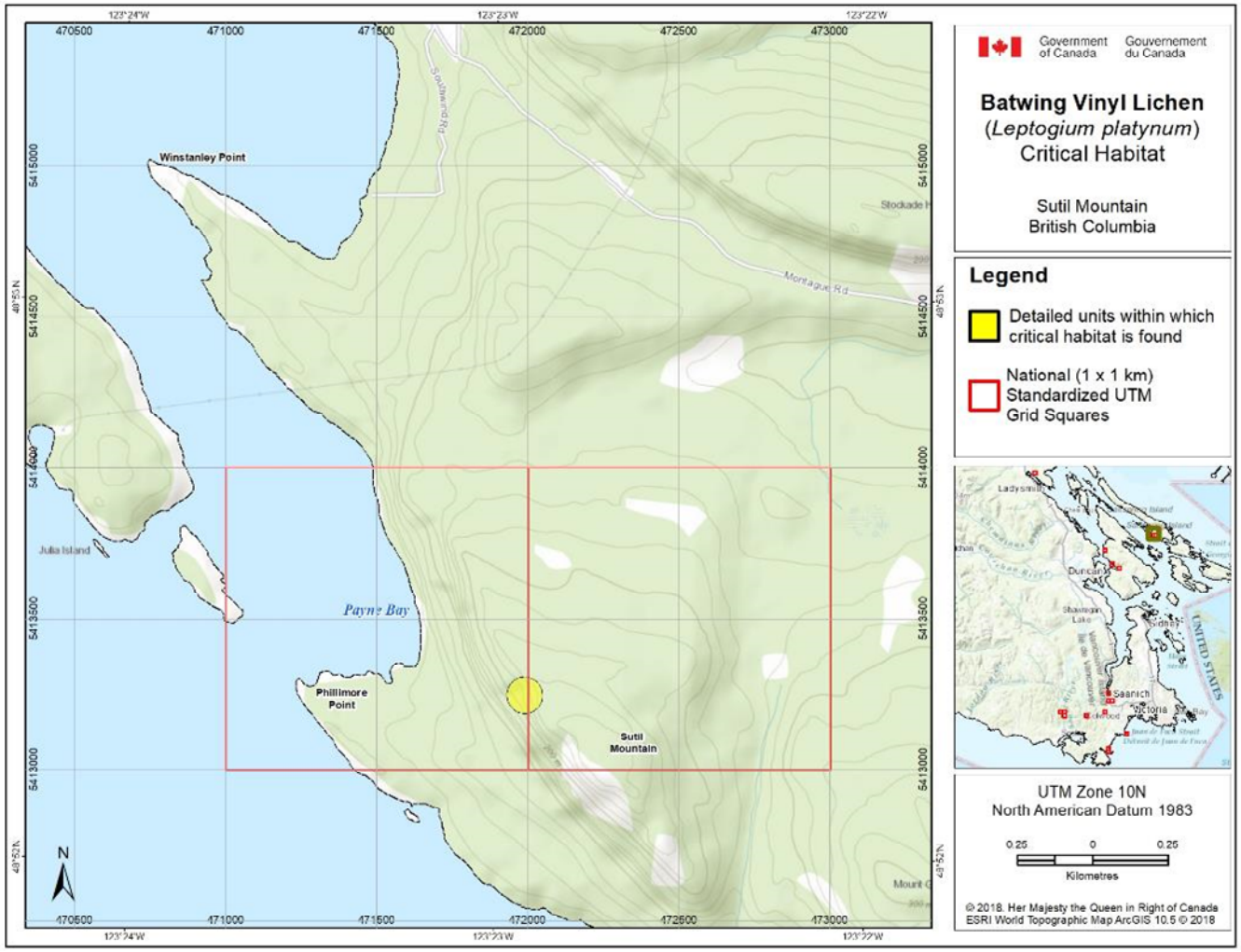

Figure 5. Critical habitat for the Batwing Vinyl Lichen at Sutil Mountain, B.C. (population 3; Table 2) is represented by the shaded yellow polygon (unit) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygon do not contain critical habitat.

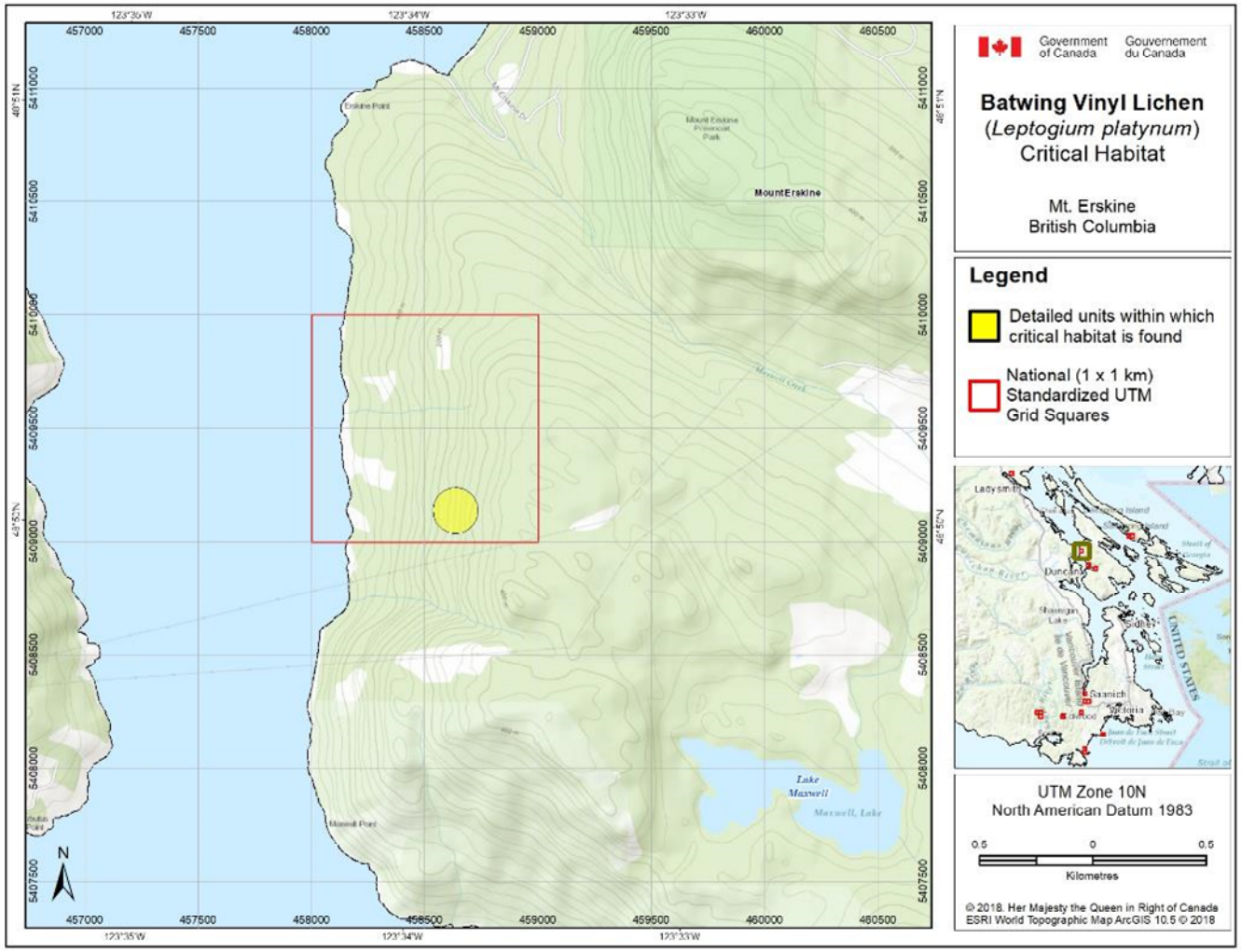

Figure 6. Critical habitat for the Batwing Vinyl Lichen at Mt. Erskine, B.C. (population 4; Table 2) is represented by the shaded yellow polygon (unit) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygon do not contain critical habitat.

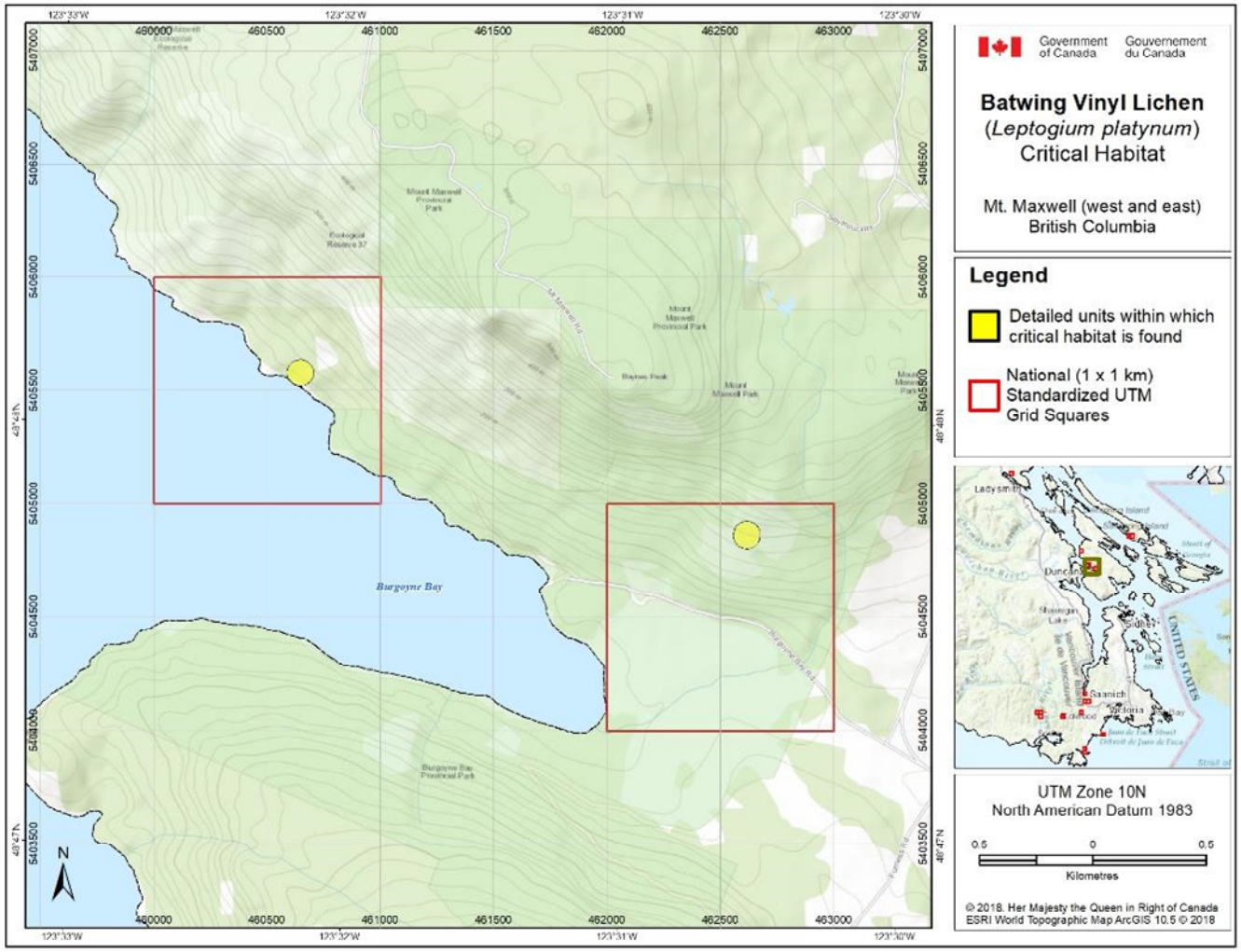

Figure 7. Critical habitat for the Batwing Vinyl Lichen at Mt. Maxwell, B.C. (populations 5 and 6; Table 2) is represented by the shaded yellow polygons (units) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygons do not contain critical habitat.

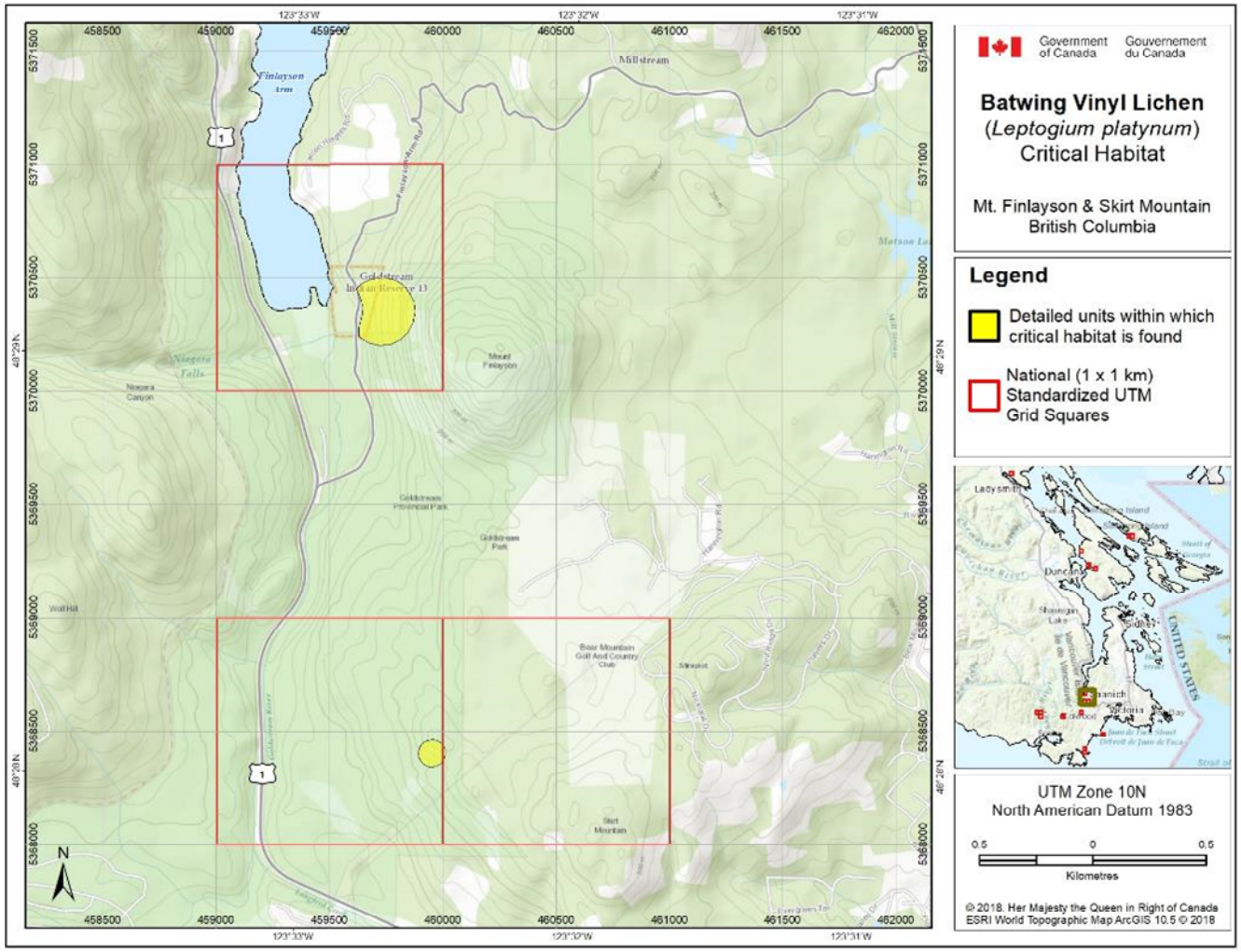

Figure 8. Critical habitat for the Batwing Vinyl Lichen at Mt. Finlayson and Skirt Mountain, B.C. (population 10 and 11; Table 2) is represented by the shaded yellow polygons (units) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygons do not contain critical habitat.

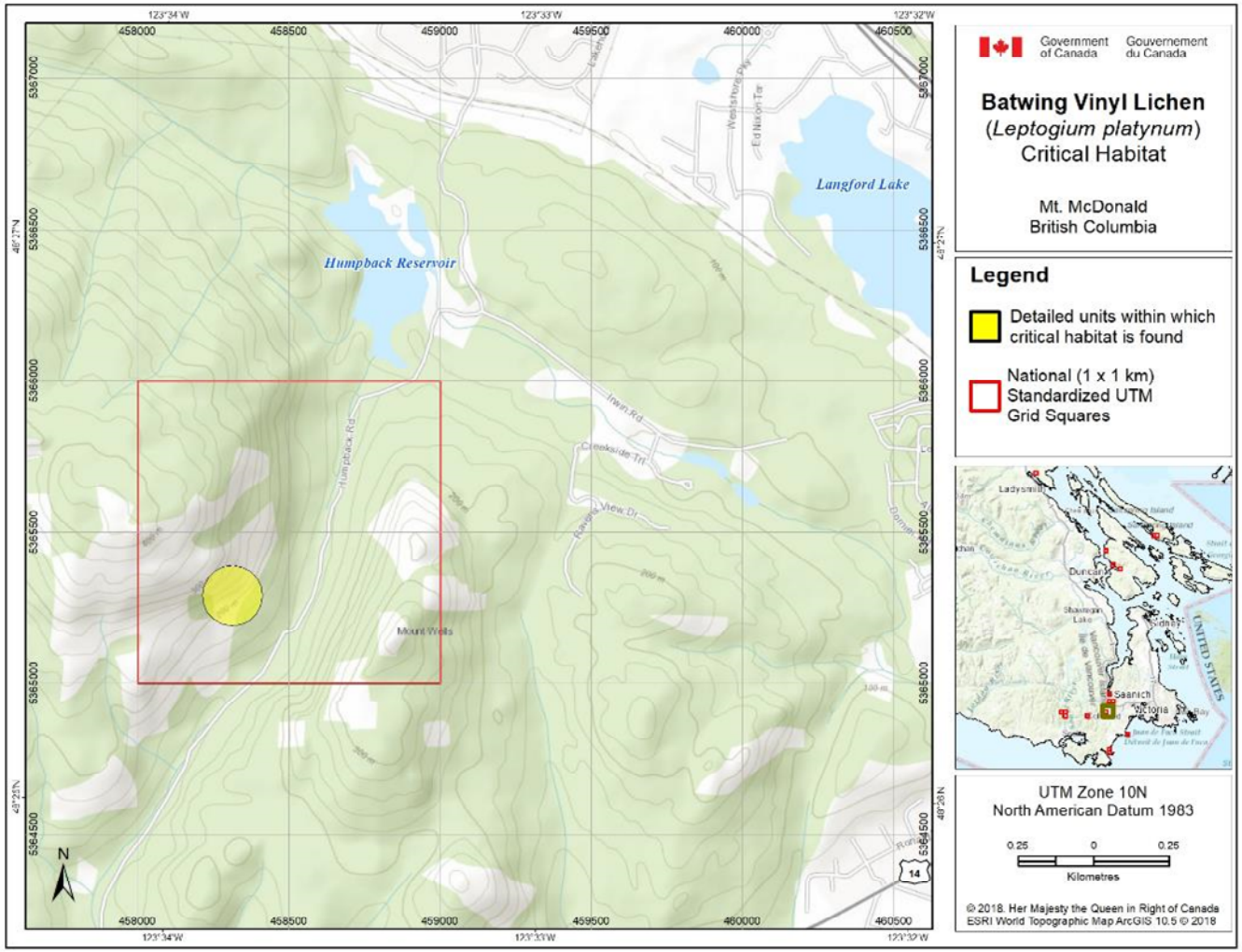

Figure 9. Critical habitat for the Batwing Vinyl Lichen at Mount McDonald, B.C. (population 12; Table 2) is represented by the shaded yellow polygon (unit) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygon do not contain critical habitat.

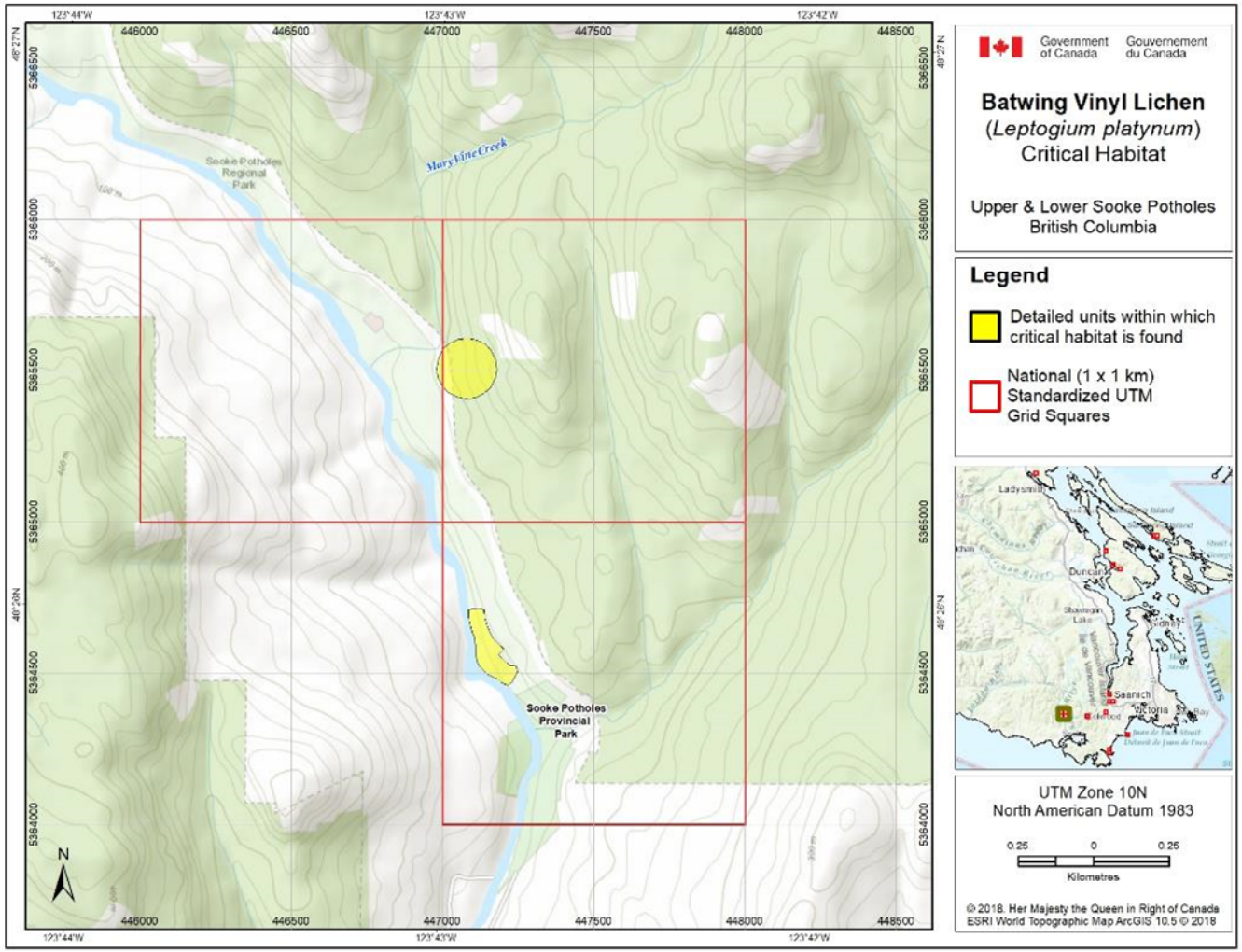

Figure 10. Critical habitat for the Batwing Vinyl Lichen at Upper Sooke Potholes and Lower Sooke Potholes, B.C. (populations 13 and 14; Table 2) is represented by the shaded yellow polygons (units) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygons do not contain critical habitat.

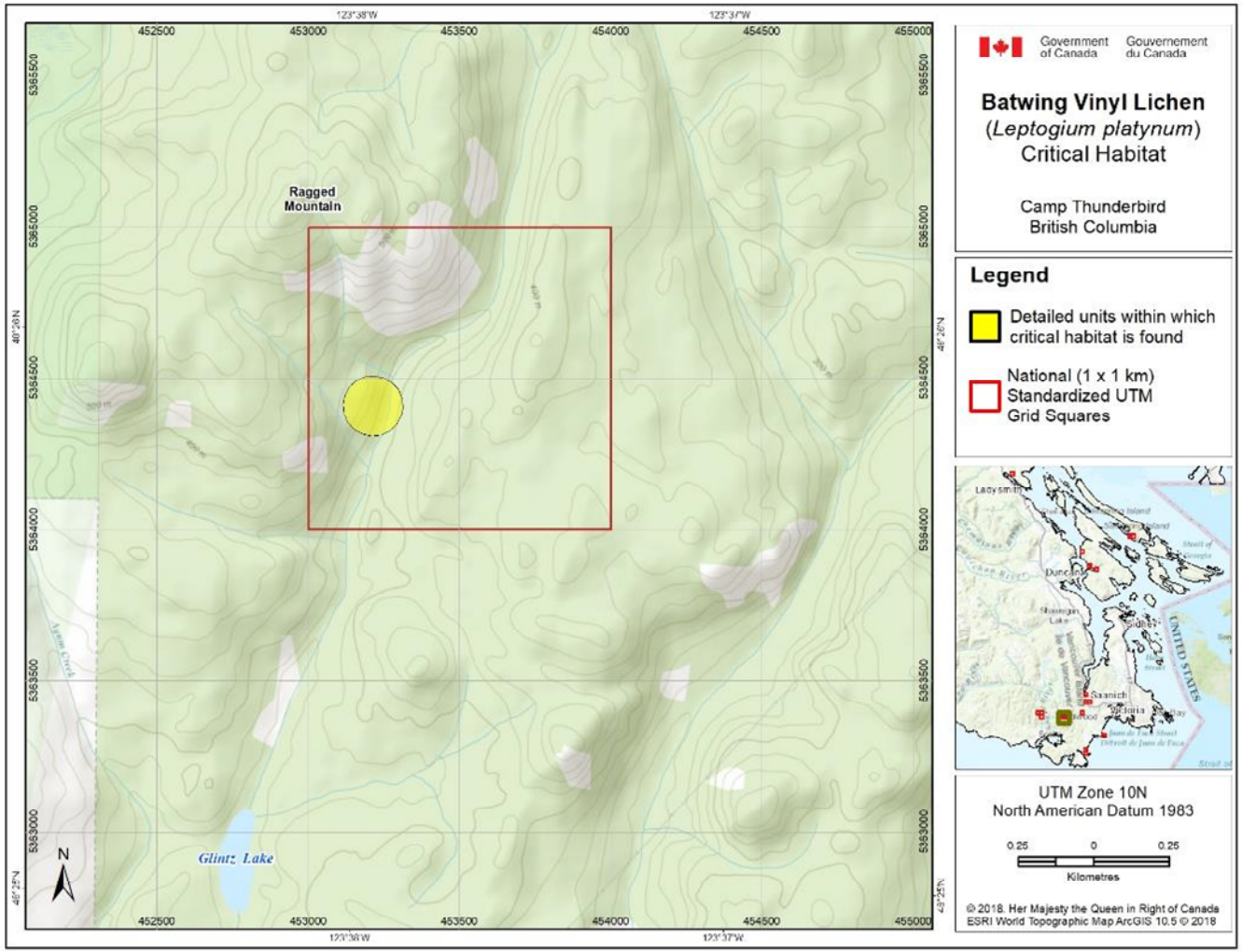

Figure 11. Critical habitat for the Batwing Vinyl Lichen at Camp Thunderbird, B.C. (population 15; Table 2) is represented by the shaded yellow polygon (unit) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygon do not contain critical habitat.

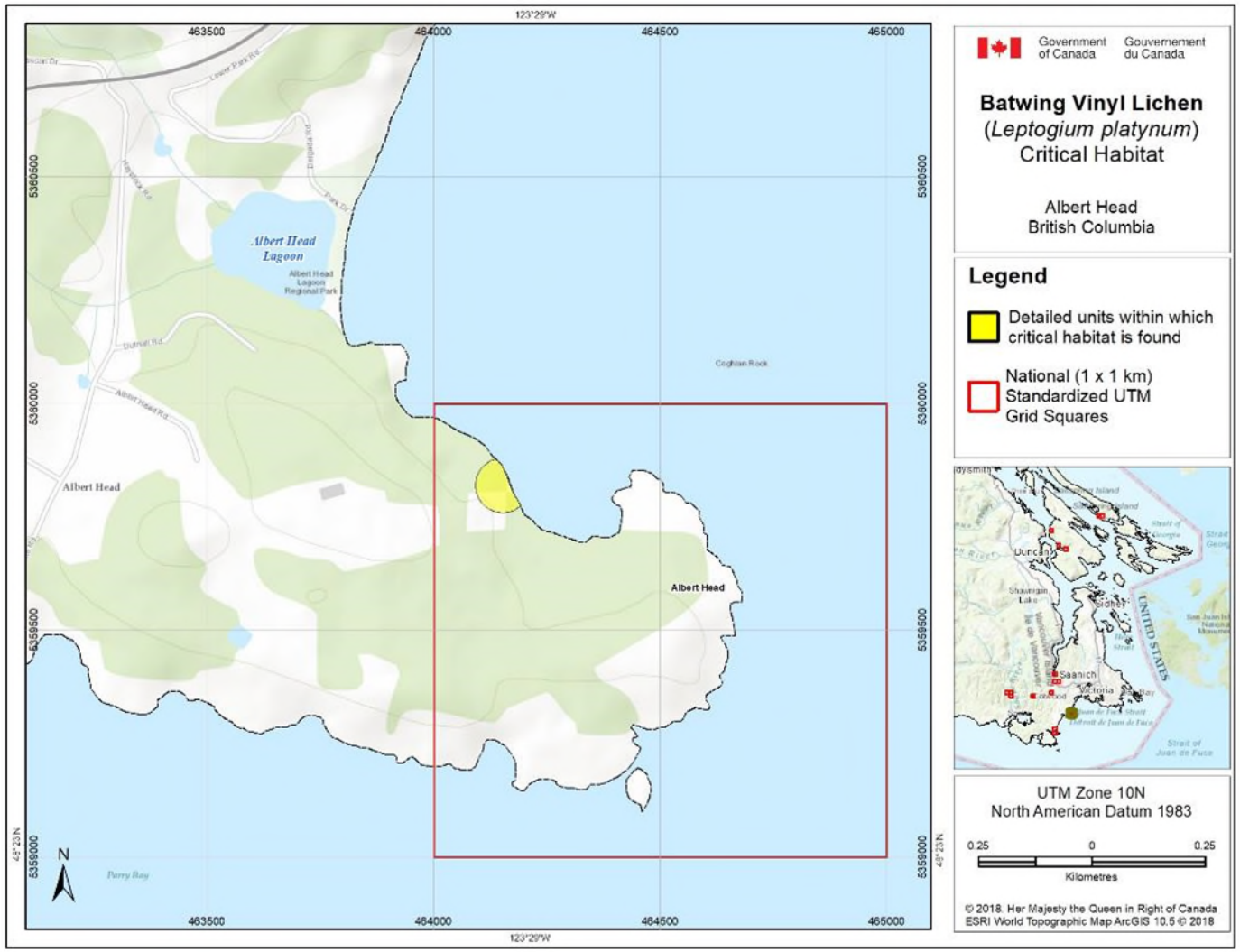

Figure 12. Critical habitat for the Batwing Vinyl Lichen at Albert Head, B.C. (population 17; Table 2) is represented by the shaded yellow polygon (unit) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygon do not contain critical habitat.

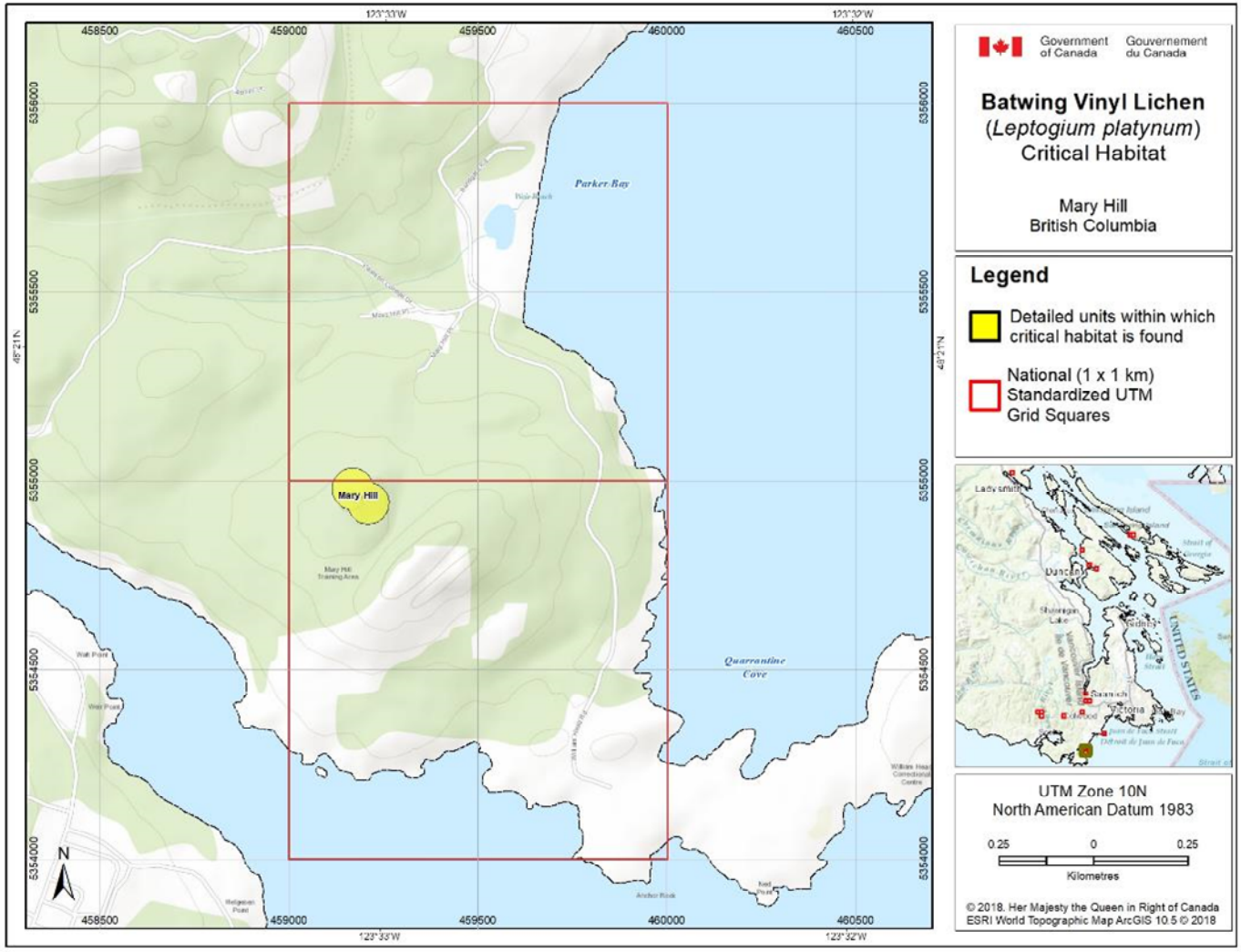

Figure 13. Critical habitat for the Batwing Vinyl Lichen at Mary Hill, B.C. (population 18; Table 2) is represented by the shaded yellow polygon (unit) where the criteria and methodology set out in Section 7.1 are met. The 1 km × 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat in Canada. Areas outside of the shaded yellow polygon do not contain critical habitat.

7.2 Schedule of Studies to Identify Critical Habitat

The following schedule of studies is required to complete the identification of critical habitat for the Batwing Vinyl Lichen.

Table 5. Schedule of studies to identify critical habitat for the Batwing Vinyl Lichen in Canada.

Description of activity	Rationale	Timeline
Identify habitat required for persistence of Batwing Vinyl Lichen metapopulation dynamics	In order to ensure the species can persist at the site-level, accounting for fine-scale cyclical succession on exposed rock surfaces at each location, sufficient additional critical habitat must be identified.	2019-2024
Survey Jocelyn Hill population (#8) to identify locations of all subpopulations.	This population is known to be extant (visited March 2013), and is known to consist of several subpopulations. Geographic references are required for all subpopulations such that critical habitat can be completely identified for this population.	2019-2024
Revisit the Metchosin Mountain population (#16)	This population has not been seen since 1975, so is of unknown status and cannot be included as critical habitat until it has been revisited to confirm its presence and update geographic references. There is no reason to assume that it has been extirpated.	2019-2024

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from single or multiple activities at a point in time or from the cumulative effects of one or more activities over time. Activities (described in Table 6) include those likely to cause destruction of critical habitat for the species; however, destructive activities are not limited to those listed.

All species exhibit some level of resilience to changes in the biophysical characteristics of their habitat. Unfortunately, the threshold of acceptable habitat disturbance is not known for the Batwing Vinyl Lichen. Given that this lichen is at the edge of its range in Canada and is restricted to very specific microhabitats, it can be assumed to have a low tolerance for changes in environmental conditions. It is, therefore, reasonable to presume that the Batwing Vinyl Lichen is highly sensitive to habitat disturbance.

Table 6. Examples of activities likely to result in the destruction of critical habitat of the Batwing Vinyl Lichen in Canada.

Description of activity	Description of effect in relation to function loss	Details of effect and related IUCN threats
Tree/vegetation removal and/or damage to natural landscape features owing to: i. Forest harvesting ii. Clearing for agricultural purposes iii. Road construction iv. Residential development v. Agricultural development vi. Tourism development	• Reduction in mean or maximum relative humidity • Increase in mean or maximum temperature • More extreme relative humidity and temperatures • Change in light availability • Alteration of hydrological processes changes water seepage patterns • Reduction in rock stability may lead to direct loss of growing substrate.	Related to Threat 1.1, 2.3 and 5.3. Changes to biophysical attributes are likely to destroy critical habitat directly and/or indirectly, as the species has narrow ecological specificity. The threshold of effect, its sensitivity to timing, and whether direct or cumulative is unknown.
Recreational activities such as hiking, climbing, or rock scrambling	• Increased erosion or development of trails may alter hydrological processes and water seepage patterns • Erosion may lead to direct loss of growing substrate.	Related to Threat 6.1. Most likely during tourist season (summer/fall). Threshold for loss caused by cumulative effects is unknown.
Agricultural activities that result in the introduction of pollutants (such as from nitrogenous aerosols) into critical habitat areas	• Nitrogen enrichment of the environment may create a habitat unsuitable for this species.	Related to Threat 9.5. Activity can occur outside critical habitat boundary. Effect likely cumulative, threshold unknown.

Note: IUCN Threat numbers are in accordance with the IUCN-CMP unified threats classification system (Open Standards 2014).

8. Measuring Progress

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

Every five years, success of recovery strategy implementation will be measured against the following performance indicators:

- Continued persistence of all 14 known extant populations of Batwing Vinyl Lichen and any additional populations that may be discovered;
- The total Canadian population of Batwing Vinyl Lichen is maintained at, or has increased from, 2018 levels.

9. Statement on Action Plans

One or more Action Plans for the Batwing Vinyl Lichen will be posted on the Species at Risk Public Registry by 2024.

10. References

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Appendix A: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[14]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[15] (FSDS) goals and targets.

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

The distribution of Batwing Vinyl Lichen overlaps with that of several other species at risk in southeastern Vancouver Island and the southern Gulf Islands. Recovery approaches outlined in this strategy focus primarily on increasing our knowledge of the Batwing Vinyl Lichen, protecting the species' natural habitat, and public education. These approaches are not expected to negatively affect any other species. Recovery actions for the Batwing Vinyl Lichen may indirectly benefit other species that require similar microhabitat characteristics. This could potentially include some provincially-listed species of the lichen *Dermatocarpon*; however, not enough is known about this genus to know if it would benefit. Recovery planning activities for the Batwing Vinyl Lichen will be implemented with consideration of all co-occurring species at risk, such that there are no negative impacts to these species or their habitats.

[14] www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html
[15] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1