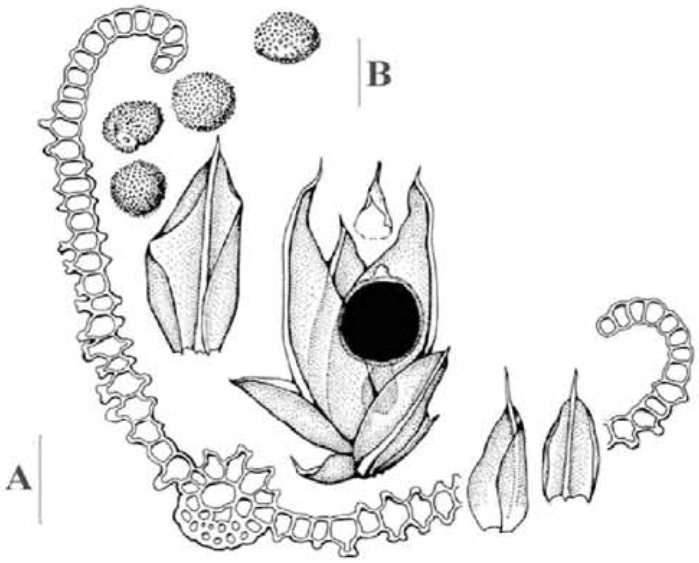
COSEWIC
Assessment and Status Report

on the

nugget moss
Microbryum vlassovii

in Canada



ENDANGERED
2006

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Production note:
COSEWIC would like to acknowledge Terry T. McIntosh for writing the status report on the nugget moss *Microbryum vlassovii* in Canada, prepared under contract with Environment Canada, overseen and edited by René Belland, Co-chair (Mosses and Lichens), COSEWIC Plants and Lichens Species Specialist Subcommittee.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le phasque de Vlassov (*Microbryum vlassovii*) au Canada.

Cover illustration:
Nugget Moss — Illustration shows an entire plant, individual leaves (corresponding to scale bar A, 0.5 mm in length), spores, and a leaf cross section (the latter correspond to scale bar B, 50 µm in length). The round black structure within the plant is a spore capsule. The illustrator is P.M. Eckel. Reproduced with permission from Flora of North America (Flora of North America Editorial Committee, eds. 1993+. Flora of North America North Mexico. 12+ vols. New York and Oxford.)

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COSEWIC
Assessment Summary

Assessment Summary – November 2006

Common name
Nugget moss

Scientific name
Microbryum vlassovii

Status
Endangered

Reason for designation
In North America, this globally rare moss is known from only three localized sites. Two of these sites are in semi-arid areas of south-central British Columbia. Recent surveys have re-located the species at only one of these. This moss grows on fine soils on the steep portions of silt banks in early stages of plant community development. The extremely small populations render this moss vulnerable to disturbance. Threats include potential road development and maintenance of existing roads, and collection of specimens.

Occurrence
British Columbia

Status history
Designated Endangered in November 2006. Assessment based on a new status report.

COSEWIC
Executive Summary

nugget moss
Microbryum vlassovii

Species information

The Nugget Moss, *Microbryum vlassovii*, is one of four species previously included in *Phascum* in North America. It was known earlier as *Phascum vlassovii*. It is characterized by the strongly ornamented, sometimes bottle-shaped cells that are present on the upper surface of the leaf lamina and mid-rib, as well as hidden capsules that do not have a lid for spore release.

Distribution

Microbryum vlassovii has a disjunct distribution between western North America and western Eurasia. It is extremely rare globally and in North America, where it is known also from California. In Canada, it has been reported from two locations in south-central British Columbia.

Habitat

In British Columbia, *Microbryum vlassovii* is restricted to undisturbed, exposed, compact silts and clays on post-glacial lacustrine banks in semi-arid steppe and grassland environments.

Biology

Microbryum vlassovii is an inconspicuous moss that grows as individuals or small, scattered patches on compact, clay-rich soil. The production of sporophytes is common in Canadian populations, but only immature capsules have been observed to date. Spores are probably of importance only in the short-range dispersal of this species. Tuber-like structures on the rhizoids may also be of importance in the survival of this species.

Population sizes and trends

No precise information is available on population condition or trends for *Microbryum vlassovii*. Eight individuals in two small patches were found in the one population that was re-located during the recent survey for the species.

Limiting factors and threats

The threats to this species' habitats include road construction or maintenance, and recreational hiking.

Special significance of the species

The British Columbia populations represent two of three known locations for the species in North America, where the species is extremely rare. Lacustrine banks are also the only known habitat for a number of other rare Canadian species of mosses and lichens.

Existing protection or other status designations

No legislation, regulations, customs, or conditions currently protect this species. In British Columbia it is Red-listed, and globally is considered possibly imperilled.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

on the

nugget moss

Microbryum vlassovii

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2006

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SPECIES INFORMATION

Name and classification

Scientific name: *Microbryum vlassovii* (Laz.) Zand.
Pertinent synonyms: *Phascum vlassovii* Laz.
Common name: Nugget Moss
Family: Pottiaceae
Major plant group: Mosses (Musci)

The Pottiaceae is a large and diverse family of mosses with many of its species restricted to dry environments. It is a challenging family taxonomically and has been undergoing extensive review in recent times (Zander 1993). New genera have been created or the constraints of older genera have been changed to exclude some species and/or include others from different genera. *Microbryum vlassovii* was previously known as *Phascum vlassovii* Laz. (McIntosh 1986, 1989). However, Zander (1993) considers *Phascum* to be polyphyletic and not taxonomically valid. He notes that the genus *Microbryum* is composed of a group of diminutive species characterized by:

1. a single round to semicircular band of thick-walled cells in the central portion of the leaf mid-rib,
2. apiculate capsules (spore sacs) when cleistocarpous (spore sacs not having a lid for spore release),
3. peristomes (fringes of tooth-like appendages surrounding the mouth of the capsule), when present (they are absent in *M. vlassovii*), are truncate and relatively large as compared to the capsule, and
4. a red KOH reaction in the upper portions of the leaf.

Microbryum vlassovii is one of four species previously included in *Phascum* in North America (Anderson *et al.* 1990). The other former species, with changes in brackets (following Zander 1993), are *P. cuspidatum* Hedw. (= *Tortula atherodes* Zand.), *P. floerkeanum* Web. & Mohr (= *Microbryum floerkeanum* (Web. & Mohr) Schimp.), and *P. hyalinotrichum* Card. & Thér. (= *Stegonia hyalinotricha* (Card. & Thér.) Zand.). *Tortula atherodes* and *M. floerkeanum* are also found in Canada, with only *T. atherodes* having a rather widespread distribution, overlapping in its range with *M. vlassovii* (Ireland *et al.* 1987; Zander 1999).

Microbryum vlassovii differs from *Tortula atherodes* (= *Phascum cuspidatum*) principally by the bottle-shaped extensions of the leaf cells adjacent to the similarly ornamented costa (mid-rib). According to Zander (1993), the leaves of *Phascum cuspidatum* turn yellow in weak KOH, whereas the leaves of species of *Microbryum* turn red.

Morphological description

The following description has been derived principally from McIntosh (1986), McIntosh & Paige (2001), and Zander (1993, 1999), and from examination of collections. Figure 1 is a composite illustration from Zander (1999) and shows many of the features discussed below.

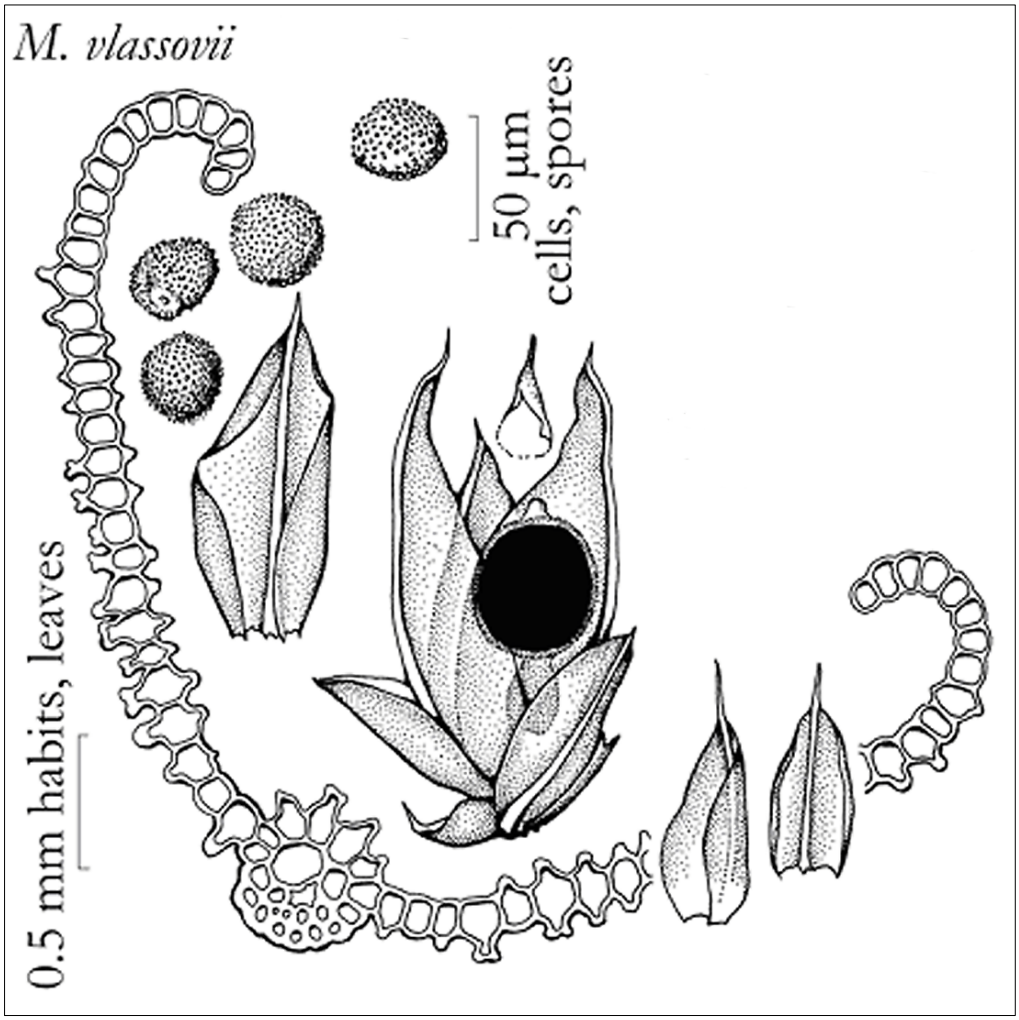

Figure 1. Illustration of spores, plant, leaves, and leaf cross-section of *Microbryum vlassovii* (from Zander 1999; with permission from the illustrator, P.M. Eckel).

Microbryum vlassovii is a small moss, less than 2 mm tall, that grows as erect individuals or small, scattered patches. Mature leaves are light green to yellow-(golden-) green, and are about 1 mm long, ovate to ovate-lanceolate, and usually somewhat concave to prow-shaped above. Leaf margins are strongly recurved to somewhat plane at midleaf, and recurved to plane above. The leaf costa (midrib) is pale brown and often wider near the apex than below, and is excurrent as a long, smooth, and often orange mucro or hair tip (awn), with a long apical cell. The upper surface of the costa is ornamented with distinctive bottle-shaped and papillose (wart-like bumps over the cell surface) cells.

The upper leaf cells are even-sided to somewhat irregular in shape, and range in size from 10–15 µm. These cells, especially adjacent to the costa, are characteristically

ornamented with tall, hollow, and papillose projections similar to the surficial costal cells. The marginal leaf cells are occasionally more elongate than the adjacent laminal cells, and usually smooth or, rarely, weakly papillose. Leaf cells are somewhat larger toward the middle of the leaf. The basal leaf cells are short to long-rectangular, thin-walled, and smooth. Its rhizoids, slender filaments that attach the moss to its substratum, bear distinctive unicellular and hemispherical units that may serve as 'tubers,' thus acting as vegetative propagules (Zander 1999).

Microbryum vlassovii is autoicous, with both male and female structures present on each plant. Sporophytes, which produce spores, mature in late winter and into the spring, and are immersed in the leaves. A tiny apiculus is present at the top of the capsule. The nearly spherical capsules do not open with a lid in order to release their spores like most mosses. Instead, the capsule wall disintegrates as conditions dry into the summer. Spores range from 18-25 µm in size, and are weakly papillose.

Additional illustrations and keys can be found in McIntosh (1986; 1989, illustrations only) and Savicz-Ljubitzkaja & Smirnova (1970, in Russian).

DISTRIBUTION

Global range

Microbryum vlassovii has a disjunct distribution between western North America and western Eurasia, where it is rare. Eurasian locations include Spain (Jiménez *et al*. 1990), the Ukraine, Armenia, and central Asia (McIntosh 1997; Zander 1999). In North America it is extremely rare, having been reported only from southern British Columbia (McIntosh 1997), and California (Zander 1999; Figure 2).

Canadian range

Microbryum vlassovii was first collected In Canada in 1980 and has been reported from two locations in south-central British Columbia (east of Kamloops and on the east side of Penticton: see Figure 4 and also McIntosh 1986). Although the Penticton population was re-located during the recent survey for the species, the Kamloops population was not.

HABITAT

Habitat requirements

In British Columbia, *Microbryum vlassovii* is found in the Bunchgrass Biogeoclimatic Zone where it occurs on undisturbed and exposed compact silts and clays on post-glacial lacustrine banks in semi-arid steppe and low-elevation grassland environments (Brink 1997). There is a variety of potential bryophyte habitats on these

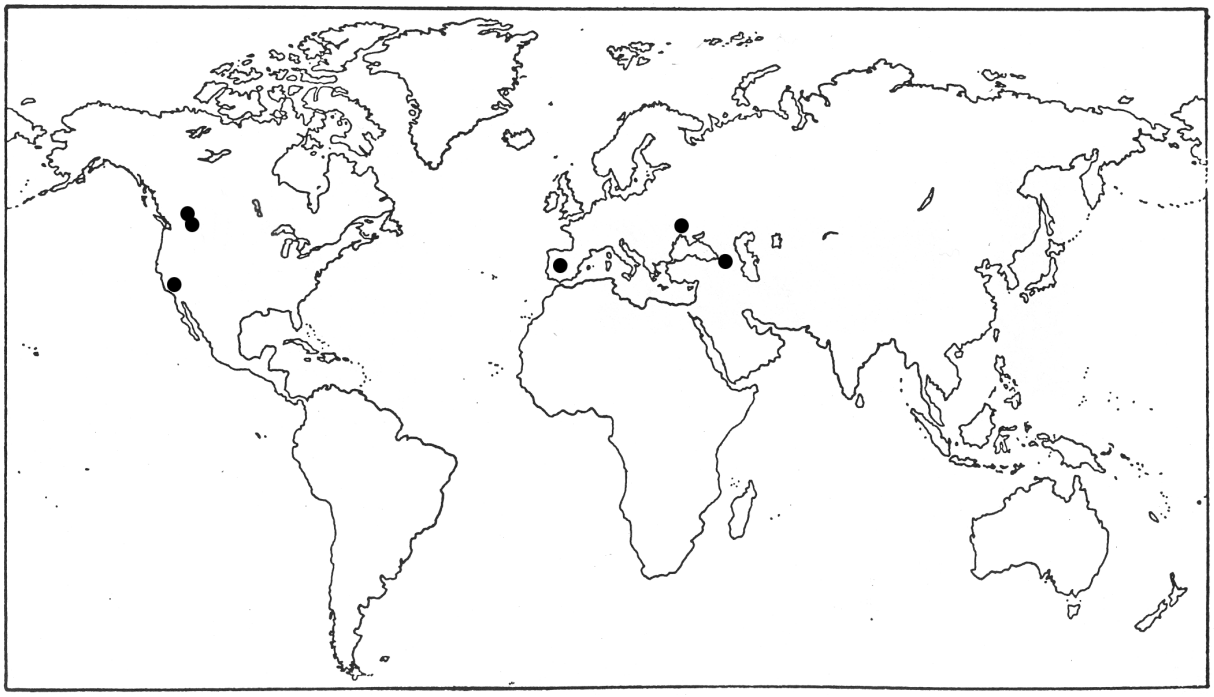

Figure 2. Global distribution of *Microbryum vlassovii*.

banks defined by aspect, slope, and associated vegetation cover. Examination of earlier collections and observations made during recent fieldwork show that this species either grows on highly exposed or partially shaded steep slopes where few other moss species are able to grow. It has not been found growing in the late successional lichen-dominated crust that predominates over most low-elevation and undisturbed lacustrine bank environments. Therefore, *M. vlassovii* may be more characteristic of early successional situations, including sites that are relatively less disturbed than other portions of the banks, and where potentially competitive lichens and mosses are unable to colonize (however, an earlier collection at Penticton had a relatively large patch of this species growing with *Barbula unguiculata*, a species characteristic of more shaded conditions). During the 2004 survey by T. McIntosh at the Penticton site, *M. vlassovii* was found on an exposed, south-facing, early successional steep face; associated moss species included *Aloina bifrons* and *Pseudocrossidium obtusulum*, and these were poorly developed. A few early successional lichen species were present as well. Zander (1999) lists the substrate and elevational range as unknown; the Californian collection was found on clay soil in a pastured hillside.

Lacustrine bank habitats are common landforms within the Bunchgrass Biogeoclimatic Zone, which is restricted to a number of narrow valleys in the south-central part of the province. Common plants in this zone are bluebunch wheatgrass (*Pseudoroegneria spicata*), needle-and-thread grass (*Heterostipa comata*), big sage (*Artemisia tridentata*), and, in the southern portions of the Okanagan Valley, antelope brush (*Purshia tridentata*).

Lacustrine banks can be very extensive and kilometres in length, such as those near Kamloops and Penticton, or can be quite small, less than a hectare in extent, such as found in smaller adjacent valleys. Although lacustrine banks are common in British Columbia, relatively few appear to have suitable habitat for the nugget moss. Based on field experience and close examination of the known habitats, T. McIntosh has defined 'potential habitat' for this taxon as:

1. Only on extensive lacustrine banks in the hottest and driest portions of the province, specifically in the South Thompson Valley near Kamloops and in the south Okanagan. Some of its associated lichens and mosses are only common or restricted to these banks, and
2. Only on very steep portions of these banks which appear in an early successional state.

Habitat trends

Both British Columbia sites appear to be, in general, relatively undisturbed, although there appears to be occasional human activity at both known sites. Hiking on the lacustrine banks in the Penticton site is apparently discouraged by the local residents. Small patches of bank erosion on the steep banks above the roadside ditch at the Penticton site are present but sporadic.

Habitat protection/ownership

Both sites are near residential areas within city limits and there doesn't appear to be any specific protection for either site.

BIOLOGY

General

Microbryum vlassovii is a small, erect-growing moss that grows as individuals or small, scattered patches on compact, silt- and clay-rich soil.

Reproduction and dispersal

Although production of sporophytes of *Microbryum vlassovii* is common in Canadian populations, only immature capsules have been observed. Incomplete development of the sporophytes may be a response to arid conditions combined with the compact substratum of the habitat of this species. It is likely that this species needs a relatively prolonged, wet spring period to enable the spores to mature. Spores, if produced, are probably of importance in the short-range dispersal of this species. They may take advantage of open soil characteristic of lacustrine bank habitats, although this is unknown. Although *Microbryum vlassovii* may be considered a member of the "pygmy mosses" whose life history is characterized by a short life cycle and "fleeting use of ephemeral habitats" (Crum & Anderson 1981), it is probably a perennial species based on examination of specimens and the presence of tuber-like structures on the rhizoids.

POPULATION SIZES AND TRENDS

Search effort

British Columbia has received considerable survey effort for mosses (bryophytes) and the flora of a large portion of the province has been well documented (Figures 3, 4). Among the areas best collected are the south-central and south-western parts. The dryland areas of south-central British Columbia, in particular, were the focus of intense survey during the early 1980's as part of a PhD dissertation by T. McIntosh (McIntosh 1986).

In 1997, T. McIntosh initiated a further survey of British Columbia arid-land areas to complement his earlier work (McIntosh 1986) in preparation for a research paper describing and providing keys for the bryophytes of these regions. From 1997 to 2002, 17 suitable lacustrine (glacial lake-derived) banks in the semi-arid portions of the province were surveyed for *Microbryum vlassovii*, as well as other uncommon species. This survey included lacustrine banks near Penticton, Naramata, and Summerland, in the Okanagan Valley, near Merritt, near Kamloops, and near Spences Bridge (place names are labelled in Figure 4). Additional populations of *Microbryum vlassovii* were not found during these surveys.

This moss is highly inconspicuous and may be overlooked in its habitat, as it is both small and grows only as scattered individuals or small patches. Notwithstanding these characters, this moss is not impossible to find. Its size and habit are similar to those of many other unrelated mosses whose occurrences are in fact well known, and that are frequently collected by non-experts. Moreover, because mosses are restricted to, and often found in only a small range microsites, searchers will generally focus their efforts on these to effectively narrow their search.

Nugget moss appears to be restricted to relatively undisturbed, yet early successional, sites where competition from other species is restricted. These types of sites are not common relative to other habitats in the dry interior. T. McIntosh extensively surveyed lacustrine banks during his PhD studies and many times since then (all major lacustrine banks have been surveyed at one point or another). Many of the other rare and localized lacustrine bank-restricted mosses (including *Grimmia plagiopodia* and *Crossidium seriatum*, also small and inconspicuous species) have been collected or observed a number of times during these surveys, yet *Microbryum vlassovii* has only been seen twice. The microsite that this species inhabits appears to be relatively rare in lacustrine bank habitats.

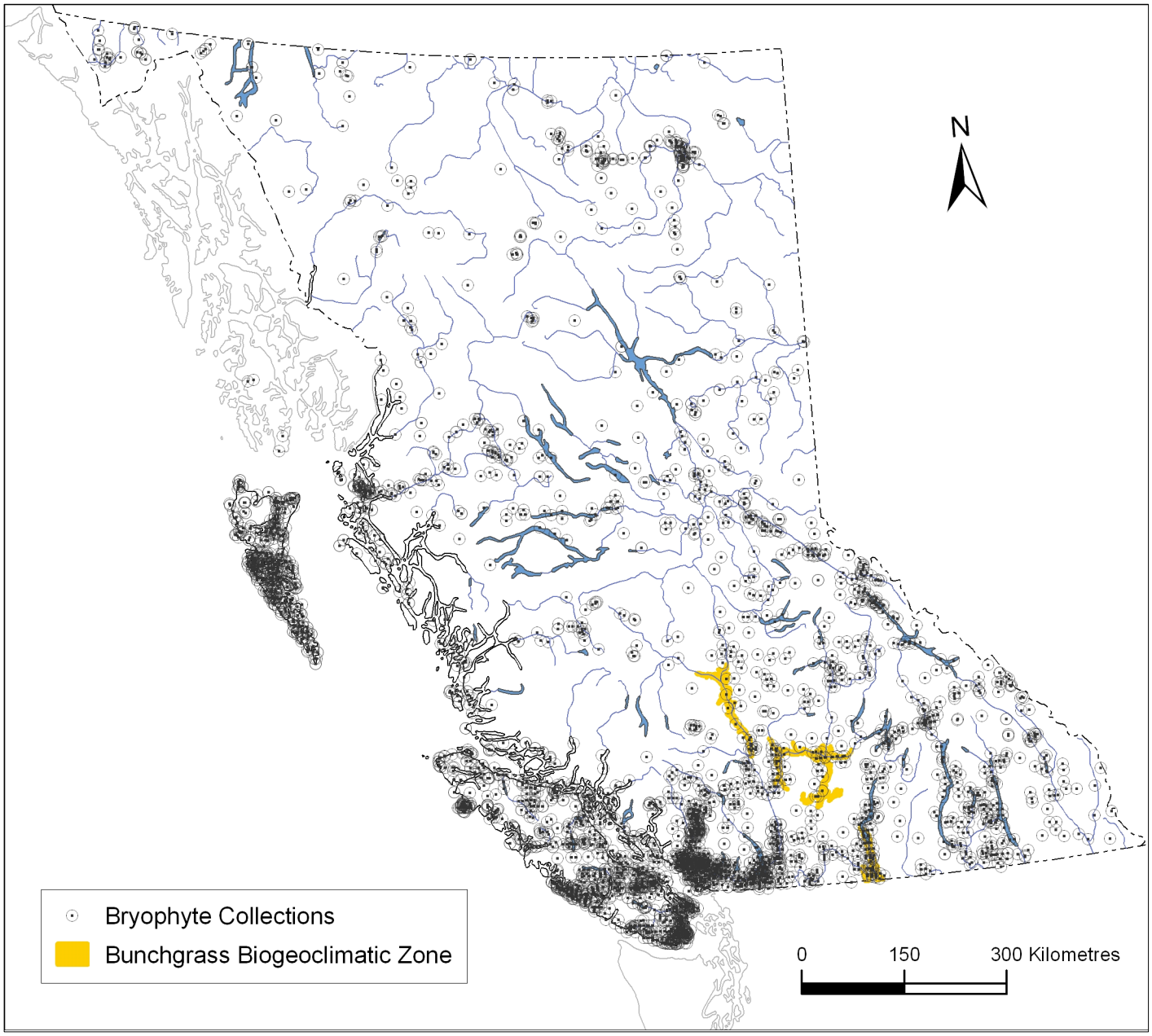

Figure 3. Collecting effort for mosses in British Columbia. Each open circle with central dot represents a general, non-targeted, collecting site for mosses. Locations were obtained from voucher data of approximately 40% of the holdings in the Bryophyte Herbarium at the University of British Columbia (UBC) in addition to several thousand records at the University of Alberta (ALTA) and Devonian Botanic Garden (ALTADBG). This map does not include many of the sites surveyed by T. McIntosh since 1987.

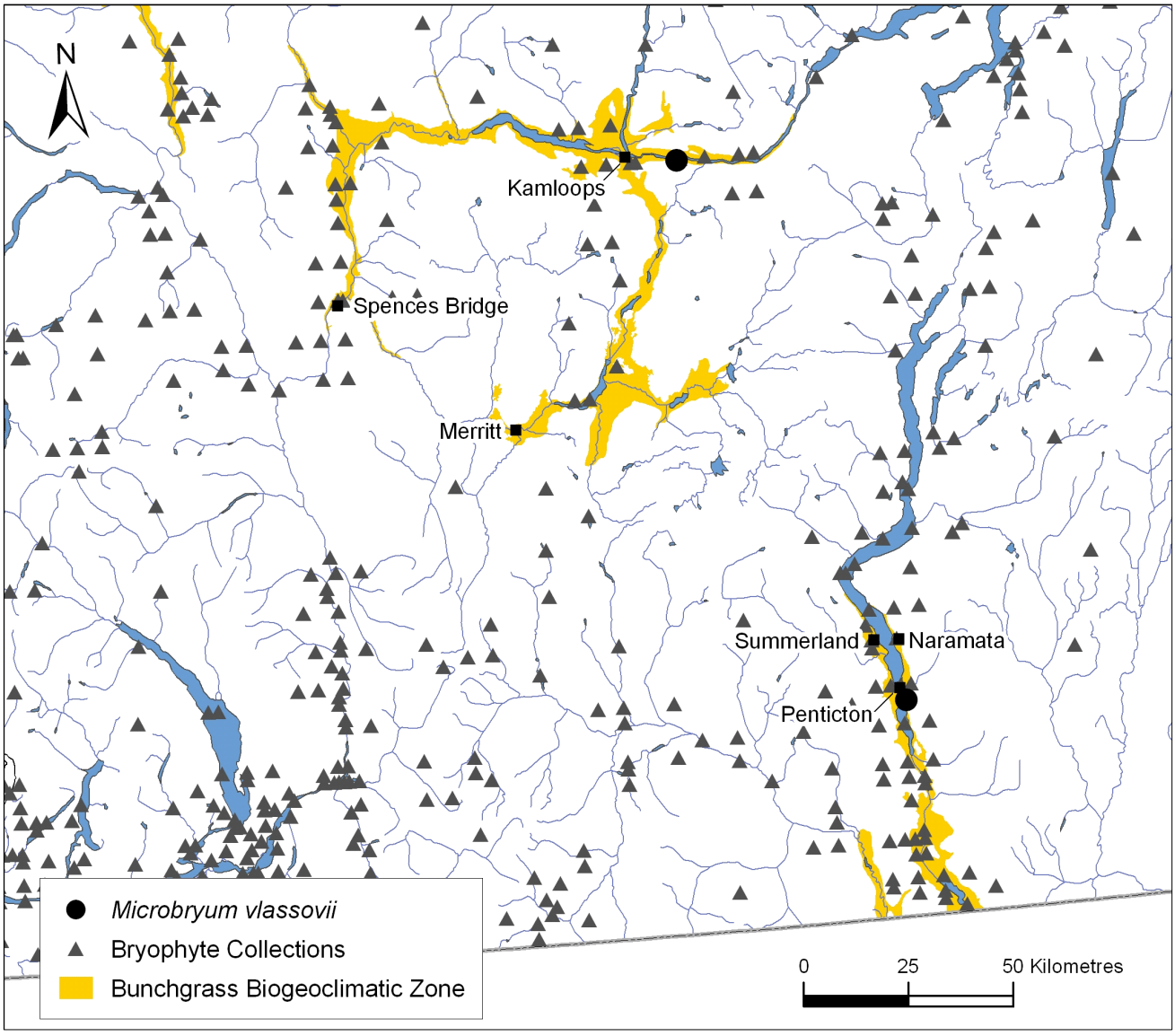

Figure 4. Distribution of *Microbryum vlassovii* in Canada and general collecting effort for bryophytes in the regions of the Bunchgrass Biogeoclimatic Zone. Each triangle is a general, non-targeted collecting site for bryophytes. Locations were obtained from voucher data of approximately 40% of the holdings in the Bryophyte Herbarium at the University of British Columbia (UBC). This map does not include many of the sites surveyed by T. McIntosh since 1987 but labelled place names show areas where T. McIntosh surveyed 17 suitable lacustrine bank sites from 1997 to 2002.

Potential sites for nugget moss are defined as sites separated by at least 0.5 km and separated by landscapes that do not contain the potential habitats (for example water near Penticton, and an urban centre at Kamloops). Through examination of representative specimens and information from locations of this taxon in Europe and

Asia, T. McIntosh considers only four areas (sides of valleys) at two locations as having

habitat potential for the nugget moss:

- Okanagan Valley, both sides of valley from about 12 km south of central Penticton to 18 km north
- South Thompson River, both sides of valley from about 18 km west of central Kamloops to about 20 km east; mainly on the south side of the river

Further, T. McIntosh has examined more than 75% of these banks and has made over 300 collections of lichens and mosses. Early in 2005, he initiated a thorough survey of the banks running south of Summerland (north-west of Penticton). Over 90% of the potential habitat for this species was examined in this ~4 km stretch and it was not found, although a number of locations for its associated species were recorded.

Abundance

Only the Penticton population was re-located during the recent survey for the species. Here, it is very rare, found in two small patches which were composed of at least 6 individuals and 2 individuals, respectively. In an earlier collection from this site (Collections Examined #2; 1980), it was found in a relatively large patch (2x4 cm), and a note on the collecting bag states that it was relatively frequent.

Fluctuations and trends

No precise information is available on population trends for *Microbryum vlassovii* in British Columbia.

LIMITING FACTORS AND THREATS

One potential threat to this species' habitats is road construction or maintenance. Both areas are adjacent to roadways and road expansion. Although not planned at either area, roadway changes may affect the lower portions of the banks where, at least in the case of the Penticton site, nugget moss is found. Recreational hiking is also a concern as both of the reported locations in British Columbia are near residential areas.

SPECIAL SIGNIFICANCE OF THE SPECIES

Microbryum vlassovii is extremely rare in North America, and appears rare globally. The British Columbia populations represent two of three known occurrences of this species in North America. Considering the number of collections examined, it is much rarer than other dryland bryophytes in the region. Lacustrine banks are also the only habitat known for a number of other apparently rare Canadian species of mosses, including *Pottia wilsonii*, *Crossidium seriatum*, *Desmatodon guepinii*, and *Grimmia plagiopodia* (McIntosh 1986). Except for the latter species, all are listed in the list of rare mosses of Canada (Belland 1998). Other more common dryland moss species

have their main populations on lacustrine banks. These include *Tortula brevipes*, *Aloina bifrons*, and *Aloina brevirostris*. Many unusual and probably rare crustose and tiny foliose lichen species are also found primarily on lacustrine bank surfaces.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

No legislation, regulations, customs, or conditions protect Canadian populations of *Microbryum vlassovii*. In British Columbia, this species is Red-listed provincially (S1, referring to any indigenous species or subspecies that have, or are candidates for Extirpated, Endangered, or Threatened status; BC Species and Ecosystem Explorer 2003, Ryan 1996). This species is listed as G2 by NatureServe Explorer (as *Phascum vlassovii*; 2003) and is considered possibly imperilled globally.

TECHNICAL SUMMARY

Microbryum vlassovii
Common name: Nugget Moss Phasque de Vlassov
Occurrence by province: BC

Extent and Area information	
• *extent of occurrence (EO)(km²)*	400 km^2
• *specify trend (decline, stable, increasing, unknown)*	unknown
• *are there extreme fluctuations in EO (> 1 order of magnitude)?*	unknown
• *area of occupancy (AO) (km²)*	<1 km^2
• *specify trend (decline, stable, increasing, unknown)*	unknown
• *are there extreme fluctuations in AO (> 1 order magnitude)?*	unknown
• *number of extant locations*	2, one population re-located in recent survey
• *specify trend in # locations (decline, stable, increasing, unknown)*	unknown
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	unknown
• *habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat*	apparently stable
Population information	unknown
• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	unknown
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	unknown; but at least 8 plants known at time of recent survey (2004)
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	unknown
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)*	unknown
• *are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?*	unknown
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?*	yes
• *list each population and the number of mature individuals in each*	2 populations: Kamloops (unknown), Penticton (at least 8 plants at time of recent survey in 2004)
• *specify trend in number of populations (decline, stable, increasing, unknown)*	unknown
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	unknown
Threats (actual or imminent threats to populations or habitats)	
There are no direct or imminent threats. Potential threats included hiking and road building, and collecting of specimens	
Rescue Effect (immigration from an outside source)	
• *does species exist elsewhere (in Canada or outside)?*	yes – in California, Eurasia
• *status of the outside population(s)?*	G2 globally

• *is immigration known or possible?*	not likely – the species is extremely rare outside Canada
• *would immigrants be adapted to survive here?*	yes
• *is there sufficient habitat for immigrants here?*	yes

Status and Reasons for Designation

Status: Endangered	**Alpha-numeric code**: D1

Reasons for Designation:

In North America, this globally rare moss is known from only three localized sites. Two of these sites are in semi-arid areas of south-central British Columbia. Recent surveys have re-located the species at only one of these. This moss grows on fine soils on the steep portions of silt banks in early stages of plant community development. The extremely small populations render this moss vulnerable to disturbance. Threats include potential road development and maintenance of existing roads, and collecting of specimens.

Applicability of Criteria

Criterion A: (Declining Total Population): Data are not available on population declines.

Criterion B: (Small Distribution, and Decline or Fluctuation): Area of occupancy is less than 1 km^2 and there are fewer than 5 sites. The Canadian population is severely fragmented. However, data are not available to evaluate declines in habitat or area of occurrence.

Criterion C: (Small Total Population Size and Decline): Not applicable.

Criterion D: (Very Small Population or Restricted Distribution): Meets EN (D1) based on few individuals recorded at Penticton; given the intensity of search effort, it is unlikely that the total number of individuals exceeds 250. May also meet requirements for TH (D2).

Criterion E: (Quantitative Analysis): Not applicable.

ACKNOWLEDGEMENTS

Fred Knezevich provided field assistance and Wynne Miles reviewed the manuscript. René Belland provided compilation of herbarium records for Figures 3 and 5. Jenny Wu, prepared the maps for Figures 3 and 4.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Dr. Terry McIntosh completed his PhD in 1986 following a study of dry grassland and steppe bryophytes in the interior portions of British Columbia. Since then, he has been active collecting bryophytes from many parts of the province and in dryland areas of adjacent Washington State. He has been a primary identifier of bryophyte collections from various government and private surveys in the province. He has recently completed 16 rare species accounts on bryophytes for the Wildlife Branch of the Province of British Columbia and two COSEWIC Status Reports on mosses.

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COLLECTIONS EXAMINED

1. Microbryum vlassovii (Laz.) Zand.
Accession number: B89041 (UBC)
Location: Silt banks East of Kamloops along road.
Habitat: Roadside embankment: Shaded, clayey.
Collector: T.T. McIntosh
Collection number: 3388
Collection date: 12 May 1980
Determiner: T.T. McIntosh
Confirmation: R. Zander, 1993, for Flora North America.

2. *Microbryum vlassovii* (Laz.) Zand.
Accession number: B89042 (UBC)
Location: East side of Penticton, clay banks and roadcut
Habitat: Open clay crust, steep.
Collector: T. T. McIntosh with A. Kruckeberg
Collection number: 4329
Collection date: 9 June 1980
Determiner: T.T. McIntosh
Confirmation: R. Zander, 1993, for Flora North America.

APPENDICES

Appendix 1. Collection Locations (populations) and observational information for *Microbryum vlassovii* in British Columbia

COLL. #	LOCATION	DATES VISITED	CONFIRMED in 2004?
1	Kamloops	1980/2002/2004	No
2	Penticton	1980/2002/2004	Yes

Appendix 2. Record of fieldwork

Fieldwork directly related to the 2006 COSEWIC assessment was completed in 2002, on the following dates and at the locations noted in brackets: May 15–18 (south Okanagan Valley), July 29–31 (Okanagan area), August 6–8 (Spences Bridge area), October 18–20 (Kamloops area), and December 2 –24 (south Okanagan area). Additional fieldwork was completed at Penticton and Kamloops on June 5 and 6, 2004.