

COSEWIC
Assessment and Status Report

on the

Bent Spike-rush
Eleocharis geniculata

Great Lakes Plains population
Southern Mountain population

in Canada



ENDANGERED
2009

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:

COSEWIC. 2009. COSEWIC assessment and status report on the Bent Spike-rush *Eleocharis geniculata*, Great Lakes Plains population and Southern Mountain population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 30 pp.
(www.sararegistry.gc.ca/status/status_e.cfm).

Production note:

COSEWIC acknowledges Terry McIntosh, Michael J. Oldham, and Curtis Björk for writing the status report on the Bent Spike-rush (*Eleocharis geniculata*) in Canada, prepared under contract with Environment Canada, overseen and edited by Erich Haber, Co-chair, COSEWIC Vascular Plants Specialist Subcommittee.

For additional copies contact:

COSEWIC Secretariat
c/o Canadian Wildlife Service
Environment Canada
Ottawa, ON
K1A 0H3

Tel.: 819-953-3215
Fax: 819-994-3684
E-mail: COSEWIC/COSEPAC@ec.gc.ca
<http://www.cosewic.gc.ca>

Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur l'éléocharide géniculée (*Eleocharis geniculata*), population des plaines des Grands Lacs et population des montagnes du Sud, au Canada.

Cover photo:
Bent Spike-rush — Photograph by T. McIntosh.

©Her Majesty the Queen in Right of Canada, 2009.
Catalogue No. CW69-14/581-2009E-PDF
ISBN 978-1-100-12947-1



Recycled paper



COSEWIC Assessment Summary

Assessment Summary – April 2009

Common name

Bent Spike-rush - Great Lakes Plains population

Scientific name

Eleocharis geniculata

Status

Endangered

Reason for designation

Only two extant Ontario populations are known for this annual species of the sedge family. The total population consists of possibly fewer than 2500 plants. They occur mainly in sandy wet habitats along ponds and in damp open meadows over an area of only about 2000 square metres. The habitat is declining due to the spread of the invasive, introduced form of Common Reed, an aggressive exotic grass.

Occurrence

Ontario

Status history

Designated Endangered in April 2009. Assessment based on a new status report.

Assessment Summary – April 2009

Common name

Bent Spike-rush - Southern Mountain population

Scientific name

Eleocharis geniculata

Status

Endangered

Reason for designation

Only a single population of this annual species of the sedge family is known from a seasonally flooded wetland complex within a sandy spit at Osoyoos Lake, BC. Approximately 10,000 small plants are restricted to an area of about 1200 square metres where they are at risk from stochastic events and the potential impacts from the spread of exotic grasses.

Occurrence

British Columbia

Status history

Designated Endangered in April 2009. Assessment based on a new status report.



COSEWIC
Executive Summary

Bent Spike-rush
Eleocharis geniculata

Great Lakes Plains population
Southern Mountain population

Species information

Bent Spike-rush (*Eleocharis geniculata*) is a small, tufted annual sedge composed of numerous slender stalks (culms). Stalks are usually terminated by a single spikelet composed of bisexual flowers that produce black achenes (small dry fruitlets). Each achene is tipped with a flat and fairly wide tubercle. The black achenes separate this species from most other tufted Canadian species of *Eleocharis*. Until recently, collections of this species from Osoyoos Lake, British Columbia, had been identified as the Purple Spike-rush (*E. atropurpurea*), but research has shown this to be in error.

Distribution

Bent Spike-rush is a pantropical species and is fairly widespread in the southern parts of North America. In Canada, it has been reported from one location in British Columbia (on Osoyoos Indian Band property on the east shore of Osoyoos Lake) and from three sites in south-western Ontario along the northern shore of Lake Erie: Long Point National Wildlife Area, Cedar Springs, and at an historical site in Rondeau Provincial Park. Two designatable units (DU) are considered in this report: the Southern Mountain DU (British Columbia) and the Great Lakes Plains DU (Ontario). The total estimated area of habitat occupied in Canada is 1200 m² in BC and 2000 m² in Ontario. The Index of Area of Occupancy based on a 2x2 km grid is 16 km² (4 km in BC and 12 km in ON).

Habitat

In British Columbia, Bent Spike-rush has been found on soil at the edges of open ephemeral pond wetland complexes within the Bunchgrass Biogeoclimatic Zone. These ponds are flooded throughout much of the year, usually drying during the spring and summer, although sometimes they flood again in late summer. In Ontario, this species is found on wet, sandy to muddy soil in open flats on or along the edges of ephemeral

ponds and wet meadows in the Deciduous Forest Region (Carolinian Zone). The Cedar Springs site appears to be an old sandpit. In British Columbia, the species' habitat appears stable, but in Ontario the habitat is threatened by extensive invasions of the exotic strain of Common Reed (*Phragmites australis*).

Biology

Bent Spike-rush grows each year from overwintering achenes. Plants grow into early autumn and produce flowers and achenes, then wither and die during the onset of winter. Not all achenes that are produced germinate the following year. Some remain dormant, sometimes for many years, as a seedbank in the soil. Bent Spike-rush depends on a seedbank for its long-term persistence. Annual plants often have wide fluctuations in plant size and numbers, and the numbers of flowers and achenes produced from year to year. Dispersal is through movement of achenes as there is no means of asexual reproduction in this species.

Population sizes and trends

Searches have been completed for Bent Spike-rush at many sites in British Columbia over the past few years. In Ontario, all three known sites for this species were surveyed in 2007. Three extant and one historical populations are known in Canada. In British Columbia, the estimated number of mature individuals in 2007 was >10,000. In Ontario, the estimated number of mature individuals in 2007 at Cedar Springs is 300-500 and at Long Point 1,000-2,000 plants. The range in British Columbia appears not to have changed over the short term, but has probably declined historically. The range in Ontario appears to be shrinking as available habitat is lost to invasion by Common Reed.

Limiting factors and threats

The main natural limiting factor across the Canadian range of Bent Spike-rush is its restriction to a rather specific and geographically limited habitat. In British Columbia, trampling and soil disturbance by cattle and horses, human-related disturbances, invasive plants, especially grasses, and artificial management of the water levels of Lake Osoyoos are threats. The greatest threat to populations in Ontario is the rapid invasion of known and potential habitat by Common Reed.

Special significance of the species

The Canadian populations of Bent Spike-rush are the most northern occurrences for this species in North America, and, because these populations are disjunct from southern populations, the gene pools of these populations are potentially important in terms of genetic variability, environmental adaptations, and long-term persistence of the species.

Existing protection or other status designations

The BC population is protected within a fenced area by the Osoyoos Indian Band. In Ontario, the Long Point National Wildlife Area population of the Bent Spike-rush is protected under federal legislation. There is no known protection for this species at Cedar Springs.



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 (2009)

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.



Environment
Canada

Canadian Wildlife
Service

Environnement
Canada

Service canadien
de la faune

Canada

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

COSEWIC Status Report

on the

Bent Spike-rush *Eleocharis geniculata*

Great Lakes Plains population
Southern Mountain population

in Canada

2009

TABLE OF CONTENTS

SPECIES INFORMATION.....	3
Name and classification.....	3
Morphological description.....	4
Genetic description.....	6
Designatable units.....	7
DISTRIBUTION.....	7
Global range.....	7
Canadian range.....	11
HABITAT.....	12
Habitat requirements.....	12
Habitat trends.....	14
Habitat protection/ownership.....	15
BIOLOGY.....	16
Life cycle and reproduction.....	16
Physiology.....	17
Dispersal.....	17
Interspecific interactions.....	17
Adaptability.....	17
POPULATION SIZES AND TRENDS.....	17
Search effort.....	17
Abundance.....	18
Fluctuations and trends.....	19
Rescue effect.....	20
LIMITING FACTORS AND THREATS.....	20
Threats in the Southern Mountain DU.....	20
Threats in the Great Lakes Plains DU.....	21
SPECIAL SIGNIFICANCE OF THE SPECIES.....	22
EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS.....	22
TECHNICAL SUMMARY - Great Lakes Plains DU.....	23
TECHNICAL SUMMARY - Southern Mountain DU.....	25
ACKNOWLEDGEMENTS AND AUTHORITIES CONSULTED.....	27
Authorities consulted.....	27
INFORMATION SOURCES.....	27
BIOGRAPHICAL SUMMARY OF REPORT WRITERS.....	29
COLLECTIONS EXAMINED.....	30

List of Figures

Figure 1.	Plants of <i>Eleocharis geniculata</i> at Long Point, Ontario	4
Figure 2.	Photograph of achenes and scales of <i>Eleocharis geniculata</i>	5
Figure 3.	The generalized range of <i>Eleocharis geniculata</i> in North America by state and province	8
Figure 4.	The distribution of <i>Eleocharis geniculata</i> in British Columbia (DU 1).....	9
Figure 5.	The distribution of <i>Eleocharis geniculata</i> in Ontario (DU 2).....	10
Figure 6.	Invasion of <i>Eleocharis geniculata</i> habitat by Common Reed at Long Point, Ontario.	15

SPECIES INFORMATION

Name and classification

Scientific name: *Eleocharis geniculata* (L.) Roemer & J.A. Schultes, Syst. Veg. 2:150. 1817.

Synonyms: *Eleocharis dispar* E.J. Hill, *Eleocharis capitata* (L.) R. Br. var. *dispar* (E.J. Hill) Fern., *Eleocharis caribaea* (Rottb.) Blake, *Eleocharis caribaea* (Rottb.) Blake var. *dispar* (E.J. Hill) Blake, *Scirpus geniculata* L. Although most recent treatments use *E. geniculata* for Bent Spike-rush (e.g., Menapace 2002), a few authors continue to use *E. caribaea* (e.g., Gleason and Cronquist 1991, Crow and Hellquist 2000, Mohlenbrock 2001). According to Menapace (2002, based on Wilson 1990), the name *E. caribaea* is misapplied; however, Gleason and Cronquist (1991) consider *E. geniculata* to be misapplied.

Common name: English: Bent Spike-rush (from Menapace 2002); also known as Canada Spikesedge, Caribbean Spike-rush, Annual Spike-rush, and Pantropic Spike-rush. French: éléocharide géniculée, éléocharide coudé.

Family: Cyperaceae (the Sedges)

Major plant group: Monocot flowering plant

Taxonomic history in Canada: Until 2007, collections of this species from the shores of Osoyoos Lake in British Columbia had been identified as the Purple Spike-rush, *Eleocharis atropurpurea* (e.g., Hitchcock *et al.* 1969, Douglas *et al.* 2001). An interim status report had been completed for the Purple Spike-rush (COSEWIC 2006). However, in 2007, the original 1939 collections as well as more recent specimens from Osoyoos were examined by T. McIntosh. These collections were compared with material of both *E. atropurpurea* and the similar *E. geniculata* from the United States based on a suggestion by C. Björk. It was determined that all of the material collected through time from the Osoyoos Lake area was *E. geniculata*. This identification was confirmed by A.A. Reznicek, University of Michigan (pers. comm. 2007). *Eleocharis geniculata* was first reported from Canada by Taylor (1935, as *E. caribaea* var. *dispar*) based on a 1934 collection by R.F. Cain (GH, TRT) from Rondeau Provincial Park, Kent County (now Chatham-Kent), Ontario.

Morphological description

Eleocharis geniculata is a small, 2 - 15 (20) cm tall, tufted, non-rhizomatous sedge (Figure 1). Individual plants are composed of numerous photosynthetic, slender culms (stems), and a dense underground patch of short roots. Each stem has two basal leaves, but these are non-photosynthetic and highly reduced, represented only as tiny, sharply-pointed sheaths. Culms are usually flower-bearing, terminated by a single, usually 3-7 mm long, ovoid and rounded or slightly pointed spikelet. The individual spikelets are composed of a central axis, flowers, and 1.5 - 2 mm long scales. Its flowers are bisexual, having both male and female organs. Following fertilization, black, shiny, and smooth achenes are produced (Figure 2). Each achene is tipped with a flat and fairly wide tubercle. González-Elizondo and Reznicek (1996) described forma *brunnea* from Venezuela. This form has brown to reddish brown rather than shiny black achenes and is known only from Venezuela.



Figure 1. Plants of *Eleocharis geniculata* at Long Point, Ontario (photograph by T. McIntosh).



Figure 2. Photograph of achenes and scales of *Eleocharis geniculata* (from 2006 collection at Osoyoos Lake; photograph by T. McIntosh).

Plants from wet sand near Lake Michigan in Lake County, Indiana, were described as *Eleocharis dispar* E.J. Hill (Hill 1882) and later renamed as *E. capitata* (L.) R. Br. var. *dispar* (E.J. Hill) Fernald (Fernald 1906) and *E. caribaea* (Rottb.) Blake var. *dispar* (E.J. Hill) Blake (Blake 1918). This entity has not been recognized in the recent treatment of *E. geniculata* by Menapace (2002). The variety differs from the type description of *E. geniculata* in having purplish-brown scales and purplish-black achenes (vs. yellow to pale-brown scales and lustrous black achenes in the type). Plants matching var. *dispar* have also been reported from Illinois (Mohlenbrock 2001), Michigan and Indiana (Hermann 1935), and Ontario (Taylor 1935). A recent examination of specimens by

Dr. A.A. Reznicek (pers. comm. 2007) supports the view that plants matching var. *dispar* from the Great Lakes region probably should not be recognized as a separate taxon. The purplish scale colour characterizing *E. dispar* may be related to climate. Dr. Reznicek found that some plants well beyond the range of *E. dispar* also had reddish or purple-tinted scales, including plants from British Columbia, the mountains of New Mexico, Florida, and temperate Argentina. These specimens were either from regions with a temperate climate or were collections made in winter. Also, no colour differences in the achene could be distinguished by Dr. Reznicek between plants from the Great Lakes region and those elsewhere in the range of *E. geniculata*. Dr. Reznicek's conclusion on the taxonomic validity of *E. dispar* is that "Great Lakes region plants are widely disjunct, but the color difference is related to the temperate climate.... I don't think the Great Lakes region *Eleocharis* is likely to be worth recognizing as a separate entity, although it is very likely that it is genetically differentiated to some degree, and therefore still worth treating separately from the BC plants." (A.A. Reznicek, pers. comm. 2007).

The dark colour of the fruit separates this species from other tufted species of *Eleocharis* that have been reported from Canada. However, it has been confused with *E. atropurpurea*, a species that has a similar distribution to the south and which may at some point be found in Canada. Both species are tufted, small, annual sedges and have black achenes at maturity. *Eleocharis geniculata*, however, can be distinguished from *E. atropurpurea* by achene and other characters. Achenes of *E. geniculata* are typically longer (0.7–1.1 mm vs. 0.3–0.5 mm in *E. atropurpurea*), its tubercles are always bigger, wider, and flatter than in *E. atropurpurea*, its spikelet scales are consistently larger (1.5 - 2 mm vs. 1 mm long in *E. atropurpurea*), and its spikelets are rounder, usually blunter, and often shorter than those of *E. atropurpurea*.

In Ontario, *Eleocharis geniculata* can be confused with the superficially similar *E. flavescens* var. *olivacea* with which it sometimes grows. *Eleocharis flavescens* var. *olivacea*, however, has olive-green to brown achenes and a green tubercle. Also, *E. flavescens* var. *olivacea* is a perennial with thin stolons whereas *E. geniculata* is an annual and lacks stolons.

Genetic description

No genetic studies have been conducted on *E. geniculata*.

Designatable units

Two designatable units (DUs) are considered for *E. geniculata* in this report: the Southern Mountain designatable unit (British Columbia) and the Great Lakes Plains designatable unit (Ontario). This division is based on the occurrence of the eastern and western populations in two widely separated COSEWIC National Ecological Areas (Southern Mountain EA in BC and Great Lakes Plains EA in Ontario) and on the fact that populations in each region are also relatively widely disjunct from their nearest populations in the United States. The BC population is in fact the most northerly occurrence of the species in North America with the nearest populations occurring in Nevada and southern California. Even within the conterminous US states, the distributional pattern based on county occurrences is highly fragmented (USDA, NRCS 2009) and potentially reflects localized adaptations. This pantropical species does exhibit variation in spikelet scale and achene colouration across its range (cf. discussion on *E. dispar* and the form of *E. geniculata* described from Venezuela above). Some specimens at the northern edge of the species' range in more temperate regions, as in BC, ON and some north-central US states, differ from the type specimens in spikelet and achene colouration. Such differences may reflect genetic differences from populations further south in more warm-temperate or tropical regions. That there may very well be a genetic distinctness between plants representing the two DUs within Canada is inferred from the observation that the bimodal distribution reflected by the BC and ON populations likely reflects a different historical origin for the DUs in these provinces.

DISTRIBUTION

Global range

Eleocharis geniculata is a pantropical species and is widespread in the southern parts of North America (Menapace 2002, NatureServe 2007). However, it is uncommon to rare in the northern portions of its North American range. Outside North America, *E. geniculata* is known from the West Indies, Bermuda, Central and South America, Asia, Africa, Pacific Islands (including Hawaii), and Australia (Svenson 1929, Menapace 2002). According to Svenson (1957), *E. geniculata* is the most widespread species of *Eleocharis*.

Figure 3 illustrates the generalized range of *E. geniculata* in North America. In Canada, it has been reported from the east side of Osoyoos Lake, British Columbia (Figure 4), and along the shores of Lake Erie, Ontario (Figure 5).

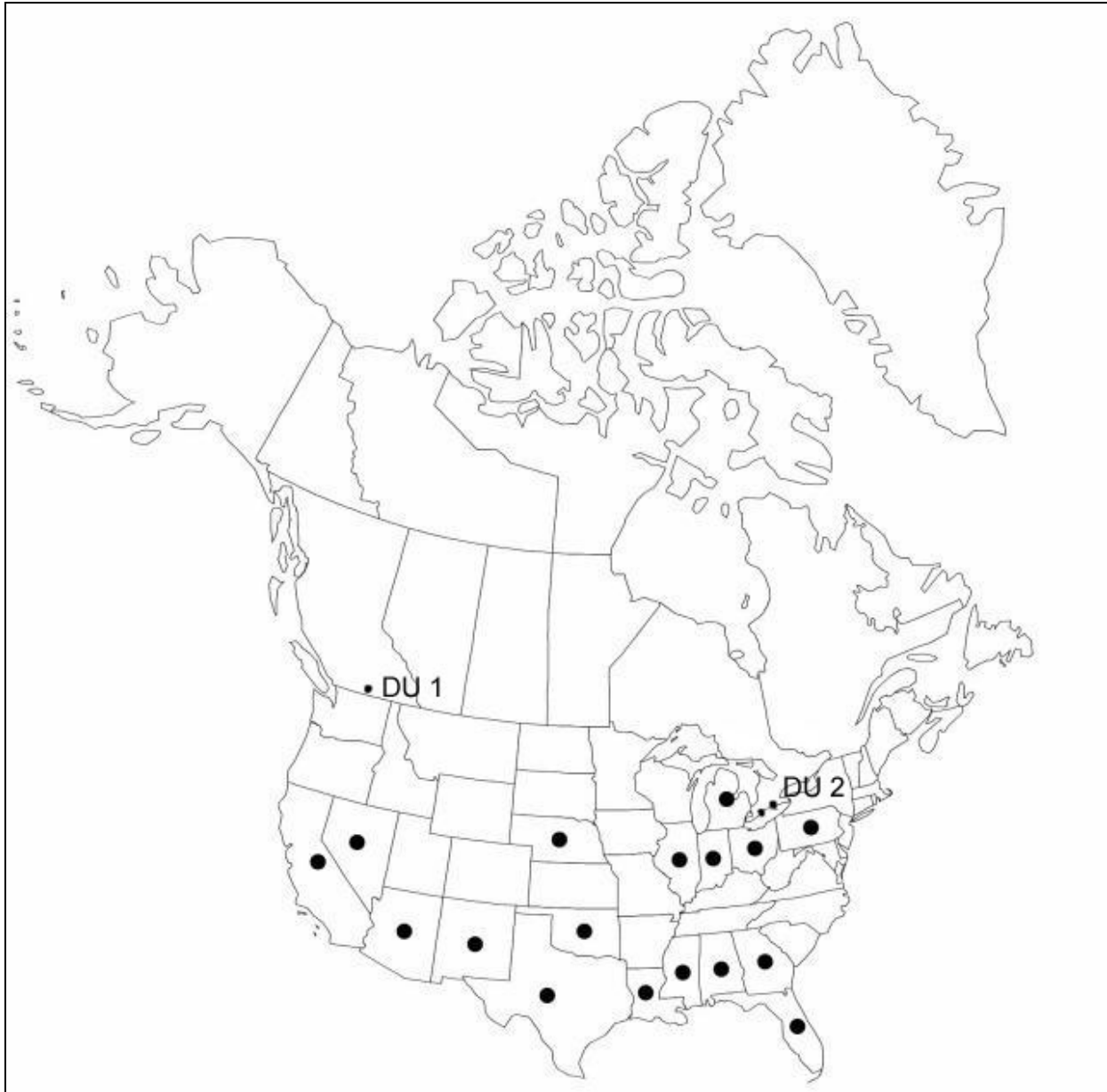


Figure 3. The generalized range of *Eleocharis geniculata* in North America by state and province (Smith *et al.* 2003); the larger black dots refer to presence in a state, not the actual location in that state).

Note: No range map of the actual distribution of the species is available for this species. Figure 3, based on the recent treatment in the Flora North America (FNA) by Smith *et al.*, differs from that in NatureServe 2007 in that no occurrences are listed in the NatureServe map for Nevada and Nebraska; NatureServe also includes the species in South Carolina and in Kansas but these occurrences have not been verified in the FNA treatment.

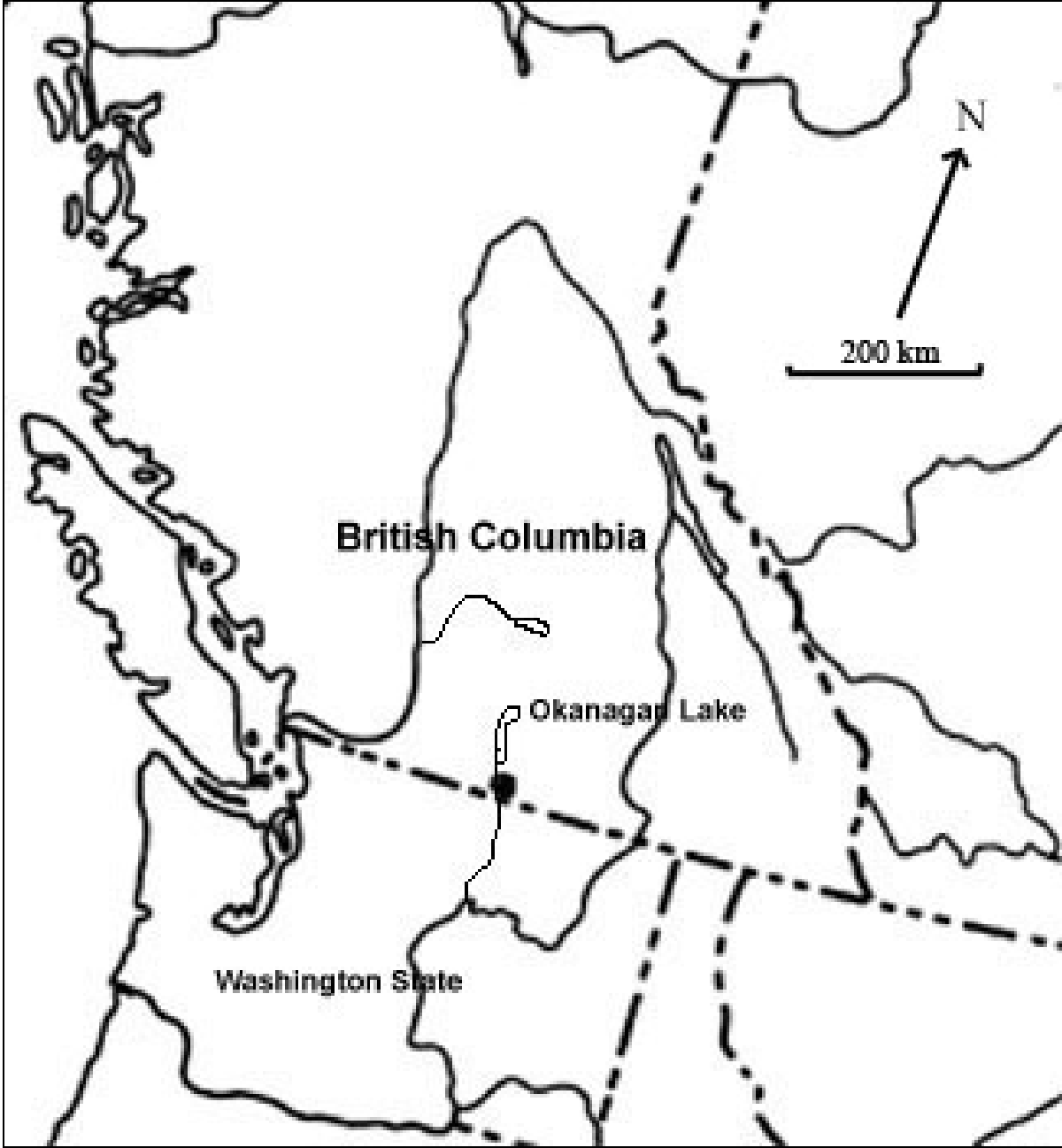


Figure 4. The distribution of *Eleocharis geniculata* in British Columbia (DU 1).

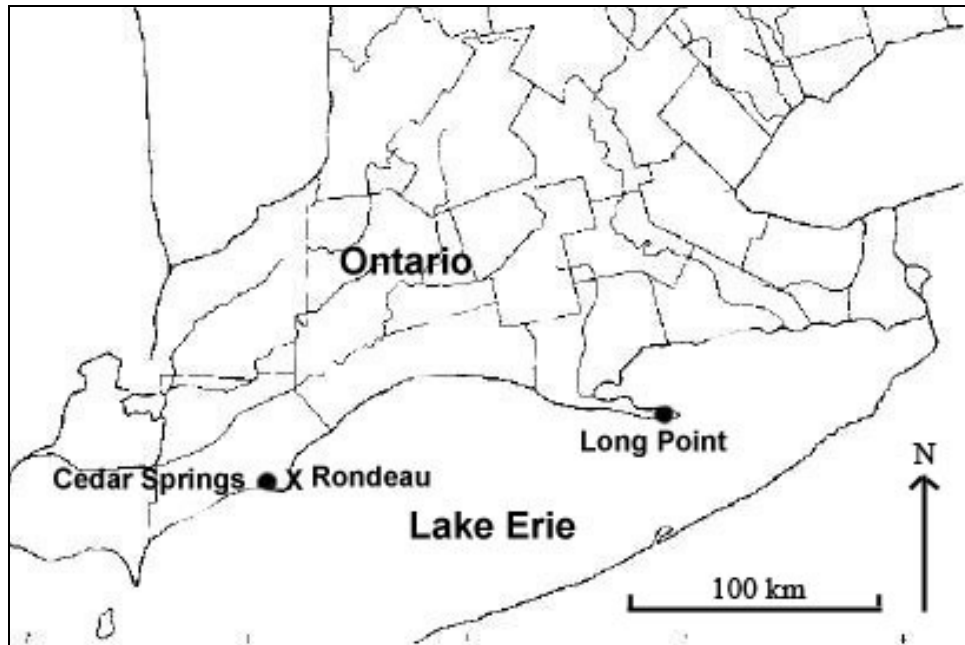


Figure 5. The distribution of *Eleocharis geniculata* in Ontario (DU 2; X = probably extirpated site at Rondeau).

The closest reported occurrence to the British Columbia population of *Eleocharis geniculata* is southern California. Although *E. atropurpurea* has been reported from Washington State (Hitchcock *et al.* 1969), this may also be a misidentification of *E. geniculata*, but this has not been confirmed as the specimen from Washington State has not been located.

The Ontario populations are part of a cluster of occurrences around the lower Great Lakes in Illinois, Indiana, Michigan, Ohio, and Pennsylvania, which are well-separated from populations further south in the U.S. In the southern U.S., the species occurs from South Carolina, Georgia, and Florida west to southern California with a few inland records in Oklahoma, Kansas, and Nebraska. The species has also been reported from North Carolina (Fernald 1950), Maryland (Brown and Brown 1984), and New Jersey (NatureServe 2007), although perhaps in error because these states are not listed by Menapace (2002). There are no documented records from New Jersey (D. Snyder pers. comm. 2007) and the only Maryland record is the Brown and Brown (1984) literature report that remains unverified (C. Frye pers. comm. 2007). There are no recent records from North Carolina (R. LeBlond, B. Sorrie, and A. Weakley 2007 pers. comm.) and its occurrence there rests on a statement in “Gray’s Manual” (Fernald 1950) that the species ranges “n. to N.C.”. In North America, *E. geniculata* is probably most common in Florida (where mapped from 33 of 67 counties by Ward and Leigh 1975) and Texas (where mapped from 32 of 254 counties by USDA 2007).

Canadian range

In Canada, *E. geniculata* has been reported from one location in British Columbia on Osoyoos Indian Band property on the east side of Osoyoos Lake, and from three sites in south-western Ontario along the northern shore of Lake Erie (Figure 4 and 5).

In British Columbia, *E. geniculata* was first collected in 1939 (and identified as *E. atropurpurea* at that time) by J. W. Thompson. It was observed and collected at the same location by A. Ceska in 1980 and 1991 (specimens from both years were deposited by A. Ceska at the Royal BC Museum Herbarium as *E. atropurpurea*). Although G. Douglas indicated that he had not seen the species at the Osoyoos site for several years (COSEWIC 2006), it was confirmed again at this site in 2005, 2006, and 2007 by C. Björk and T. McIntosh.

In Ontario, *E. geniculata* has been reported from Long Point National Wildlife Area, at a historic site in Rondeau Provincial Park, and at Cedar Springs, south-west of Blenheim (Figure 5). The Long Point and Rondeau sites are located on the shoreline of Lake Erie and the Cedar Springs site is located on an old glacial Lake Warren shoreline beach ridge, sometimes referred to as the Blenheim Moraine. It was first collected in Ontario at Rondeau Provincial Park in 1934 (Taylor 1935), but has not been relocated there because, despite several specific searches over multiple years (including in 2007), it may be extirpated at that site. It was reported from Long Point by Reznicek and Catling (1989) where it was first observed in 1979. The Cedar Springs population was first found in 1996 by M.J. Oldham and A.W. Cusick (specimens at DAO, MICH, TRT, WIS; all herbarium acronyms listed in Holmgren and Holmgren 1998).

The Canadian range currently makes up less than one percent of the species' total North American range. The Extent of Occurrence of *E. geniculata* populations in Canada, based on field observations and UTM data, is approximately 7.7 km². Of this, 1 km² occurs in BC and 6.7 km² in Ontario. The Ontario value is based on a polygon including the Long Point population and the Cedar Springs population but excludes all of the intervening area of Lake Erie. The estimated area of habitat occupied by the known populations is approximately 1200 m² in BC and 2000 m² in Ontario. The Index of Area of Occupancy in Canada, as determined by a 1x1 km grid overlay, is equivalent to 5 km² (1 km² in BC and 4 km² in ON) and 16 km² using a 2x2 grid (4 km² in BC and 12 km² in ON).

It should be noted that the bimodal distributional pattern is not unique to this species which occurs with such endangered species listed under the federal *Species at Risk Act* (SARA) as: Toothcup (*Rotala ramosior*), Scarlett Ammannia (*Ammannia robusta*) and Small-flowered Lipocarpha (*Lipocarpha micrantha*).

HABITAT

Habitat requirements

Globally, *E. geniculata* is a wetland species that is found on sand or soil along the edges of ponds and lakes, along canal, river, and creek banks, in dune and other types of depressions, lagoons, and mud flats, and in irrigation ditches and rice fields (Menapace 2002, COSEWIC 2006). Usually, these habitats are flooded through the early parts of the year and dry out into the summer or autumn exposing the wet soils of receding shorelines necessary for the growth of *E. geniculata*. In Canada, this species is restricted to open, sandy or silty-sandy (muddy) soils that are free from competition from taller and more aggressive vascular plants.

In British Columbia, it has been found on wet, silty-sandy soil at the edges of open ephemeral pond wetland complexes on a broadly triangular spit that stretches into Osoyoos Lake. The ponds are flooded throughout much of the winter and dry into the summer, but usually flood again in late summer or early autumn as a result of lake level changes or late discharge groundwater from the mountains to the east of the lake. They subsequently dry down again into the autumn following this flooding event. The drying down events expose the soils necessary for the growth of *E. geniculata*. The pond complexes are isolated from the lake by sand dunes and vegetated flats. This species may require the calmer water conditions that characterize the ponds and which are protected from the wave action found along Osoyoos Lake. It may also require the more complex silty-sandy soils that are found in the ponded areas; the lakeshore is primarily composed of sand. The pH of the surficial soil (taken during fieldwork in 2007) was ~8.0 at one site and ~7.0 at a second site. This habitat lies within semi-arid shrub-steppe ecosystem in the Bunchgrass Biogeoclimatic Zone (Iverson and Haney 2005).

In Ontario, *E. geniculata* has been found on wet, sandy to muddy soil in open flats on or along the edges of ephemeral ponds and wet meadows in the Carolinian Zone or Deciduous Forest Region. Populations at Long Point and Rondeau (historically) are probably somewhat dependent on fluctuating Great Lakes water levels. The Cedar Springs site appears to be an old, human-made sandpit located on an ancient beach ridge about 1.7 km inland from the current Lake Erie shoreline.

Numerous, mostly low-growing plant species are associated with *E. geniculata* habitat. In British Columbia, the presence of SARA-listed endangered plant associates is significant; they include: Scarlet Ammannia and the Short-rayed Alkali Aster (*Symphyotrichum frondosum*), as well as, occasionally, Toothcup and Small-flowered Lipocarpha. Additional associates include Green Sedge (*Carex viridula*), Many-headed Sedge (*C. sychnocephala*), Needle Spike-rush (*Eleocharis acicularis*), Creeping Spike-rush (*E. macrostachya*), Ovate Spike-rush (*Eleocharis ovata*), Torrey's Rush (*Juncus torreyi*), Jointed Rush (*J. articulatus*), American Bulrush (*Schoenoplectus pungens*), Western Goldenrod (*Euthamia occidentalis*), Nodding Beggarticks (*Bidens cernua*), and Shore Buttercup (*Ranunculus cymbalaria*). Few introduced plants are present and include Sow-thistle (*Sonchus* sp.), Reed Canary Grass (*Phalaris arundinacea*), and Creeping Bentgrass (*Agrostis stolonifera*).

In Ontario, frequent native associates of *E. geniculata* include Green Spike-rush (*Eleocharis flavescens* var. *olivacea*), Elliptic-fruited Spike-rush (*E. elliptica*), Square-stemmed Spike-rush (*E. quadrangulata*), Low Nut-rush (*Scleria verticillata*), Needle Beak Sedge (*Rhynchospora capillacea*), Green Sedge, Twig-rush (*Cladium mariscoides*), Shining Flat Sedge (*Cyperus bipartitus*), Slender Fimbry (*Fimbristylis autumnalis*), Northern Green Rush (*Juncus alpinus*), Witch Grass (*Panicum capillare*), Tuckerman's Witch Grass (*P. tuckermanii*), Greater Canadian St. John's-wort (*Hypericum majus*), Northern Water-horehound (*Lycopus uniflorus*), Small-flower False Foxglove (*Agalinis paupercula*), Narrowleaf Paleseed (*Leucospora multifida*), Marsh Arrow-grass (*Triglochin palustre*), Fall Sneezeweed (*Helenium autumnale*), and Horned Bladderwort (*Utricularia cornuta*). Inverted Bladderwort (*Utricularia resupinata*) was a common to locally abundant associate of *E. geniculata* at Long Point in 1994 and 1995 in ponds between Gravelly Bay and the eastern end of the point (D.A. Sutherland pers. comm. 2008). The most prominent invasive plant at all sites in Ontario is the invasive race of Common Reed (*Phragmites australis* ssp. *australis*).

Suitable habitat for *E. geniculata* appears to be rare in British Columbia. Although there is extensive shoreline habitat in the semi-arid interior portions of the province, few shorelines appear to have the flats or spits with isolated ponds that *E. geniculata* requires. The only other known similar habitats are found at the north-west end of Osoyoos Lake. The apparent restriction to these habitats is supported by field research. Between 2005 and 2007, C. Björk and T. McIntosh investigated numerous shoreline habitats in the Okanagan Valley, Thompson Plateau, Shuswap Lake, and Similkameen Valley, and did not observe this species outside of its known site. Earlier, R. and B. Klinkenberg conducted searches for this species along lake and pond shorelines from Osoyoos to Salmon Arm in the north Okanagan Valley, but failed to discover any new populations (COSEWIC 2006). However, although the shorelines that were investigated had receded considerably by the time searches were conducted, this species may yet be found in some of these sites as additional drawdown could still have occurred and, because this species exhibits fluctuating numbers from year to year, populations may have been missed.

In Ontario, potential habitat along Lake Erie, such as natural sand beaches and coastal meadows, is uncommon and has been heavily impacted by human activities. Remaining natural and semi-natural moist sandy shoreline habitat along the north shore of Lake Erie (e.g., at Pelee Island, Holiday Beach, Point Pelee, Hillman Marsh, Wheatley, Rondeau, Port Burwell, Turkey Point, Point Abino, and elsewhere) has been searched several times at appropriate times of year by M.J. Oldham and others for *E. geniculata* and other species of moist sandy shorelines. Due to the biology of the species and fluctuating nature of its habitat, it is possible that undiscovered populations exist in southern Ontario, though such populations are likely to be few and small.

Habitat trends

In British Columbia, the extant habitat for *E. geniculata* appears to have declined. Historically, this species probably occurred in similar spits and flooded ponds or meadows alongside Osoyoos Lake that have been lost over the past 100 years or so, mainly through urban or agricultural development. In the late 1990s, A. Ceska (pers. comm. 2007) observed Small-flowered Lipocarpha on the Osoyoos Lake shoreline in the Town of Osoyoos. It was found in a habitat that resembled the flats on the Osoyoos Indian Band land where he had collected *E. atropurpurea* (= *E. geniculata*). This site was filled with sand about a year later and washrooms were built, completely destroying the site. Another site that may have housed *E. geniculata* is a very large, seasonally flooded flat at the north-west end of Osoyoos Lake. This area has been heavily altered through time by livestock and related activities yet the adjacent shoreline still houses a number of plant species often associated with *E. geniculata*, in particular, Alkali Short-rayed Aster, Small-flowered Lipocarpha, Many-headed Sedge, and Ovate Spike-rush.

Osoyoos Lake water levels have been managed since 1987 following the reconstruction of the Zosel Dam in Oroville in Washington State. The management of water levels may, at some point, threaten the habitat for this species but this is unknown at this time. Since at least 2005, although probably since 1987 when lake levels first were managed at the current levels, the shorelines along many portions of the eastern shore of Osoyoos Lake, including the spit, have been slowly eroding. This was likely due to wave action as a consequence of the more or less constant lake level through the summer. In the past, natural lake level fluctuations would have impacted a much wider elevational range along the lakeshore. As a result of the constant water level management, benches have been formed in a number of areas, probably through wave erosion (waves cut away at the once gently sloped shoreline, creating cut benches above a submerged shoreline). Although somewhat isolated and protected from wave action, the habitat of *E. geniculata* may be exposed to wave impact at some point in the future.

In Ontario, because of the very serious invasion of moist open areas by the non-native strain of *Phragmites australis*, habitat quality is declining at all of the known and historical sites (Figure 6). Wilcox *et al.* (2003) documented an exponential increase in Common Reed at Long Point, from 18 ha in 1995 to 137 ha in 1999. Fieldwork in 2007 at Long Point confirmed that *Phragmites* is rapidly invading the moist sandy pond shores and open meadow habitats favoured by *E. geniculata*. The habitat at Cedar Springs may also be lost through invasion by Common Reed, and may be permanently lost if development occurs on this site.



Figure 6. Invasion of *Eleocharis geniculata* habitat by Common Reed at Long Point, Ontario.

Note: The oblong, darker depression below the dense clump of Common Reed (upper centre) and above the footprints in the sand is one site for the species at Long Point. The smaller stems to the left and right growing into the foreground are probably 2007 stems of Common Reed that have developed from underground rhizomes. (photo by T. McIntosh)

Habitat protection/ownership

The BC population of *E. geniculata* is fenced, protecting it from most livestock grazing and trampling. This fence also provides a barrier against some incursions from visitors. Also, the Osoyoos Indian Band has supported Habitat Stewardship Program for

Species at Risk (HSP) conservation efforts since 2004. Most of this HSP work has been focused on invasive plant removal, especially in the sites where rare plant species have been found. Signage that denotes the rarity of the species in this area is located along the shore of the protected area. Various development proposals from the Osoyoos Indian Band have existed for the eastern shoreline of Osoyoos Lake, but, to date, none have gone forward and none involve utilizing the spit area. However, any development of the shoreline site near where the species is found will probably result in increased usage of the site. This may impact the habitat and populations of *E. geniculata*.

In Ontario, most or all of the *E. geniculata* population at Long Point is located in the Long Point National Wildlife Area, which is administrated by the Canadian Wildlife Service, Environment Canada. Some *E. geniculata* plants near the tip of Long Point may be on land owned by Transport Canada or the Ontario Ministry of Natural Resources. *Eleocharis geniculata* is not known from Long Point Provincial Park at the base of the point. Accordingly, the habitat for *E. geniculata* at Long Point is protected under federal legislation (e.g., the *Canada Wildlife Act*) and guidelines. Much of Long Point was designated by UNESCO as a World Biosphere Reserve in 1986, although this designation confers no legal protection. There is no known protection for the habitat of this species at Cedar Springs. The site is adjacent to a baseball diamond, which is probably owned by the local municipality. The historic (extirpated) population at Rondeau is within a provincial park.

BIOLOGY

Life cycle and reproduction

Eleocharis geniculata is an annual plant that grows each year from achenes when conditions are favourable. Plants grow into early autumn, producing flowers and achenes, then wither and die during the onset of winter. Achenes fall from the plant, and are probably buried under a fine layer of soil and/or litter as water levels rise. However, not all achenes germinate the following year. Some remain dormant as a seedbank, germinating when specific environmental signals occur. Dormancy can last for many years, possibly for decades. Annual species such as *E. geniculata* depend on a seedbank for their long-term persistence in habitat. In natural ecosystems of this type, there are always achenes available in the soil to maintain the population over the long term, even through years of adverse growing conditions when few or no plants are produced. Annual plants often have wide fluctuations in plant size and numbers, and the numbers of flowers and achenes produced from year to year. The uncertainty of seed production and germination, combined with the difficulty in assessing the inherent dormancy trends of seed banks, makes populations of annuals such as those of *E. geniculata* difficult to predict on an annual basis. This species does not reproduce asexually.

Physiology

Little is known about the physiology of *E. geniculata*. Observations along Osoyoos Lake suggest that it may require slightly alkaline soil and water conditions; however, this requires confirmation.

Dispersal

Dispersal is through movement of achenes as there is no means of asexual reproduction in this species. Achenes probably fall close to the plant but may be moved around the habitat by water flow or animals. In laboratory conditions, when first wetted, the achenes float, rapidly sink when the water is disturbed, then immediately float back to the surface. After a few hours they sink again and remain submerged. This may indicate that they will not travel long distances effectively. Because *E. geniculata* grows in open habitats, dispersal to other wetlands may occur via the feet of waterfowl. Such movement, or possibly through foraging, has been reported for the genus in Australia (Bell 2000), but this is unknown for *E. geniculata*. The absence of this species in adjacent, otherwise suitable habitats at Long Point suggests that *E. geniculata* normally only disperses over short distances.

Interspecific interactions

There is no information on interspecific interactions between this and other organisms.

Adaptability

Eleocharis geniculata appears adapted to a relatively narrow ecological range/habitat.

POPULATION SIZES AND TRENDS

Search effort

In 2007, searches by T. McIntosh and C. Bjork for rare plant species, including *E. geniculata*, were completed along Okanagan Lake and Thompson River shorelines of British Columbia at a number of sites from August through October. Searches included along the north and west shores of Osoyoos Lake, as well as the east side of Osoyoos Lake on the Osoyoos Indian Reserve. Other sites that were surveyed include Vaseux Lake, Mahoney Lake, Okanagan Lake, and Skaha Lake. In addition, 2 days of intensive search effort (by T. McIntosh, C. Björk, and Ron Hall from the Osoyoos Indian Band) were completed at the known site assessing population and habitat conditions. Numerous additional searches have also been made over the last 10 years in the Okanagan Valley. T. McIntosh and C. Björk have searched for and documented rare plant population and habitat data on the Osoyoos Indian Reserve for the past 3 years.

A. Ceska (pers. comm. 2007) and O. Ceska surveyed Osoyoos Lake shorelines for this and other rare species during the 1980s and 1990s. COSEWIC (2006) notes that G. Douglas conducted botanical work on the spit on the Osoyoos Indian Reserve several times between 1991 and 2004. Between 2002 and 2003, R. and B. Klinkenberg completed a survey in the Okanagan that targeted this species (COSEWIC 2006). They surveyed the following lakes and wetlands during that period: Deadman Lake, Gallagher Lake, Mahoney Lake, Okanagan Lake, Osoyoos Lake, Prather Lake, Shannon Lake, Skaha Lake, Tugunuit Lake, Twin Lakes, Vaseux Lake, White Lake, and others, plus associated wetlands.

On September 7 and 8, 2007 the three known Ontario sites for *Eleocharis geniculata* were surveyed. The Lake Erie shoreline as well as the shore along the Rondeau Bay side were searched at Rondeau Provincial Park's South Beach on September 7 by M.J. Oldham, T. McIntosh, and S. Brinker. M.J. Oldham and T. McIntosh surveyed and gathered population and habitat data for *E. geniculata* at the Cedar Springs site on September 7. A.A. Reznicek, M.J. Oldham, T. McIntosh, and S. Brinker surveyed and gathered population and habitat data at Long Point on September 8. The Long Point surveys consisted of a series of transects into known sites for this species as well as in areas where it had not been observed previously. Over the past twenty-five years, other potentially suitable sites along the Lake Erie shore in Ontario have been specifically searched for this species by M.J. Oldham and others at the appropriate time of year, often multiple times. Sites searched include Lighthouse Point and Fish Point on Pelee Island, Point Pelee National Park, Big Creek Conservation Area, Turkey Point, Port Burwell Provincial Park, and Point Abino and other shoreline sites in the Niagara area.

Although *E. geniculata* has not been specifically searched for in other Canadian provinces, it is unlikely to occur elsewhere in the country. This is surmised from the fact that the extensive collections of the genus, made over a period of many decades from across Canada and housed at major herbaria, only include collections from the sites documented in this report. As well, the records of occurrence across North America for this pantropical species are highly disjunct with the nearest populations to those in Canada being present only in Pennsylvania, Ohio, and Michigan where the species is also rare.

Abundance

Three extant populations and one historic population are known in Canada. In British Columbia, the estimated number of mature individuals in 2007, based on visual estimates during walking transect surveys by C. Bjork and T. McIntosh, is >10,000. These are all part of a single population.

In Ontario, the estimated number of mature and fruiting individuals in 2007 at Cedar Springs is 300-500 and at Long Point 1,000-2,000 plants. These estimates are based on visual estimates during walking surveys by M.J. Oldham and T. McIntosh at Cedar Springs and by M.J. Oldham and A.A. Reznicek at Long Point. Each of these locations is considered a single population. Not all potentially suitable habitat at Long Point was surveyed and more plants may be present at this site. No abundance information was provided on the label of the 1934 Rondeau specimen.

Fluctuations and trends

The geographical range in population extent in British Columbia appears not to have changed over the short term, but has probably declined historically. However, the range in Ontario is shrinking. Numerous botanists have surveyed habitats at Rondeau Park since its original discovery there in 1934 (including in 2007), but it has not been observed again and may be extirpated from this site. Also, the population of this species at Long Point appears to have been reduced over the past 10 to 20 years due to the invasion of the open habitats by the extremely aggressive *Phragmites australis*.

In British Columbia, although fluctuation and trend data were not recorded before 2005, the size of the population doesn't appear to have changed significantly from 2005 to 2007 (the survey in 2007 for this species was more thorough than in the previous two years).

Limited fluctuation and trend data are available for the known Ontario populations of *E. geniculata*. The population at the Cedar Springs site appears to be relatively stable. No changes in its population size and density have been observed since it was first discovered by M.J. Oldham and A.W. Cusick in 1996 through subsequent visits in 1999 and 2007 (quantitative data were not gathered before 2007). The Long Point population, however, appears to be declining as available habitat is lost to *Phragmites* invasion. On a previous visit to Long Point in 1988, M.J. Oldham and A.A. Reznicek observed *E. geniculata* on the north shore of the Point. It was not found at this location in 2007. Fewer plants were observed in 2007 than in 1988 in wet meadows near the tip of Long Point (where *Phragmites* has increased dramatically). No population counts were made in 1988 or earlier years so declines cannot be quantified, although it was the impression of the surveyors that populations had declined between 1988 and 2007 and that some habitat, which was suitable in 1988, was occupied by dense *Phragmites* stands in 2007. Unless remedial action is taken with respect to the loss of habitat and populations of *E. geniculata* at Long Point, a continued decline of this species can be anticipated.

Rescue effect

The probability of rescue occurring is extremely low. Because of the distances involved and the unlikelihood of long-distance dispersal of this species, it is unlikely that there is any exchange between populations in Canada and in the United States. *Eleocharis geniculata* is rare (Michigan, Ohio, Pennsylvania) or absent (New York, possibly Washington depending on the confirmation of this record) in all jurisdictions adjacent to Canadian populations. Appropriate adjacent habitat appears available for both of the DUs in Canada. However, even these have not been colonized by local populations of *E. geniculata* as might have been expected if there was any movement of propagules beyond the immediate vicinity of currently known sites.

LIMITING FACTORS AND THREATS

The main natural limiting factor across the Canadian range of *E. geniculata* is its restriction to a rather specific and geographically limited habitat; that is, open soil alongside ephemerally wet, sheltered ponds. These areas are particularly vulnerable to degradation by invasive plants and human-related disturbance.

Threats in the Southern Mountain DU

In British Columbia, several threats to the occurrence and distribution of *E. geniculata* are present. Even though protected by a fence, trampling and soil disturbance by cattle and horses occasionally occurs in the spit area, although damage to populations of *E. geniculata* has not been observed. A small gate in the fence is sometimes opened and livestock gain entrance to the spit area. This happened at least three times in 2007 (twice by cattle and another time by horses), although this was not observed in 2005 and 2006. However, before this site was fenced, livestock grazed across the site for many decades and did not extirpate the populations of this or other rare species that are restricted to the site. The addition of the fence has the potential to increase population size and density.

Human-related disturbances are threats in British Columbia. The shoreline to the south and east of the spit area is frequently used by boaters and swimmers. Occasionally, people have been seen walking along the beach in the protected spit area but none of these people have been observed in *E. geniculata* habitat. Although there are no development plans for the area near the spit, this is a possibility in the future. Development there would increase the use of the spit site, even though it is marked as a site where rare species are found.

Invasive species may pose a continuing threat, in particular Reed Canary Grass, but efforts of weed removal during HSP-funded work have been focused on the areas where rare species have been found. Risk to the population is likely to continue if the control of the invasive grass is not consistently maintained. Concern has also been expressed over the recent documentation of the presence of the introduced form of Common Reed within the region. Its aggressive spread in moist habitats and wetlands has been well documented in other parts of North America.

The artificial management of the water levels of Lake Osoyoos by the Zosel Dam in Oroville by the United States under the International Joint Commission has been suggested as being a possible threat to this species (COSEWIC 2006). Lake levels have been managed for at least the last twenty years and *E. geniculata* remains at the site, although we do not have any data on population changes over this period (the distribution of this species before the dam was built is unknown but may have been more widespread). However, it may take more time in order for the influence of the dam on lake levels and on the habitat to affect this species. For example, at least since 2005 when first observed, the shorelines along many portions of the shore of Osoyoos Lake, including along the spit, have slowly been eroded away by wave action. Although wave action has always been present, wave action would have affected a much broader elevational range of shore before the dam was built, and the shore would not have had the cut banks that appear today. This may eventually threaten the populations of *E. geniculata*.

COSEWIC (2006) states that sediments and chemicals from storm water discharge, agricultural fertilizers, and pesticides from vineyards can impact riparian ecosystems. However, these factors are unlikely to affect the spit vegetation because the nearest vineyard is about 1 km away from the site and there is no connection to the spit. COSEWIC (2006) also notes that, in 1996, the BC Water Quality Status Report gave Osoyoos Lake a "Poor Rating" which is the lowest rating given. More recent data are unavailable. However, the location of *E. geniculata* is well away from the shoreline, and the filtering action of the soils during periods of high lake levels probably make this a very low potential threat, but this is unknown.

Threats in the Great Lakes Plains DU

The greatest threat to populations of *E. geniculata* in Ontario is the rapid invasion into known and potential habitat by Common Reed. This species threatens the populations at both Long Point (Figure 6) and Cedar Springs.

Human-related disturbance is a threat to the Cedar Springs population as a residential development may be planned for the site (P. Allen Woodliffe 2007 pers. comm.). This would likely destroy the Cedar Springs population.

SPECIAL SIGNIFICANCE OF THE SPECIES

The Canadian populations of *Eleocharis geniculata* are the most northern occurrences for this species in North America, and, because these populations are disjunct from southern populations, the gene pools of these populations are potentially important in terms of its genetic variability, environmental adaptations, and long-term persistence. No information has been found on economic or First Nations use of Bent Spike-rush, and, because of its size, unreliable annual population size from year to year and rarity, these types of uses are unlikely.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

The British Columbia population of *E. geniculata* is protected within a fenced area by the Osoyoos Indian Band. The Band has supported HSP-funded conservation efforts since 2004. Most of this work has been focused on invasive plant removal, especially at the sites where rare plant species have been found. Signage that denotes the rarity of the species in this area is located along the shore of the protected area.

In Ontario, the Long Point National Wildlife Area is administrated by the Canadian Wildlife Service of Environment Canada. Accordingly, all populations of rare organisms found there including *E. geniculata* are protected under federal and provincial guidelines and legislation. Also, much of Long Point was designated by UNESCO as a World Biosphere Reserve in 1986. There is no known protection for this species at Cedar Springs.

NatureServe (2007) lists the species as globally secure (G5) with the following subnational rankings: Alabama (SNR), Arizona (SNR), California (SNR), Florida (SNR), Georgia (SNR), Hawaii (SNA), Illinois (S1), Indiana (S2), Kansas (S1), Louisiana (S1?), Maryland (SU), Michigan (SNR), Mississippi (S3S4), Nebraska (SNR), New Jersey (SNR), New Mexico (SNR), North Carolina (SNR), Ohio (S1), Oklahoma (SNR), Pennsylvania (SNR), South Carolina (SNR), Texas (SNR), and Ontario (S1). *Eleocharis geniculata* is rare throughout the Great Lakes region and is listed as Endangered in Ohio and Pennsylvania and Threatened in Indiana and Michigan (USDA 2007). In Illinois, it has not been seen since 1894 (Swink and Wilhelm 1994, Mohlenbrock 2001). *Eleocharis atropurpurea* is listed as SX (presumed extirpated) in Washington State (NatureServe 2007). This ranking would apply to *E. geniculata* if the collection from this state is located and identified as such. NatureServe does not list the species in British Columbia due to its previous misidentification.

TECHNICAL SUMMARY - Great Lakes Plains DU

Eleocharis geniculata

Bent Spike-rush - Great Lakes Plains DU

Éléocharide géniculée

Range of Occurrence in Canada: Ontario

Demographic Information

Generation time (average age of parents in the population)	<1 yrs
Observed percent reduction in total number of mature individuals over the last 10 years.	Unknown
Projected percent reduction in total number of mature individuals over the next 10 years.	Unknown
Observed percent reduction in total number of mature individuals over any 10 years period, over a time period including both the past and the future.	Unknown
Are the causes of the decline clearly reversible? Decline unknown	Unknown
Are the causes of the decline understood? Decline unknown	Unknown
Have the causes of the decline ceased? Decline unknown	Unknown
Observed trend in number of populations 1 population lost historically	Stable
Are there extreme fluctuations in number of mature individuals? A seed bank is present.	No
Are there extreme fluctuations in number of populations?	No
Is the total population severely fragmented?	No

Number of mature individuals in each population

Population	N Mature Individuals
Long Point	1000-2000
Cedar Springs	300-500
Total	>1300-2500
Number of populations (locations)	2

Extent and Area Information

Estimated extent of occurrence (km ²)	6.7 km ² (excluding open water of Lake Erie)
Observed trend in extent of occurrence A historic decline due to the loss of the Rondeau population.	Stable
Are there extreme fluctuations in extent of occurrence?	No
Estimated area of occupancy (km ²)	5 based on a 1x1 km grid 16 based on a 2x2 km grid km ²
Observed trend in area of occupancy Loss of habitat due to spread of Common Reed at both localities.	Decline
Are there extreme fluctuations in area of occupancy?	No
Is the extent of occurrence or area of occupancy severely fragmented?	No
Number of current locations	2
Trend in number of locations	Stable
Are there extreme fluctuations in number of locations?	No
Trend in area or quality of habitat Common Reed is aggressively spreading at Long Point.	Decline in quality and area

Quantitative Analysis

	None available
--	----------------

Threats (actual or imminent, to populations or habitats)

Habitat loss primarily due to the invasive Common Reed at both sites. Potential residential development at one of two sites (Cedar Springs).

Rescue Effect (immigration from an outside source)

Status of outside population(s)? USA: rare in all jurisdictions near Ontario: Illinois (S1), Indiana (S2; Threatened), Michigan (SNR; Threatened), Ohio (S1; Endangered), Pennsylvania (SNR: Endangered)	
Is immigration known or possible? Not known and unlikely	No
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

Current Status

COSEWIC: Endangered (April 2009)

Additional Sources of Information: None

Status and Reasons for Designation

Status: Endangered	Alpha-numeric code: B1ab(ii,iii)+2ab(ii,iii)
Reasons for designation: Only two extant Ontario populations are known for this annual species of the sedge family. The total population consists of possibly fewer than 2500 plants. They occur mainly in sandy wet habitats along ponds and in damp open meadows over an area of only about 2000 square metres. The habitat is declining due to the spread of the invasive, introduced form of Common Reed, an aggressive exotic grass.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Degree of decline unknown.
Criterion B (Small Distribution Range and Decline or Fluctuation): Meets Endangered B1ab(ii,iii)+2ab(ii,iii) based on the presence of only two locations with very small EO and IAO and decline in area and quality of habitat at Long Point due to the aggressive spread of the invasive Common Reed and the potential impact of planned development adjacent to the Cedar Springs locality.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Extent of future impact on the loss of mature individuals at Long Point or Cedar Springs is uncertain but could potentially be more than 10-20%.
Criterion D (Very Small Population or Restricted Distribution): Meets Threatened D2 with only 2 localities and threats from expansion of an invasive grass at both localities and potential development occurring adjacent to the Cedar Springs locality.
Criterion E (Quantitative Analysis): None available.

TECHNICAL SUMMARY - Southern Mountain DU

Eleocharis geniculata

Bent Spike-rush - Southern Mountain DU

Éléocharide géniculée

Range of Occurrence in Canada: British Columbia

Demographic Information

Generation time (average age of parents in the population)	<1 yrs
Observed percent reduction in total number of mature individuals over the last 10 years.	Unknown
Projected percent reduction in total number of mature individuals over the next 10 years.	Unknown
Observed percent reduction in total number of mature individuals over any 10 years period, over a time period including both the past and the future.	Unknown
Are the causes of the decline clearly reversible? Decline unknown	Unknown
Are the causes of the decline understood? Decline unknown	Unknown
Have the causes of the decline ceased? Decline unknown	Unknown
Observed trend in number of populations	Stable
Are there extreme fluctuations in number of mature individuals? A soil seed bank is present.	No
Are there extreme fluctuations in number of populations?	No
Is the total population severely fragmented?	No

Number of mature individuals in each population

Population	N Mature Individuals
Total	>10,000
Number of populations (locations)	1

Extent and Area Information

Estimated extent of occurrence (km ²)	1 km ²
Observed trend in extent of occurrence Likely a decline due to habitat losses at Osoyoos	Unknown
Are there extreme fluctuations in extent of occurrence?	No
Estimated area of occupancy (km ²)	2x2 km grid: 4 km ²
Observed trend in area of occupancy Likely loss of former suitable habitat but actual loss unknown.	Unknown
Are there extreme fluctuations in area of occupancy?	No
Is the extent of occurrence or area of occupancy severely fragmented?	No
Number of current locations	1
Trend in number of locations	Stable
Are there extreme fluctuations in number of locations?	No
Trend in area or quality of habitat Presence of an aggressive invasive grass (Reed Canary Grass) could significantly impact the habitat if left unchecked.	Decline in quality inferred

Quantitative Analysis

	None available
--	----------------

Threats (actual or imminent, to populations or habitats)

Trampling (cattle, horses, humans) Invasive plants (e.g., Reed Canary Grass)

Rescue Effect (immigration from an outside source)

Status of outside population(s)? USA: rare or absent adjacent to Canada	
Is immigration known or possible?	No
Would immigrants be adapted to survive in Canada?	Likely
Is there sufficient habitat for immigrants in Canada?	Likely
Is rescue from outside populations likely?	No

Current Status

COSEWIC: Endangered (April 2009)

Additional Sources of Information: None

Status and Reasons for Designation

Status: Endangered	Alpha-numeric code: B1ab(iii)+2ab(iii)
Reasons for designation: Only a single population of this annual species of the sedge family is known from a seasonally flooded wetland complex within a sandy spit at Osoyoos Lake, BC. Approximately 10,000 small plants are restricted to an area of about 1200 square metres where they are at risk from stochastic events and the potential impacts from the spread of exotic grasses.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Declines unknown.
Criterion B (Small Distribution Range and Decline or Fluctuation): Meets Endangered B1ab(iii)+2ab(iii) based on the presence of a single locality with inferred decline in habitat based on the presence of an aggressive invasive grass.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Population size is seemingly > 10,000.
Criterion D (Very Small Population or Restricted Distribution): Meets Threatened D2 with only 1 population and threats from an invasive exotic grass. This species could decline very quickly if current management is discontinued.
Criterion E (Quantitative Analysis): None available.

ACKNOWLEDGEMENTS AND AUTHORITIES CONSULTED

The authors would like to thank the Osoyoos Indian Band for providing support, guidance, and permission to use their data from British Columbia. They would also like to thank Tony Reznicek for examining collections, assisting with fieldwork, and for helpful discussions on the species. Sam Brinker assisted with fieldwork. Barton Feilders and Bill Crins (Ontario Ministry of Natural Resources) provided a permit to collect specimens in Ontario provincial parks, and Jeff Robinson (Canadian Wildlife Service) provided a permit to collect in Long Point National Wildlife Area. Danny Bernard (Canadian Wildlife Service) assisted us with 2007 fieldwork at Long Point.

Authorities consulted

- Ceska, Adolf. 2007. Botanist specializing in Cyperaceae of British Columbia. Victoria, BC. [Regarding history of collecting activities near Osoyoos].
- Frye, Christopher T. 2007. Maryland Natural Heritage Program [Clarification of status in Maryland].
- LeBlond, Richard. 2007. Richlands, North Carolina [Clarification of status in North Carolina].
- Reznicek, A.A. 2007. Curator of Vascular Plants, University Herbarium, specialist, Systematics and evolution of Cyperaceae, plant geography, Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, Michigan, USA.
- Snyder, David. 2007. New Jersey Natural Heritage Program [Clarification of status in New Jersey].
- Sorrie, Bruce A. 2007. North Carolina Natural Heritage Program [Clarification of status in North Carolina].
- Weakley, Alan S. 2007. University of North Carolina Herbarium (NCU) [Clarification of status in southeastern United States].
- Woodliffe, P. Allen. 2007. Ontario Ministry of Natural Resources, Chatham [Regarding status of the Cedar Springs site].

INFORMATION SOURCES

- Argus, G.W., K.M. Pryer, D.J. White, and C.J. Keddy, editors. 1982-1987. Atlas of the Rare Vascular Plants of Ontario. Four parts. National Museum of Natural Sciences, Ottawa.
- Bell, D. M. 2000. *Dispersal of Eleocharis seeds by birds*. The Australian Society for Limnology Conference, Darwin, N.T.
- Blake, S.F. 1918. Notes on the Clayton Herbarium. *Rhodora* 20(230):21-28.

- Brown, M.L. and R.G. Brown. 1984. *Herbaceous Plants of Maryland*. Port City Press, Baltimore, Maryland.
- COSEWIC. 2006. COSEWIC Status Report on the Purple Spike-rush (*Eleocharis atropurpurea*), 2-Month Interim Report. Committee on the Status of Endangered Wildlife in Canada, Ottawa. [This report was never finalized since it was based on a misidentification of the species in question.]
- Crow, G.E., and C.B. Hellquist. 2000. *Aquatic and Wetland Plants of Northeastern North America. Volume 2, Angiosperms: Monocotyledons*. University of Wisconsin Press, Madison.
- Douglas, G.W., D. Meidinger, and J. Pojar. 2001. *Illustrated Flora of British Columbia. Volume 6: Monocotyledons (Acoraceae through Najadaceae)*. British Columbia Ministry of Environment, Lands and Parks, and British Columbia Ministry of Forests.
- Fernald, M.L. 1906. Some new or little known Cyperaceae of eastern North America. *Rhodora* 1906:126-130.
- Fernald, M.L. 1950. *Gray's Manual of Botany*. 8th Corrected Edition (1970). Van Nostrand Co., New York.
- Gleason, H.A., and A. Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. Second Edition. New York Botanical Garden, Bronx, N.Y.
- González-Elizondo, M.S., and A.A. Reznicek. 1996. New *Eleocharis* (Cyperaceae) from Venezuela. *Novon* 6:356-365.
- Hermann, F.J. 1935. *Eleocharis caribaea* var. *dispar* in Michigan. *Rhodora* 37:366-367.
- Hill, E.J. 1882. *Eleocharis dispar* N. Sp. *Botanical Gazette* 7:3.
- Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1969. *Vascular Plants of the Pacific Northwest. Part 1: Vascular Cryptogams, Gymnosperms, and Monocotyledons*. University of Washington Press, Seattle.
- Holmgren, P. K., and N. H. Holmgren. 1998 [continuously updated]. *Index Herbariorum: A global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/>.
- Iverson, K. and K. Haney. 2005. *Updated Ecosystem Mapping for the South Okanagan Valley*. Report prepared for BC Ministry of Water, Land and Air Protection.
- Menapace, F.J. 2002. *Eleocharis* R. Brown (subg. *Eleocharis* sect. *Eleogenus*) ser. *Maculosae*. Pp. 100-102 in: *Flora of North America Volume 23, Magnoliophyta: Commelinidae (in part): Cyperaceae*. Oxford University Press, New York.
- Mohlenbrock, R.H. 2001. *The Illustrated Flora of Illinois, Sedges: Cyperus to Scleria*. Second Edition. Southern Illinois University Press, Carbondale, Illinois.
- NatureServe. 2007. *NatureServe Explorer: An online encyclopedia of life [web application]*. Version 4.5. NatureServe, Arlington, Virginia. Available www.natureserve.org/explorer [Accessed: November 2007].

- Reznicek, A.A. and P.M. Catling. 1989. Flora of Long Point, Regional Municipality of Haldimand-Norfolk, Ontario. *Michigan Botanist* 28(3): 99-175.
- Smith, S.G., J.J. Bruhl, M. S. González-Elizondo and F.J. Menapace. 2003. *Eleocharis*, Flora North America, Vol. 23, p. 101; on-line 21 February 2003.
- Sutherland, D. A. pers. comm. 2008. Natural Heritage Information Centre, Ontario Ministry of Natural Resources, Peterborough, ON. [November 2008 status report review comments regarding 1994 and 1995 surveys of Long Point ponds].
- Svenson, H.K. 1929. Monographic studies in the genus *Eleocharis*. *Rhodora* 31:121-135, 152-163, 167-191, 199-219, 224-242.
- Svenson, H.K. 1957. North American Flora. Poales, Cyperaceae, Scirpeae (continuation). 18(9):505-556. New York Botanical Garden.
- Swink, F. and G. Wilhelm. 1994. Plants of the Chicago Region. 4th Edition. Morton Arboretum, Lisle, Illinois.
- Taylor, T.M.C. 1935. *Eleocharis caribaea* var. *dispar* in Ontario. *Rhodora* 37:365-366.
- USDA (United States Department of Agriculture). 2007. Plants Profile for *Eleocharis geniculata*. Plants Database, Natural Resources Conservation Service, USDA. Available at <http://plants.usda.gov/java/profile?symbol=ELGE> [Accessed: November 2007].
- USDA, NRCS. 2009. The PLANTS Database (<http://plants.usda.gov>, 23 April 2009). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
- Ward, D.B. and E.M. (Hodgson) Leigh. 1975. Contributions to the Flora of Florida – 8, *Eleocharis* (Cyperaceae). *Castanea* 40(1):16-36.
- Wilcox, K.L., S.A. Petrie, L.A. Maynard, and S.W. Meyer. 2003. Historical distribution and abundance of *Phragmites australis* at Long Point, Lake Erie, Ontario. *Journal of Great Lakes Research* 29(4): 664-680.
- Wilson, K.L. 1990. Typification and application of *Scirpus geniculatus* L. *Cyperaceae Newsletter* 7: 6-8.

BIOGRAPHICAL SUMMARY OF REPORT WRITERS

Terry McIntosh is a consulting botanist who specializes in plants, in particular bryophytes, of arid land ecosystems. He is a Taxon Editor (for the bryophyte volumes) of the Flora of North America project. He has authored eight COSEWIC status reports: Columbian Carpet Moss, Banded Cord-moss, Rusty Cord-moss, Silver-hair Moss, Nugget-moss, Alkaline Wing-nerved Moss, Margined Stream-side Moss, and Twisted Oak Moss. He has also completed seven National Recovery Strategies. Terry has a strong interest in conservation and natural history, and is working closely with the Osoyoos Indian Band in their conservation efforts.

Michael J. Oldham is a botanist with Ontario's Natural Heritage Information Centre. He is a member of COSEWIC, COSSARO (the Committee on the Status of Species at Risk in Ontario), and the COSEWIC Vascular Plants Species Specialist Subcommittee. He has authored or co-authored more than a dozen COSEWIC status reports including the Bald Eagle, Spotted Turtle, Blanchard's Cricket Frog, Wood-poppy, Small-flowered Lipocarpha, Toothcup, Juniper Sedge, Crooked-stemmed Aster, Short's Aster, Riddell's Goldenrod, Scarlet Ammannia, and Wild Hyacinth. Mike has diverse interests in natural history and conservation biology.

Curtis Björk has worked in botany in the northwestern United States and British Columbia since 1991, and has specialized in grassland and shrub steppe habitats, vernal pools, taxonomy, and general floristics of vascular plants. Since 2003, he has researched lichenology and lichen ecology, primarily in British Columbia. He has authored or co-authored nine peer reviewed papers in botany and lichenology. Curtis is a regional reviewer for the Flora of North America Project.

COLLECTIONS EXAMINED

BC collections were examined from the University of Washington Herbarium, Seattle, and from Royal British Columbia Museum, Victoria. Personal collections of T. McIntosh and C. Björk were also examined. Most Ontario herbaria were searched for collections of this species during the preparation of the "Atlas of the Rare Vascular Plants of Ontario" (Argus *et al.* 1982-1987), with specimens located only at AAR, DAO, MICH, and TRT. Recently collected Ontario specimens (since Argus *et al.* 1982-1987) have been deposited at DAO (Agriculture and Agri-Food Canada), MICH (University of Michigan), NHIC (Ontario Ministry of Natural Resources), TRT (Royal Ontario Museum), TRTE (Erindale College, University of Toronto), WAT (University of Waterloo), WIS (University of Wisconsin). Details for institutional herbaria are provided in Holmgren and Holmgren (1998).