COSEWIC
Assessment and Status Report

on the

Rusty Cord-moss
Entosthodon rubiginosus

in Canada

ENDANGERED
2004

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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Cover illustration:
Rusty cord-moss — plants and young sporophytes (partially covered by calyptrae) of *Entosthodon rubiginosus* from the White Lake area. Photograph by Ole Westby.

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COSEWIC
Assessment Summary

Assessment Summary – November 2004

Common name
Rusty Cord-moss

Scientific name
Entosthodon rubiginosus

Status
Endangered

Reason for designation
This species is endemic to western North America where it occurs in southern British Columbia, and has been reported from Montana, Arizona, and New Mexico. This moss has a highly restricted distribution in south-central British Columbia where only four populations have been found. Of these, three populations are extant, and one was not relocated; the species is not abundant at any known site. The species' habitat is a narrow band of shoreline dominated by grasses and other mosses in seasonally wet, alkaline habitats. Two populations have been affected by trampling by horses or cattle, and all sites examined have been impacted to varying degrees by domestic animals. At least a portion of one population has been lost as a result of trampling by domestic animals.

Occurrence
British Columbia

Status history
Designated Endangered in November 2004. Assessment based on a new status report.

COSEWIC
Executive Summary

Rusty Cord-moss
Entosthodon rubiginosus

Species information

Entosthodon rubiginosus belongs to the moss family Funariaceae, characterized by small species with a great degree of vegetative similarity. There are twelve species of *Entosthodon* in North America, of which only *2* are found in Canada. *Entosthodon rubiginosus* is a small, pale green to green moss that grows as individual stems or in tiny patches. In habitat, it is inconspicuous and often hidden among other mosses. Sporophytes are common.

Distribution

This species is endemic to western North America, found in southern British Columbia, Montana, Arizona, and New Mexico. It has been found in four sites in Canada.

Habitat

In Canada, *Entosthodon rubiginosus* is restricted to seasonally damp and alkaline, usually silt or clay-rich soil at the edges of ponds, lakes, and sloughs, and on seepage slopes in relatively dry environments.

Biology

Entosthodon rubiginosus grows on seasonally wet and usually alkaline soil in relatively dry environments. The production of sporophytes is common in Canadian populations and spores are probably of importance in the short-range dispersal of this species.

Population sizes and trends

At all of the known sites, *Entosthodon rubiginosus* is uncommon and the species is represented by a few small patches.

Limiting factors and threats

The major limiting factor and threat to *Entosthodon rubiginosus* is probably the trampling and general alteration of its habitat by domestic animals, in particular cattle. A further threat may be long periods of drought.

Special significance of the species

This species is endemic to North America. The British Columbia populations represent the northern extension of its range in North America. It is rare across its total range in North America.

Existing protection and other status designations

No legislation, regulations, customs, or conditions currently protect this species. It is listed as S1 at the provincial level and it is Red-listed. Globally, it is ranked G1G3.

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 5th 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 agencies (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 members and the co-chairs of the species specialist and the Aboriginal Traditional Knowledge subcommittees. The Committee meets to consider status reports on candidate species.

DEFINITIONS (NOVEMBER 2004)

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 it is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for atleast 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 wildlife species for which there is inadequate information to make a direct, or indirect, assessment of its 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.

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Canada

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2004

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SPECIES INFORMATION

Name and classification

Scientific name: *Entosthodon rubiginosus* (Williams) Grout
Pertinent synonyms: *Funaria rubiginosa* Williams
Common name: Rusty cord-moss (earlier name: wrinkled flask moss; McIntosh and Paige 2001)
Family: Funariaceae
Major plant group: Mosses (Musci)

The Funariaceae is a large moss family characterized by small species with a great degree of vegetative similarity, with most taxa having broad, light green leaves and large, pale leaf cells (Crum and Anderson 1980). Most species are considered to be short-lived, either annual or biennial (Grout 1935, Lawton 1971). Genera within the family are distinguished by differences in the sporophyte (spore producing generation): by the shape, size, and straightness of the capsule (spore sacs), and by the presence, absence, or degree of development of the peristome (a fringe of tooth-like appendages surrounding the mouth of the capsule).

The genus *Entosthodon* consists of a group of diminutive species which have derived their name from the peristome which, when present, is inserted well inside the mouth of the capsule. *Entosthodon* has shortly exserted, erect, symmetrical, and operculate capsules (with lids), and moderately large spores. Members of this genus often colonize ephemeral habitats that are repeatedly, but inconsistently, available in the same area, rather than depending on wind dispersal of spores to reach more widely distributed suitable areas.

There are twelve species of Entosthodon in North America, with only *E. rubiginosus* and *E. fascicularis* found in Canada. Both of these species are restricted to British Columbia (Anderson *et al*. 1990; Ireland et al. 1987).

Description

The following description has been derived from Grout (1935), Lawton (1971), McIntosh & Paige (2001), and from personal observations. Figure 1 illustrates many of the characters described here. Figure 2 is a photograph of a small patch of *Entosthodon rubiginosus* from the White Lake area of southern British Columbia.

Entosthodon rubiginosus is a small, 2-3(-5) mm tall, pale green to green acrocarpous (producing female structures and sporophytes at the tips of the main stems) moss that grows as individual stems or in tiny patches. It is inconspicuous and often hidden among other mosses. Mature leaves are crowded at the summit of an erect stem and range in length from 1.5-2.4 mm, and average about 1 mm wide. They are ovate to, occasionally, somewhat obovate, acuminate to acute, erect-spreading when moist, and slightly contorted when dry. The leaf margins are usually plane, rarely

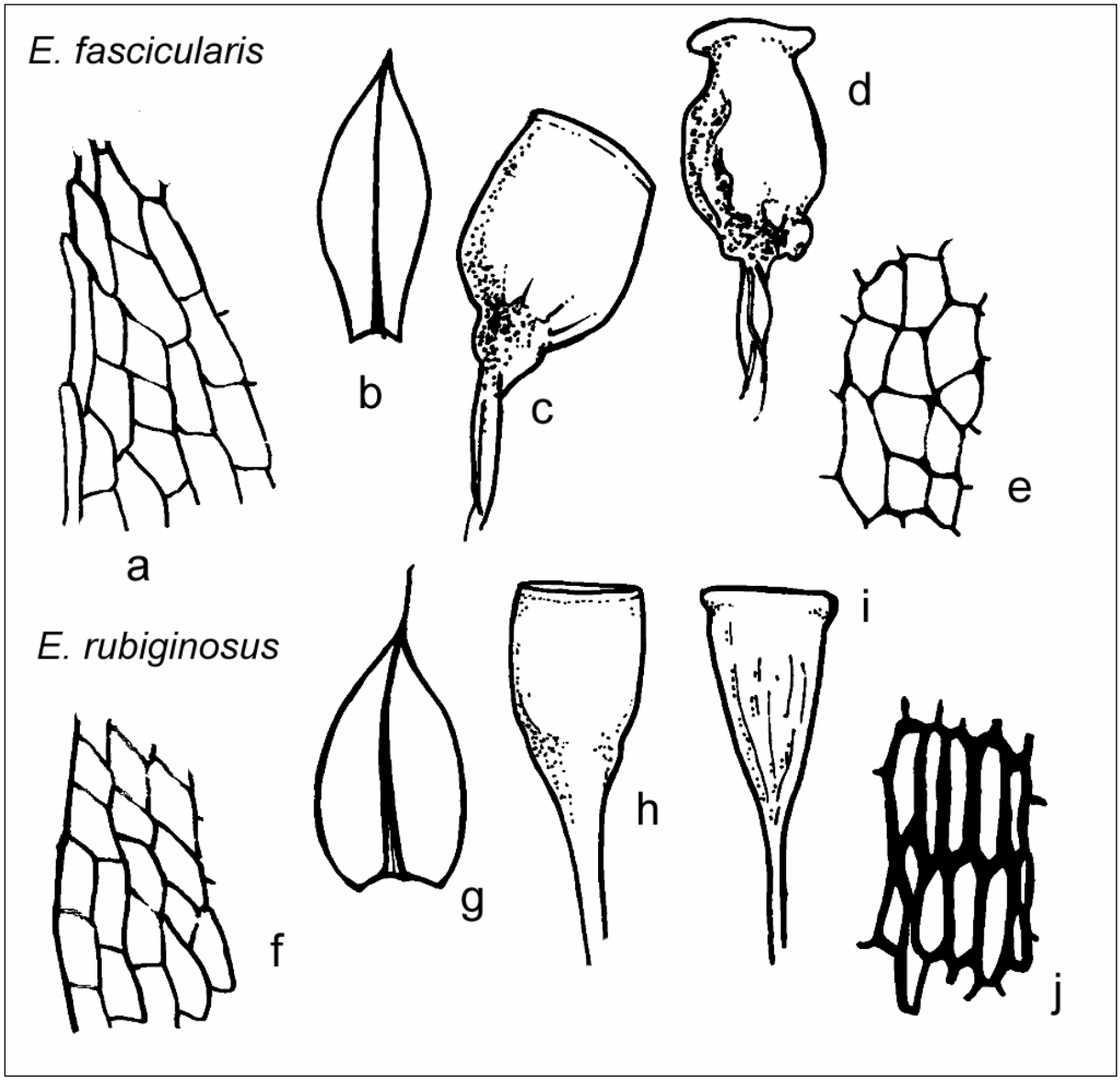

*Figure 1. Comparison of *Entosthodon fascicularis* (a – e) and *E. rubiginosus* (f – j); a, f: upper leaf margins (X 175); b, g: stem leaves (a: X12, b: X16); c, h: fresh capsules (c: X12, h: X16); d, i: dry capsules (d: X12, i: X16); e, j: upper cells of capsule walls (X 175); a, b, and f modified from Lawton, 1971, all others by T. McIntosh.

*Disclaimer: The original size of the drawing may not be reproduced accurately in the figure. The scales provided should be used only as indicators of relative size. Actual length measurements are given in the text.

slightly uneven above, and lack a clearly defined border although some marginal cells are occasionally slightly shorter than the adjacent laminal cells. The irregularly rectangular to rhomboidal upper laminal cells are thin-walled and range in size from 40-60 µm long to 20-30 µm wide. Basal leaf cells are rectangular-elongate. The costa, or mid-rib, usually ends below the apex in lower stem leaves, but is excurrent in the upper leaves.

Figure 2. Plants and young sporophytes (partially covered by calyptrae) of *Entosthodon rubiginosus* from the White Lake area (+/- X 18; Photograph by Ole Westby).

The sexuality of *Entosthodon rubiginosus* is uncertain. It is probably autoicous, with male and female organs on the same stem, since sporophytes appear to be produced on most plants annually. The sporophytes of *E. rubiginosus* are small, and range from 4-5(-7) mm in height. They mature in the late winter and into the spring, and, in British Columbia, the sporophytes usually remain obvious into the autumn, even though the leaves tend to dry out and become inconspicuous. It has relatively large, distinct calyptrae (vegetative hoods that protect the young sporophyte), and they completely cover the maturing capsules. The calyptrae have long thin tips and are split near the base. Its capsules are erect, somewhat pyriform (pear-shaped), red- to yellow-brown when mature, and usually somewhat contracted below the mouth and wrinkled when dry. The mouth of the capsule is bordered by a series of transversely-rectangular cells below which are cells that are elongate and thick-walled (this character separates it from the similar *E. fascicularis*, which has small and irregularly even-sized cells below). The operculum is conic and the peristome is rudimentary or absent. Spores are papillose and vary in size from 25-35 micrometers.

Taxonomic keys and additional illustrations are found in Grout (1935) and Lawton (1971). Discussion about *Entosthodon rubiginosus* and related taxa is found in McIntosh (1986).

DISTRIBUTION

Global range

Entosthodon rubiginosus is endemic to western North America (Lawton 1971; McIntosh 1986, 1997; Figure 3). It has a scattered distribution, found in southern British Columbia, Montana (Montana Natural Heritage Program 2003), Arizona, and New Mexico (Lawton 1971, McIntosh 1989, NatureServe Explorer 2002). In Montana, it is known from a single collection made in 1887 on the banks of the Missouri River near Great Falls (the type collection site). Efforts by others to relocate the type location were unsuccessful, partly because the search was not exhaustive and also because the original river banks above and below Great Falls have been inundated by reservoirs resulting from the construction of dams (NatureServe Explorer 2003). There is still a possibility that a new population of *E. rubiginosus* may yet be found in this area.

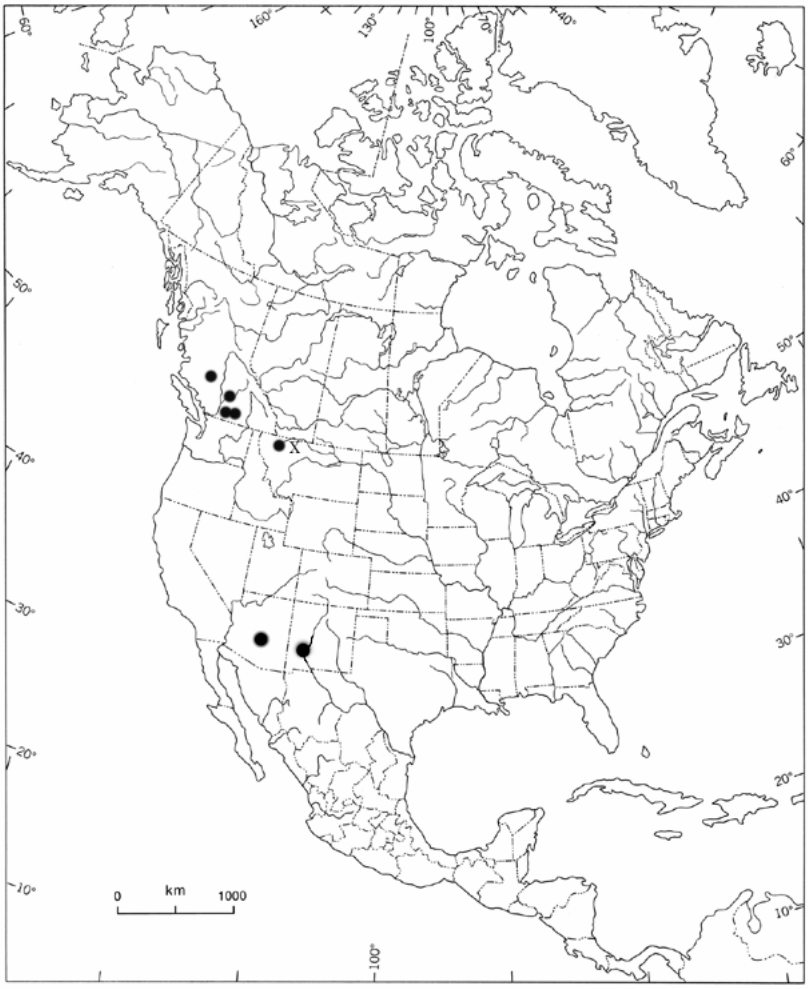

Figure 3. North American distribution of *Entosthodon rubiginosus* (X = Great Falls site where population has probably been extirpated).

Canadian range

In Canada, the rusty cord-moss has been found at four sites in the south-central portion of British Columbia: at White Lake in the southern Okanagan Valley, south-east of Princeton, north-west Kamloops, and south of Riske Creek in the Cariboo Forest Region (Figure 4).

Major collection efforts contributing to our present knowledge of the Canadian distribution include the following: 1) surveys conducted as part of the PhD research of T. McIntosh from 1980 to 1983, 2) a provincial arid-land survey conducted by T. McIntosh (1997-2001), and 3) field work conducted by T. McIntosh in support of a COSEWIC assessment in 2002-2003.

Figure 4. Canadian distribution of *Entosthodon rubiginosus* (X = Kamloops site where population was not confirmed).

HABITAT

Habitat requirements

In British Columbia, *Entosthodon rubiginosus* is restricted to seasonally damp and alkaline, usually silt or clay-rich soil at the edges of open ponds, lakes, and sloughs, and on seepage slopes in relatively dry environments. It grows amongst litter and vascular plants, in particular graminoids, in particular salt grass (*Distichlis stricta*) and field sedge (*Carex praegracilis*). Common moss associates are *Desmatodon heimii*, *Drepanocladus* sp., and *Conardia compacta*. It is most often found within a narrow band around the edges of the wetland where the topography is flat to very slightly sloping. It has not been found in alkaline sites where tall rushes and sedges dominate. The alkaline nature of these areas arises from evaporation of water during warmer months over many years, leaving minerals behind.

Alkaline wetlands are relatively common in the south-central portions of the province, along river valleys and adjacent lowlands. They are most common in a relatively large area south and west of Williams Lake, but are also fairly common in relatively narrow bands in the drier portions of the Fraser, Thompson, Nicola, Similkameen, and Okanagan Valleys. Scattered alkaline areas are also present in the Rocky Mountain Trench.

Although alkaline wetlands probably number in the hundreds in British Columbia relatively few appear to have suitable habitat for *Entosthodon rubiginosus*. Based on field experience, Terry McIntosh has defined 'potential habitat' for this taxon as:

1. In seasonally wet alkaline areas where bare soil is available; these alkaline areas are either distinct ponds, pocket complexes comprised of small ponds and seepage areas, or seepage slopes. The species appears to be most common near ponds and least common on seepage slopes.
2. On a flat to very gentle slope within a low-growing vegetation zone above, but not in, a zone defined by a complete alkaline-deposit crust; the low-growing vegetation is often defined by the presence of two graminoid species: *Carex praegracilis* and *Distichlis stricta*. The species has not been found where taller sedges and rushes predominate.
3. In open areas (no shade) at relatively low elevations in sagebrush, grassland, and open forested (ponderosa pine/Douglas-fir/lodgepole pine, although less commonly with the latter two species)
4. In areas where erect-growing moss species predominate; *E. rubiginosus* has not been found in sites where creeping moss species, and in particular where *Drepanocladus* (probably *D. aduncus*) are present.

Table 1 gives estimates of potential sites, by regions. Potential sites are defined as sites separated by at least 5 km. (but usually much more) and separated by landscapes that do not contain the potential habitats. Based on examinations of maps and through field work, between 93 and 111 distinct sites (geographically isolated ponds, lakes,

seepage slopes, or complexes) may provide suitable habitat for this species in the province. Although more work needs to be completed, this species appears to be restricted to those alkaline areas in warmer locations (lower elevation/more southerly latitude). This is supported by the concentration of this species in the Okanagan and Kamloops areas. Alkaline wetlands are found in the Bunchgrass, Ponderosa Pine, and dry Interior Douglas-fir Biogeoclimatic Zones.

Over the past seven years and during his Ph.D. work, the report writer has investigated the edges of probably more than 75% of the alkaline wetlands that have potential habitat for this species in British Columbia (see Table 1). Despite this intensive survey effort, *Entosthodon rubiginosus* was found only three times. However, the edges of many of these ponds and the potential habitat for this species are extensive, covering hectares in some sites, and, because of collection time constraints, this species could have been overlooked at some of the sample locations. Moreover, in field surveys conducted by T. McIntosh in 2002-2003, 30 additional alkaline wetland sites were visited. Although the investigations during this survey were more intense than the earlier survey, and more time was spent at each site, only one new population was found (Riske Creek).

Table 1. Estimated numbers of 'potential habitat' alkaline areas in British Columbia, including visitation and collection information. Potential sites are defined as sites separated by at least 5 km., (but usually much more) and separated by landscapes that do not contain the potential habitats.

Region	Number of Potential Sites[a]	Approximate number of sites visited	Numbers of Known Sites
Kootenay	8 - 10	7	0
Okanagan (from Osoyoos to the SE base of Richter Mountain westwards and to just north of Kaledon to the north)	20 - 25	18 - 20	2
Kamloops (from just east of the city to Spences Bridge/Cache Creek, and including the Pavilion and Clinton areas, although somewhat disjunct)	28 -32	22 - 25	1
Cariboo (mainly in areas along the Fraser and Chilcotin Valleys, but also north and east of Chasm north of Clinton)	37 - 44	28 -32	1

[a]A number of individuals who have expert knowledge about the geographical extent and ecological condition of provincial alkaline areas were consulted, including Ray Coupe, Hans Roemer, Fred Knezevich, Don Gayton, and Kent Watson. See also section on Authorities Contacted.

Trends

In 1997, T. McIntosh initiated a survey of provincial arid-land areas in order to complement his PhD work (McIntosh 1986) in preparation for a research paper describing and providing keys for the bryophytes of these regions. From 1997 to 2001, some 45 alkaline wetlands of potential habitat for this species were visited at various

locations throughout the semi-arid regions of south-central British Columbia (about 20 sites were visited in the Cariboo Region from north of Clinton to west of Williams Lake, and another 25 were visited in the Kamloops/Merritt/Okanagan areas; these sites were not documented with UTM information). The primary focus of these visits was to look for a number of rare bryophytes, including *Entosthodon rubiginosus*. No additional sites were found during this field work period.

Three extant populations of *Entosthodon rubiginosus* are currently known in Canada. The Riske Creek population was discovered during 2002-03 field work by T. McIntosh and the White Lake and Princeton populations were confirmed during that field work period also. The early collection from Princeton has probably been extirpated because of serious grazing activities around the pond where it was collected; however, more plants were found in a small seasonally wet pocket to the southeast of this pond, and probably represent the same population. The population found in 1981 near Kamloops was not relocated.

The White Lake and Riske Creek habitats appear to be stable, although there appears to be intermittent, but minor cattle activity at both sites. The Princeton site is regularly heavily disturbed by cattle and horses, and the pond where this moss was collected previously is now almost completely devoid of vegetation around its margins; however, other areas near this pond, including the small wet area where this species was relocated, show no signs of recent disturbance.

Protection/ownership

Ownership of the Kamloops and Princeton locations is undetermined. The Riske Creek site is on Crown land. It has also been collected at White Lake in the southern Okanagan Valley. In the past, cattle and horses utilized the area around the lake. However, The Nature Trust (J. Hope, pers. comm. 2002) recently signed a 99 year lease in order to establish a study area on federal lands at White Lake in accordance with their 2000 Biodiversity Ranch Management Plan. As part of this plan, White Lake and the surrounding riparian vegetation, including the known location for *Entosthodon rubiginosus*, are to have been permanently excluded from grazing and other potential large-scale disturbances through the construction and maintenance of a fence. It is expected that the habitat will improve in the riparian area, although data is lacking on how changes will affect the population of this species.

BIOLOGY

General

Entosthodon rubiginosus is a small acrocarpous moss that grows as individual stems or in tiny patches on seasonally wet and usually alkaline soil in semi-arid shrub-steppe and grassland environments.

Reproduction and dispersal

The production of sporophytes of *Entosthodon rubiginosus* is common in Canadian populations and spores are probably of importance in the short-range dispersal of this species, especially into open areas. It possibly takes advantage of open soil, characteristic of early successional, often repeatedly, but, in the case of this species, lightly disturbed habitats (Porley 2000). Although usually considered short-lived, this species may be perennial or pauciperennial (short-lived perennial) in nature (T. McIntosh, personal observations). Many small buds are present on underground stems and they appear to persist from year to year.

POPULATION SIZES AND TRENDS

At all of the known sites, *Entosthodon rubiginosus* is uncommon and the species is represented by a few small (<1cm^2) patches, each of which can be considered one individual, following IUCN guidelines. Total known patches at White Lake number < 20, 3 patches were found at Princeton, and only 1 patch was found at Riske Creek. Population trends cannot be determined. Site monitoring is necessary in order to confirm population trends.

LIMITING FACTORS AND THREATS

The major limiting factor and threat to *Entosthodon rubiginosus* is probably the trampling and general alteration of its habitat by domestic animals, in particular cattle. A further threat may be long periods of drought. The last four to five years have been particularly dry in interior British Columbia, and populations may have declined, but this is unknown.

SPECIAL SIGNIFICANCE OF THE SPECIES

This species is endemic to North America. The British Columbia populations represent the northern extension of its range in North America. Also, it is a rare across its total range in North America; this species has been collected only seven times, and at widely spaced intervals, since its discovery in 1887 (Williams 1913).

EXISTING PROTECTION OR OTHER STATUS

No legislation, regulations, customs, or conditions protect Canadian populations of *Entosthodon rubiginosus*.

In British Columbia, this species is considered imperiled to vulnerable globally (G2G3), and it 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).

The Montana Natural Heritage Program (2002) and NatureServe Explorer (2002) rank this species as G1G3 (ranging between being critically imperiled because of extreme rarity and/or other factors making it highly vulnerable to extinction, and vulnerable because of rarity or restricted range and/or other factors, even though it may be abundant at some of its locations). The Montana Natural Heritage Program (2002) ranks it SH for the state (H = Historical, known only from records over 50 years ago, and it may be rediscovered). *Entosthodon rubiginosus* is listed as G2G3 in a large scale ecosystem plan for the upper Missouri, Yellowstone, and upper Columbia Rivers (MOYOCO), a conservation effort that covers Montana, northern Wyoming, and part of western North Dakota (U.S. Fish and Wildlife Service 2000).

SUMMARY OF STATUS REPORT

Entosthodon rubiginosus is a tiny moss found amongst grasses and other mosses in seasonally wet and open alkaline habitats. This moss has a highly restricted distribution in south-central British Columbia where only four populations have been found. Of these, 3 populations are extant, and 1 may have been lost; the species is not abundant at any known site. The species' habitat is threatened by cattle activity, and all sites examined have been impacted to varying degrees by domestic animals. At least one portion of one population has been lost as result of trampling. The species is Red-listed in British Columbia, and is considered critically imperiled to vulnerable globally.

TECHNICAL SUMMARY

Entosthodon rubiginosus
Rusty cord moss — Entosthodon rouilleux
Range of Occurrence in Canada: BC

Extent and Area Information	
• *Extent of occurrence (EO)(km²)*	20,000 km² (excluding the unconfirmed site)
• *Specify trend in EO*	unknown
• *Are there extreme fluctuations in EO?*	no
• *Area of occupancy (AO) (km²)*	±0.01 km² based on actual size of habitat
• *Specify trend in AO*	unknown
• *Are there extreme fluctuations in AO?*	unknown
• *Number of known or inferred current locations*	3 (White Lake, SE of Princeton, south of Riske Creek)
• *Specify trend in #*	Stable? (The Kamloops population was not relocated)
• *Are there extreme fluctuations in number of locations?*	No
• *Specify trend in area, extent or quality of habitat*	White Lake is stable. Princeton is heavily disturbed in places and a portion of the population has been lost. Riske Creek appears stable.
Population Information	
• *Generation time (average age of parents in the population)*	unknown, but species is possibly perennial
• *Number of mature individuals* The species may be difficult to detect, therefore population sizes may be underestimated.	<24 total <20 at White Lake 1 at Riske Creek 3 at Princeton
• *Total population trend:*	Unknown
• *% decline over the last/next 10 years or 3 generations.*	Unknown
• *Are there extreme fluctuations in number of mature individuals?*	Unknown
• *Is the total population severely fragmented?*	Yes
• *Specify trend in number of populations*	Unknown
• *Are there extreme fluctuations in number of populations?*	Unknown
List populations with number of mature individuals in each	see number of mature individuals, above
Threats (actual or imminent threats to populations or habitats)	
Impacts of cattle; it is not known what level of disturbance the species can withstand and continue to persist at a site. Development, road building, off road vehicles.	
Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* Type locality in Montana has not been relocated.	
• *Is immigration known or possible?*	not likely
• *Would immigrants be adapted to survive in Canada?*	Yes
• *Is there sufficient habitat for immigrants in Canada?*	Yes
• *Is rescue from outside populations likely?*	No
Quantitative Analysis	Not applicable

Previous Status
COSEWIC: none
NatureServe: critically imperiled – highly vulnerable globally
Montana : SH

Status and Reasons for Designation

Status: Endangered	**Alpha-numeric code:** B2ab(iii); C2a(i); D1

Reasons for Designation:
This species is endemic to western North America where it occurs in southern British Columbia, and has been reported from Montana, Arizona, and New Mexico. This moss has a highly restricted distribution in south-central British Columbia where only four populations have been found. Of these, three populations are extant, and one was not relocated; the species is not abundant at any known site. The species' habitat is a narrow band of shoreline dominated by grasses and other mosses in seasonally wet, alkaline habitats. Two populations have been affected by trampling by horses or cattle, and all sites examined have been impacted to varying degrees by domestic animals. At least a portion of one population has been lost as result of trampling by domestic animals.

Applicability of Criteria

Criterion A (Declining Total Population): Not applicable, does not meet criteria for decline.

Criterion B (Small Distribution, and Decline or Fluctuation): Meets thresholds for Endangered, 2 (area of occupancy less than 100 m²) a (severely fragmented) b, iii (decline in quality of habitat in two populations).

Criterion C (Small Total Population Size and Decline): Meets thresholds for Endangered, 2a(i) (number of individuals < 2500 and no population estimated to contain > 250 individuals).

Criterion D (Very Small Population or Restricted Distribution): Meets threshold for Endangered, D1 (number of individuals < 250).

Criterion E (Quantitative Analysis): Not available.

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Fred Knezevich provided field assistance in the Cariboo Forest Region. Ole Westby and Paul Kroeger provided assistance at the White Lake site. Wynne Miles provided editorial comments on the manuscript.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Dr. Terry McIntosh completed his Ph. D. in 1985 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 sixteen 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

Duplicates of collection 1 (in possession of T. McIntosh) as well as collection 4 will be deposited into the UBC Herbarium.

1. *Entosthodon rubiginosus* (Williams) Grout
Accession number: B89097
Locality: Around White Lake West of Okanagan Falls
Habitat: Clay soil crust near lake.
Collector: T. T. McIntosh with A. Kruckeberg
Collection number: 4131
Collection date: 7 June 1980
Determination by: T.T. McIntosh (1982)
Confirmation: A. Fife
Notes: By A. Fife: “Material scant but comparing very well with William’s type at the Field Museum.”

2. *Entosthodon rubiginosus* (Williams) Grout
Accession number:
Locality: Near Princeton
Habitat: on soil near alkaline pond
Collector: T. T. McIntosh and A. Kruckeberg
Collection number: 4482
Collection date: July 25, 1980
Determination by: T.T. McIntosh

3. *Entosthodon rubiginosus* (Williams) Grout
Accession number:
Locality: N of Tranquille, NW Kamloops
Habitat: on damp soil along track in grassland
Collector: T. T. McIntosh
Collection number: 7015
Collection date: July 9, 1981
Determination by: T.T. McIntosh

4. *Entosthodon rubiginosus* (Williams) Grout
Accession number:
Locality: Cariboo Forest Region, south of Riske Creek
Habitat: on soil amongst mosses and litter in widespread seasonally wet, alkaline area on east facing gentle slope; in alkali salt grass (*Distichlis stricta*) and field sedge (*Carex praegracilis*) sward; associated mosses: *Pottia heimii*, *Drepanocladus* sp., *Funaria* sp., and *Conardia compacta*.
Collector: T. T. McIntosh with F. Knezevich
Collection number: 8078
Collection date: October 17, 2002
Determination by: T.T. McIntosh

Record of work

Field work related to this Report was completed in 2002, on or during the following dates and at the locations noted in brackets: May 15 – 18 (south Okanagan Valley, including White Lake), July 29 – 31 (Okanagan area), October 7 - 9 (Okanagan area), October 14 (Ashcroft area), October 16 – 20 (Cariboo Region and Kamloops area), November 9 – 10 (Cranbrook area), and December 22 – 24 (south Okanagan area).

Total search effort at specific sites for this report: Riske Creek 3 hrs; Princeton 4 hrs; White Lake 5 hrs. This represents minimum search at White Lake, where more than 24 hours have been spent in prior years.