

COSEWIC
Assessment and Status Report

on the

Baikal Sedge
Carex sabulosa

in Canada



THREATENED
2005

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA



COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

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For additional copies contact:

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

Tel.: (819) 997-4991 / (819) 953-3215
Fax: (819) 994-3684
E-mail: COSEWIC/COSEPAC@ec.gc.ca
<http://www.cosewic.gc.ca>

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Baikal sedge — Illustration (Habit drawing from Cody 2000, by permission; perigynia and scale drawing by Lora May Richards, Douglas Ecological Consultants Ltd.).

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COSEWIC Assessment Summary

Assessment Summary – May 2005

Common name

Baikal sedge

Scientific name

Carex sabulosa

Status

Threatened

Reason for designation

A geographically restricted species of three sand dune areas that serve as habitat for five populations. These consist of several million shoots produced mainly through asexual reproduction. The species has been impacted by declines in population numbers, size, area, quality of its habitat and on-going impacts from the recreational use of all-terrain vehicles at Carcross and Bennett Lake. Such activity and much increased tourist visitations at the Carcross dune systems may result in increased impacts on the habitat with the development of a major resort facility at this location by 2006. If the Alsek River is dammed again by the advance of the Lowell Glacier, as had occurred in recent past, the large population at the confluence of the Dezadeash and Kaskawulsh Rivers could be at risk.

Occurrence

Yukon Territory

Status history

Designated Threatened in 2005. Assessment based on a new status report.



COSEWIC Executive Summary

Baikal Sedge *Carex sabulosa*

Species information

Baikal sedge, *Carex sabulosa*, is a tufted perennial plant with long rhizomes. The stems are 15-35 cm long, weak, arching, with mature fruiting heads often touching the ground. The 1-3.5 mm wide leaves are thick at the base, grayish-green, flat with margins curled inward. The leaves have purplish sheaths and are mostly shorter than the stems. The 2-5 cm long inflorescence consists of 3 to 5 spikes. The club-shaped terminal spike has female flowers positioned above the male flowers while the lateral spikes have female flowers only.

Distribution

In North America, *Carex sabulosa* occurs at four areas in southwestern Yukon and one in central Alaska. It is then disjunct to central Asia, over 3000 km away. In Canada, *Carex sabulosa* has recently been confirmed in the Yukon in Kluane National Park Reserve near the Kaskawulsh/Dezadeash Rivers, at two sites along the Takhini River, and at two sites near the town of Carcross. A fourth location, at Christmas Bay, Kluane Lake could not be reconfirmed and is considered historic.

Habitat

Carex sabulosa occurs on semi-stabilized and active sand dunes where it is often the only prominent species. Associates may include *Elymus calderii*, *Artemisia alaskana*, *A. campestris*, *Aster sibiricus*, *Bromus pumpellianus*, *Calamagrostis purpurascens*, *Equisetum arvense*, *Festuca saximontana*, *Kobresia myosuroides*, *Lupinus kuschei*, *Oxytropis campestris*, *Pinus contorta*, *Populus balsamifera*, *Polemonium pulcherrimum*, *Silene acaulis* and *Solidago simplex*.

Biology

The biology of *Carex sabulosa* has not been studied. It is evident, however, that this species can withstand high, desiccating winds. Reproduction of *Carex sabulosa* is by seed and rhizomes.

Population sizes and trends

Carex sabulosa has been recently recorded on five dune systems, at three areas, in the Yukon. A search was made for a historic site but it was not relocated during 2003.

The largest dune system in the southern Yukon, covering almost 40 ha, is found near the confluences of the Kaskawulsh/Dezadeash rivers in Kluane National Park. Estimates of ramet numbers range from three to four million at this site. The Carcross dune systems had ramet numbers ranging from 38 to 196 thousand covering areas of 4.8 to 13.1 ha while the Takhini River dune systems had ramet numbers ranging from 168 to 294 thousand covering areas of 8.4 to 9.6 ha.

Population trends at all but the two Carcross dune systems have probably remained stable in recent years since there has been little change at the dunes. Clones of *Carex sabulosa* have probably declined in recent years at the Carcross systems due both to reductions in dune system size and recreational vehicles.

Limiting factors and threats

The greatest threat to the persistence of populations of *Carex sabulosa* would be through natural changes to the dune systems, especially at the Kaskawulsh/Dezadeash rivers dunes. Climate changes that affect the glaciers, and subsequently wind speeds, could result in drastic alterations to the dune systems, such as successional changes.

Threats of disturbance from recreational vehicles are of concern at the Takhini River (south) and Carcross dune systems. *Carex sabulosa* clones at these sites are threatened by heavy use, which packs the sand and eliminates the clones.

At the Carcross Klondike Highway dunes, there is the imminent threat of development of a large hotel and resort complex to be completed in 2006. This development could change wind patterns or sand distribution and dune stabilization at this site and would almost certainly lead to vegetation invasion. Increased recreational use of the dunes would also result from the regular, scheduled, tourist stops of the White Pass Railroad at Carcross planned as part of the recent federal and territorial initiatives aimed at increasing economic growth and tourism in the area in 2006.

Special significance of the species

Carex sabulosa occurs in a sand dune ecosystem that is no longer common in the Yukon or Canada. The potential sites for the plant are restricted; thus the plant is rare. In addition, the populations are of possible genetic interest since they are at the eastern periphery of a range that extends from central Asia to the southwestern Yukon. This sedge occurs on lands under Aboriginal jurisdiction in the Yukon Territory. Although no information on this species was found in a major ethnobotany database, other species of *Carex* are used extensively by Aboriginal peoples in North America.

Existing protection or other status designations

In Canada, *Carex sabulosa* is protected in the Kluane National Park Reserve; the Takhini River dune system will be protected in the proposed Kusawa Territorial Park. Elsewhere it occurs on Crown land where only a special federal order can protect the species under the *Species at Risk Act*.



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

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Baikal Sedge *Carex sabulosa*

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2005

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SPECIES INFORMATION

Name and classification

Scientific name: *Carex sabulosa* Turczaninow ex Kunth
Synonym: *Carex leiophylla* Mackenzie;
Carex sabulosa ssp. *leiophylla* (Mackenzie) A.E. Porsild
Common name: Baikal sedge
Family: Cyperaceae (Sedge Family)
Major plant group: Monocot flowering plant

Description

Baikal Sedge, *Carex sabulosa*, is a member of a genus of about 2000 species (Ball and Reznicek 2002). One hundred and five *Carex* species occur in the Yukon and about 275 in Canada (Scoggan 1978, Cody 2000).

Carex sabulosa is a tufted perennial with long rhizomes (Figures 1 and 2, Cody 2000). The stems are 15-35 cm. long, weak, arching with mature fruiting heads often touching the ground. The 1-3.5 mm wide leaves are thick at the base, grayish-green, flat with involute margins and taper to a fine tip. The leaves have long, usually underground, purplish sheaths and are mostly shorter than the stems. The 2-5 cm long inflorescence consists of 3 to 5 spikes. The club-shaped terminal spike has female flowers positioned above the male flowers while the lateral spikes have female flowers only. The lateral spikes may be aggregated or have the lower ones separated. They have stiff, short, erect stems or some may be stemless. The female scales are ovate-lanceolate, acute to acuminate, as long as the perigynia, purplish-black with a lighter midvein and have hyaline margins. The perigynia are 4-5 mm long, ovate to suborbicular, yellowish green, blotched with brown and stipitate with bidentate, brown marked beaks about 1 mm long. There are three stigmas.

Carex sabulosa was first described in 1837 from material collected in central Asia near Lake Baikal. In North America, *Carex sabulosa* was first recognized as *C. leiophylla* Mackenzie (Murray 2002). Later, the species was considered synonymous with *C. sabulosa* by Raymond (1965). Porsild (1966), published the combination, *Carex sabulosa* ssp. *leiophylla* (Mackenzie) A.E. Porsild, based on minor differences between the Asian and North American plants. In a recent *Carex* treatment in *Flora North America*, Murray (2002) placed ssp. *leiophylla* in synonymy with *C. sabulosa* since the North American material falls “well within the variability of *C. sabulosa* from Asia”.

Carex sabulosa is distinguished from other sedges in the Yukon by the presence of at least some lateral spikes with stems; glabrous, spreading to ascending perigynia which have toothed beaks; lack of septate-nodulose leaf sheaths (Welsh 1974); long, mostly underground, reddish leaf sheaths; and usually curled basal leaves.



Figure 1. Illustration of *Carex sabulosa* (Habit drawing from Cody 2000, by permission; perigynia and scale drawing by Lora May Richards, Douglas Ecological Consultants Ltd.).



Figure 2. *Carex sabulosa* on the Takhini River south dunes (Photo by S.J. Smith, Douglas Ecological Consultants Ltd.).

DISTRIBUTION

Global range

In North America, *Carex sabulosa* occurs in southwestern Yukon and central Alaska (Figure 3, Cody 2000, Alaska Natural Heritage Program 2002). It is then disjunct to central Asia, over 3000 km away (Hultén 1968, Cody 2000, Murray 2002).

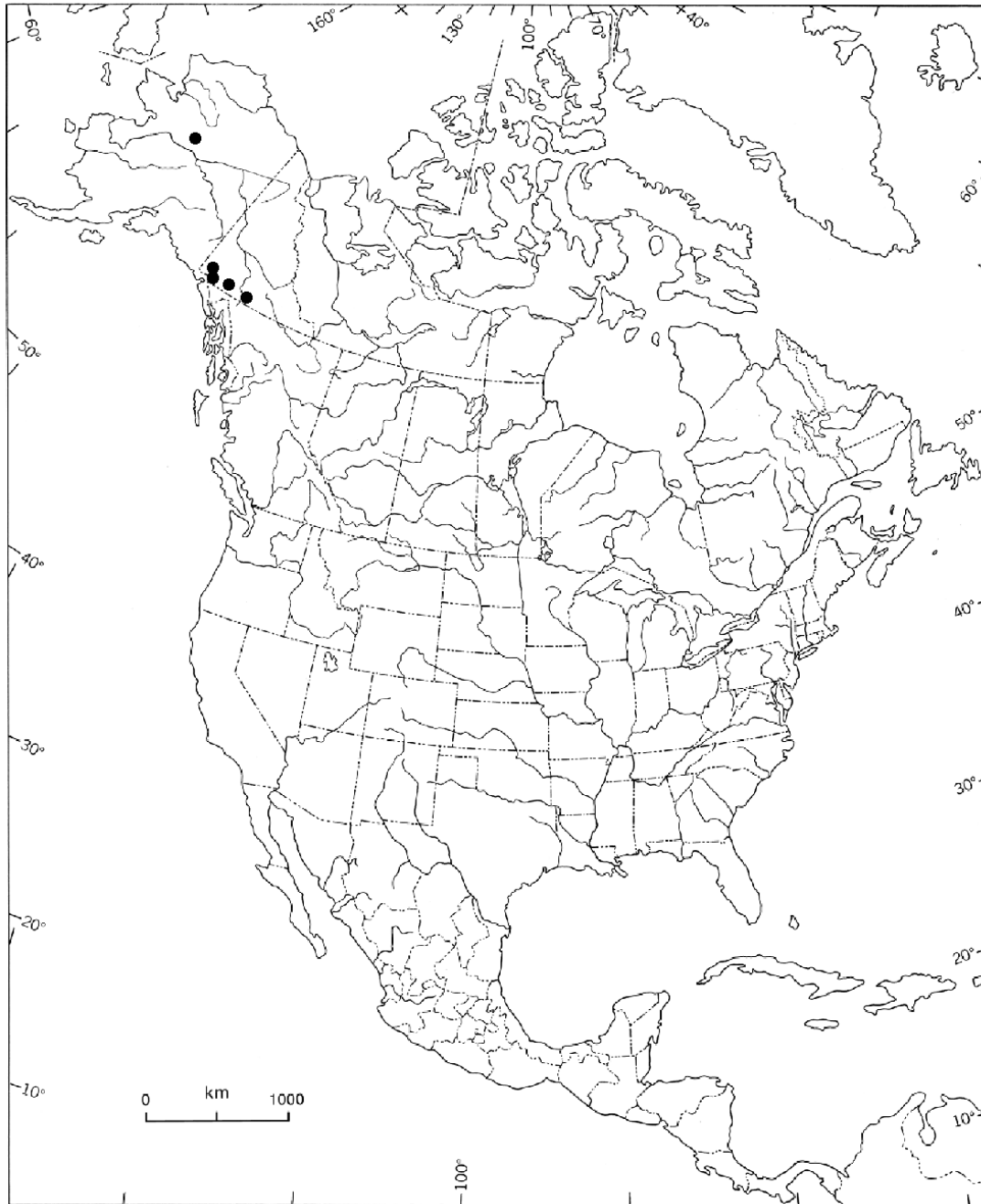


Figure 3. Distribution of *Carex sabulosa* in North America.

Canadian range

In Canada, *Carex sabulosa* is known from four areas in the southwestern Yukon (Figure 4, Douglas *et al.* 1981, 2004). Five dune complexes were thoroughly examined at three of these areas during 2003. The dune system at the Kaskawulsh/Dezadeash

ivers is essentially continuous. There is a south and north dune system, 1.5 km apart, on opposite sides of the the Takhini River and there are two dune systems, 1.2 km apart, located near Carcross. The latter systems are located at Bennett Lake and along the Klondike Highway (Highway 2). A fourth location, represented by a collection taken at Christmas Bay, Kluane Lake in 1974, remains unconfirmed. The entire windward area at the latter location, covering an area of about 30 to 40 m wide and 2 km long, was searched in 2003 without positive results.

There are also a number of smaller dune systems in southern and western Yukon Territory. None of these systems are known to support *Carex sabulosa*.

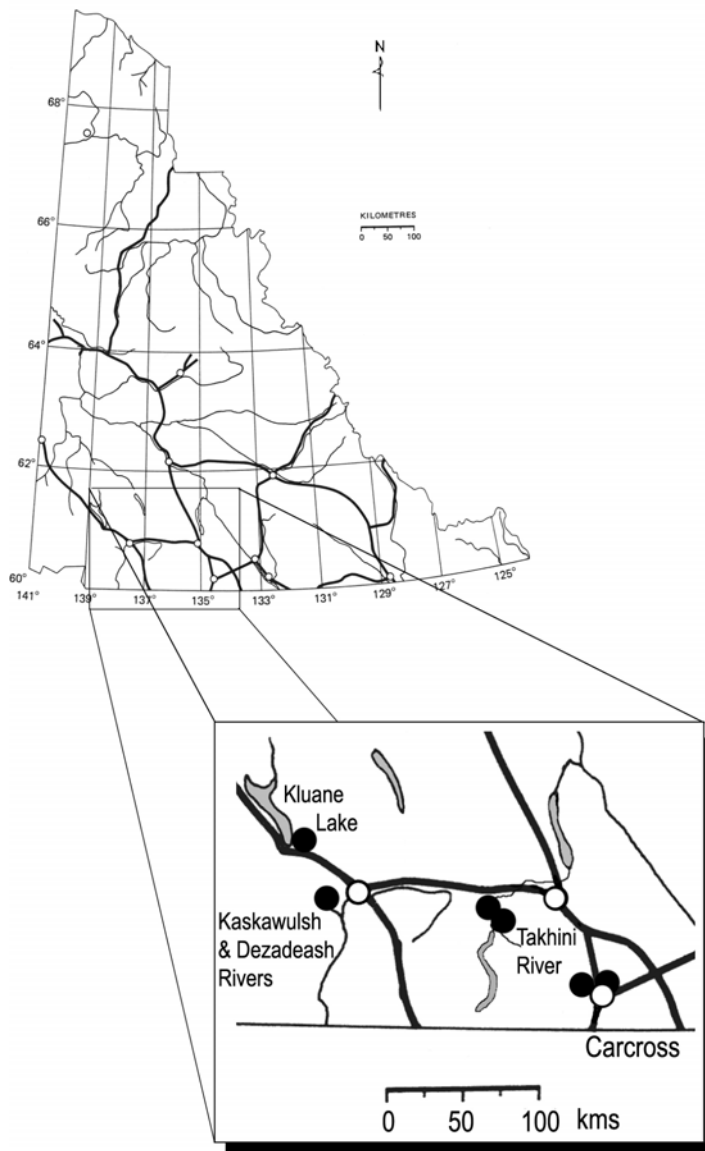


Figure 4. Distribution of *Carex sabulosa* in Yukon Territory.

HABITAT

Habitat requirements

Carex sabulosa occurs only on semi-stabilized or active sand dunes. These dunes are usually 0.6 to 4 m deep. Although the ramets of these rhizomatous plants have the ability to send up new ramets when older ones have been completely buried, sand deposits greater than 1 m in depth, occurring over short periods, appear to restrict the growth of the ramets.

In the Kluane National Park Reserve, *Carex sabulosa* forms a plant community type that occurs only on the semi-stabilized sand dunes near the confluence of the Kaskawulsh and Dezadeash rivers (Figure 4, Douglas 1974). In 2003, almost all of the available dunes system was vegetated with the *Carex sabulosa* community type. This community type is a pioneer community on the dunes and appears to be relatively stable with only minimal invasion on the dune edges. It is a relatively young community since it is located on the site of Recent Lake Asek. This proglacial lake, formed by the damming of the Asek River by the Lowell Glacier, existed 150 years ago and had an upper shoreline at an elevation of about 604 to 640 m (Kindle 1952, Johnson and Raup 1964).

The *Carex sabulosa* community type at the Kaskawulsh and Dezadeash rivers has a low mean average cover of 15% and a frequency of 98% and is the only prominent species in this community type (Douglas 1974). Other constant species, with low prominence, include *Elymus calderi* (formerly known as *Agropyron yukonensis*), *Equisetum pratense*, and *Artemisia alaskana*. An average of five species per stand (total of 10) occur in this community. *Juniperus communis*, which was not encountered in any of the sampled stands, is a sporadic invader of the *Carex sabulosa* community. Only one other rare plant species, *Corispermum ochotense* var. *alaskanum*¹, occurs on the dunes. It occurs at only two other sites in the Yukon (Douglas *et al.* 2004).

At the Takhini River and the Bennett Lake dune systems the dunes are generally much more active than those at the Kaskawulsh and Dezadeash rivers. Sand accumulations, however, are not greater than the species can tolerate. About 75% of these dunes were vegetated in 2003. On these sparsely vegetated dunes, *Carex sabulosa* is always the most prominent species and may occur with a number of other species (Figures 5 and 6) or may be the sole species present (Figures 7 and 8). Other frequent, but sparse, dune species include *Artemisia campestris*, *Aster sibiricus*, *Bromus pumpellianus*, *Calamagrostis purpurascens*, *Elymus calderi*, *Equisetum arvense*, *Festuca saximontana*, *Kobresia myosuroides*, *Lupinus kuschei*, *Oxytropis campestris*, *Pinus contorta*, *Populus balsamifera*, *Polemonium pulcherrimum*, *Silene acaulis* and *Solidago simplex*.

¹This species was recorded by G.W. Douglas at the Kaskawulsh/Dezadeash rivers and at Christmas Bay, Kluane Lake during a 2003 survey. This plant had not been recorded south of the Dawson area previously.



Figure 5. The semi-stabilized dunes near the confluence of the Kaskawulsh and Dezadeash Rivers occur on the former lakebed of Recent Lake Alsek. The beach ridges of Recent Lake Alsek are evident on the lower mountain slopes (Photo by S.J. Smith, Douglas Ecological Consultants Ltd.).



Figure 6. The well-vegetated portion of the dune system at Takhini River (south dunes). *Carex sabulosa* is the most abundant species in this view but many associates are also evident (Photo by S.J. Smith, Douglas Ecological Consultants Ltd.).



Figure 7. The entrance to the Takhini River (north dunes) system (Photo by S.J. Smith, Douglas Ecological Consultants Ltd.).



Figure 8. *Carex sabulosa* abundance on parts of the dune system at Bennett Lake, near the town of Carcross. It is essentially the only species on the active dunes (Photo by S.J. Smith, Douglas Ecological Consultants Ltd.).



Figure 9. Extent of vegetational cover of dune system near Carcross. Almost 90% of this dune system along the Klondike Highway, near the town of Carcross, is unvegetated. This is due mainly to extremely high winds that move large amounts of sand that completely cover the vegetation (Photo by S.J. Smith, Douglas Ecological Consultants Ltd.).

The dune system along the Klondike Highway, near Carcross, included the most active dunes encountered. In fact, sand distribution and accumulations are so great that *Carex sabulosa* is unable to persist on about 90% of the dunes. Although there is evidence of invasion by *Pinus contorta* and *Populus balsamifera*, it is likely that sand movement eliminates about the same percentage of older trees. Most of the vegetation at the dunes consists solely of *Carex sabulosa*, but in some areas many of the species mentioned above may be found.

The habitat of the Christmas Bay, Kluane Lake, location remains unknown since collection label information is lacking and attempts to relocate the site in 2003 were unsuccessful. There were only several m² of dune blowouts and less than 200 m² of sandy beach at this location.

Trends

The sand dune habitat of *Carex sabulosa* has been substantially reduced since glaciation. The reductions are mostly due to invading vegetation through natural succession where dune formation is no longer able to continue. The dunes that remain appear to be maintained at present by a consistent source of materials and consistent winds.

Air photos taken during the mid-1940s and, more recently, between 1977 and 1999, indicate that all but one of the five extant dunes systems remain unchanged. Only the Bennett Lake dunes, near Carcross, show significant changes between 1948 and 1999. There appears to be a reduction of about 15 to 20% in dune area at this site.

Observations made by G.W. Douglas in 1974, 1978, 1992 and 2003 indicate that the large central area of the dunes along the Klondike Highway, near Carcross, has remained mostly unvegetated during recent years. It is likely that winds coming off Bennett Lake are much stronger than those encountered on the other dune systems in the southern Yukon.

Protection/ownership

The largest population of *Carex sabulosa* in the Yukon occurs at the confluence of the Dezadeash and Kaskawulsh rivers in Kluane National Park Reserve. The dune systems along the Takhini River will be protected within the boundaries of the proposed Kusawa Territorial Park, the establishment of which was triggered by the signing of the Kwanlin Dun First Nation's Final Agreement in February 2005. However, a management plan for this park will not be drawn up until the Carcross/Tagish First Nation ratifies their final agreement. The other extant dune systems at the Takhini River and Carcross occur on Crown land.

BIOLOGY

General

The biology of *Carex sabulosa* has not been studied. It is evident, however, that this species can withstand high, desiccating winds and tolerates shifting sands, which can bury most of the clones.

Reproduction

Reproduction of *Carex sabulosa* is by seed and rhizomes. It is apparent, from the widely disjunctive populations in northwestern North America, that dispersal of the seeds, over at least moderate distances, is possible. On both the active (Carcross and Takhini River) and semi-stabilized (Kaskawulsh/Dezadeash Rivers) sand dunes, the rhizomatous nature of the plants is readily evident (Figure 9).

Survival

Sand deposits of depths greater than 1 m, over short periods of time, appear to restrict or prevent the growth of *Carex sabulosa* ramets.

Physiology

No information is available.

Genetics

No information is available.

Movements/dispersal

Carex sabulosa reproduces successfully from rhizomes in local populations. The population at the confluence of the Kaskawulsh/Dezadeash rivers occupies, due mainly to its rhizomatous habit, almost all the stabilized sand dune habitat in the area. This is also readily evident on the active dunes at Carcross. Parts of the latter dunes, and about 90% of the dunes along Klondike Highway at Carcross, are so unstable that vascular plants are unable to establish.



Figure 10. Exposed root system of *Carex sabulosa* at the Klondike Highway dunes, near Carcross. The root system (a rusty-brown colour when seen in the field) is readily evident at this eroded sand bank. All the fibrous roots in this photo belong to *Carex sabulosa* clones. Below-ground biomass at this site is probably 10 to 20 times greater than above-ground biomass (Photo by S.J. Smith, Douglas Ecological Consultants Ltd.).

Dispersal of *C. sabulosa* by seeds, over at least moderate distances of 40 to 100 km is demonstrated by the Yukon sites (Figure 4). It is quite evident from geomorphological features that sand dunes were a common feature on the landscape during the Pleistocene. It is likely that *Carex sabulosa* would have been required to

move at intervals to temporarily ice-free sites during the Pleistocene since most of the region was covered by ice at various times. Studies indicate that all the valleys in the region were covered to a depth of 1825 to 2194 m elevation (Kindle 1952, Day 1962, Krinsley 1965, Muller 1967). Wheeler (1963) noted glacial erratics at an even higher elevation than 2194 m on Outpost Mountain just south of Kluane Lake.

Movement of the species between the southern Yukon and the nearest North American site, 900 km away in central Alaska, was probably by occupation of smaller refugia or temporarily ice-free areas during glaciation. Transportation by birds is also a possibility. In Alaska, *C. sabulosa* occurs in the Nogahabara Sand Dunes within the Koyukuk National Wildlife Refuge (Alaska Natural Heritage Program, 2002). This refuge is within the Alaska/Yukon Refugium, an extensive refugium that was ice-free during the Pleistocene. Rescue of Canadian populations by propagules from Alaskan plants is unlikely.

Nutrition and interspecific interactions

No information is available.

Behaviour/adaptability

No information is available.

POPULATION SIZES AND TRENDS

Carex sabulosa has been recorded on six dune systems at four areas in the Yukon (Figure 4, Table 1). One of the sites, an historic one at Christmas Bay, Kluane Lake, was not relocated during this study. If it still persists, this *C. sabulosa* population is extremely small, since the entire windward side of Christmas Bay was searched in 2003 and only a few, small, sometimes unstable sandy areas were found. Each of the locations, at Carcross and Takhini River, has two separate dune systems. Two other, much smaller, dune systems or blowouts also occur along the Takhini River between the larger systems treated in this report. They were not examined in detail but they contained fewer than 10,000 ramets.

The largest dune system in the southern Yukon, covering almost 40 ha, is found at the Kaskawulsh/Dezadeash Rivers in Kluane National Park. Estimates of ramet numbers range from three to four million at this site (Table 1). The Carcross dune systems had ramet numbers ranging from 38 to 196 thousand covering areas of 4.8 to 13.1 ha while the Takhini River dune systems had ramet numbers ranging from 168 to 294 thousand covering areas of 8.4 to 9.6 ha.

Population trends at all but the two Carcross dune systems have probably remained stable in recent years since dune areas have remained relatively stable (see Habitat trends). Clones of *Carex sabulosa* at the Bennett Lake dunes have probably

declined by 10 or 15% in recent years due to reduction in dune size. At the Klondike Highway dunes there has been some loss of clones on the areas of the dunes where heavy recreational vehicle use taken place. Data is not available but this loss has probably not been substantial since the areas destroyed are mainly those where heavy use has compacted the soils (Figure 10).

Table 1. Locations and population sizes for *Carex sabulosa* on six dune systems in the Yukon.

Collection Site	Observation Date	Collector/ Observer	Population Numbers ² /Area Occupied
Christmas Bay (Kluane Lake)	1974	Brink	Unknown, no 1974 label data; search unsuccessful in 2003
Kaskawulsh/Dezadeash Rivers (Haines Confluence)	2003	Douglas & Smith	3-4 million/ca. 38.3 ha
Takhini River - south dunes	2003	Douglas & Smith	168-294 thousand/ca. 8.4 ha
Takhini River - north dunes	2003	Douglas & Smith	240-288 thousand/ca. 9.6 ha
Carcross - Bennett Lake dunes	2003	Douglas & Smith	131-196 thousand/ca. 13.1 ha
Carcross - Klondike Highway dunes	2003	Douglas & Smith	38-58 thousand/ca. 4.8 ha

²Population numbers given here are for ramets. Excavation of clones during this study indicated that there may be up to 8 ramets per clone but sampling was not sufficient to provide an accurate estimate of the average number of ramets per clone. Population estimates were made after an inventory of 20, or more, 1 m² plots at each dune system.

LIMITING FACTORS AND THREATS

The greatest threat to the persistence of populations of *Carex sabulosa* would be through natural changes to the dune systems. At the Kaskawulsh/Dezadeash river dunes, the *Carex sabulosa* plant community likely leads a precarious existence. Changes to the habitat could come through natural succession or climate change that might affect the glaciers, and subsequent changes in wind speeds, along the Alsek River.

Threats of disturbance from recreational use are of little concern at the Kaskawulsh/Dezadeash or Takhini River (north) dunes. The former is located in the Kluane National Park Reserve while the latter is accessible only by canoe and is not visible from the river. The remaining three systems may be threatened with increased recreation vehicle use. *Carex sabulosa* clones at these sites are not drastically impacted with light use since the root and rhizome system is relatively deep (Figure 10) and not disturbed by minimal surface disturbance. Heavy use, however, which packs the sand, can eliminate *C. sabulosa* clones. This compaction, and subsequent elimination of vegetation, is most evident at the Klondike Highway dunes (Figures 11 and 12).



Figure 11. Heavy recreational vehicle use, which packs the sand and eliminates *Carex sabulosa* clones, is evident here on the Klondike Highway dunes, near Carcross. The vegetation on either side of the tracks, which has received lighter use, is able to persist (Photo by S.J. Smith, Douglas Ecological Consultants Ltd.).



Figure 12. Recreational use by an all-terrain vehicle on the Klondike Highway dune system near the town of Carcross (Photo by S.J. Smith, Douglas Ecological Consultants Ltd.).

At the Carcross Klondike Highway dunes, there is the imminent threat of development of a large hotel and resort complex to be completed in 2006. This development could change wind patterns or sand distribution and dune stabilization at this site and would almost certainly lead to vegetation invasion. Increased recreational use of the dunes would also result from the regular, scheduled, tourist stops of the White Pass Railroad at Carcross planned as part of the recent federal and territorial initiatives aimed at increasing economic growth and tourism in the area in 2006.

Another potential threat to the populations of *C. sabulosa* is their vulnerability to extirpation due to their small area occupied in Canada. Such geographically restricted

populations are more vulnerable to demographic and environmental variation and loss of genetic variability (Primack 1998). Since suitable habitats for *C. sabulosa* are also extremely restricted, the opportunities for colonization and expansion are also limited.

SPECIAL SIGNIFICANCE OF THE SPECIES

Carex sabulosa occurs in a sand dune ecosystem that is no longer common in the Yukon. The potential sites for the plant are restricted; thus the plant is rare.

In addition, the populations are of possible genetic interest since they are at the eastern edge of a range that extends from central Asia to the southwestern Yukon. Edge of range populations are sometimes genetically and morphologically divergent from central populations and may have an evolutionary and ecological significance out of proportion to the percentage of the species they represent (Mayr 1982; Lesica and Allendorf 1995). The protection of genetically distinct peripheral populations may be important for the long-term survival of the species as a whole (Lesica and Allendorf 1995).

This sedge occurs on lands under Aboriginal jurisdiction in the Yukon Territory. Although no information on this species was found in a major ethnobotany database (<http://herb.umd.umich.edu/>), other species of *Carex* are used extensively by Aboriginal peoples in North America.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

International status

Carex sabulosa is listed by the State of Alaska (Alaska Natural Heritage Program 2002) as rare and is ranked as S1, which indicates it is "critically imperiled because of extreme rarity (typically five or fewer occurrences or very few remaining individuals) or because of some factors making it especially vulnerable to extirpation or extinction". In Alaska, it occurs in a protected area, the Koyukuk National Wildlife Refuge. It is not covered under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Endangered Species Act (USA) or the IUCN Red Data Book. NatureServe (2002) has designated a global rank of G5 for this species, a ranking that indicates that, on a global scale, the plant is considered "frequent to common to very common; demonstrably secure and essentially ineradicable under present conditions".

National and territorial status

In the Yukon, *Carex sabulosa* is ranked S1 (Douglas *et al.* 2004). The national rank, by definition, is N1.

There is currently no specific legislation in place for the protection of rare vascular plants in Yukon. The Kluane National Park Reserve population, however, is protected under the *Canada National Park Act*.

TECHNICAL SUMMARY

Carex sabulosa

Baikal sedge

carex des sables

Range of Occurrence in Canada: Yukon Territory

Extent and Area Information	
<ul style="list-style-type: none"> Extent of occurrence (EO)(km²) (Area encompassed within a polygon including the 3 extant dune systems) 	ca. 200 km ²
<ul style="list-style-type: none"> Specify trend in EO 	Stable
<ul style="list-style-type: none"> Are there extreme fluctuations in EO? 	No
<ul style="list-style-type: none"> Area of occupancy (AO) (km²) (Sum of the extant dune systems supporting the 5 populations) 	ca 0.74 km ²
<ul style="list-style-type: none"> Specify trend in AO 	Decline (2-3%)
<ul style="list-style-type: none"> Are there extreme fluctuations in AO? 	No
<ul style="list-style-type: none"> Number of known or inferred current locations 	3 extant with 5 populations
<ul style="list-style-type: none"> Specify trend in # 	Stable
<ul style="list-style-type: none"> Are there extreme fluctuations in number of locations? 	No
<ul style="list-style-type: none"> Specify trend in area, extent or quality of habitat 	Decline
Population Information	
<ul style="list-style-type: none"> Generation time (average age of parents in the population) 	Several years
<ul style="list-style-type: none"> Number of mature individuals 	3.5-5 million ramets (uncertain as to how many separate plants this represents due to extensive rhizomatous growth)
<ul style="list-style-type: none"> Total population trend 	Declining
<ul style="list-style-type: none"> % decline over the last/next 10 years or 3 generations. 	1-2% over 30-40 years
<ul style="list-style-type: none"> Are there extreme fluctuations in number of mature individuals? 	No
<ul style="list-style-type: none"> Is the total population severely fragmented? 	No
<ul style="list-style-type: none"> Specify trend in number of populations 	Stable
<ul style="list-style-type: none"> Are there extreme fluctuations in number of populations? 	No
<ul style="list-style-type: none"> List populations with number of mature individuals in each: <ol style="list-style-type: none"> 3-4 million/ca. 38.3 ha (Kaskawulsh/Dezadeash Rivers) 168-294,000/ca. 8.4 ha (Takhini River, south) 240-288,000/ca. 9.6 ha (Takhini River, north) 131-196,000/ca. 13.1ha (Carcross-Bennett Lake) 38-58,000/ca. 4.8 ha (Carcross-Klondike Highway) 	
Threats (actual or imminent threats to populations or habitats)	
<ul style="list-style-type: none"> - imminent development of a major resort at Carcross, together with a planned regular rail service to Carcross for 2006, poses a significant threat from increased recreational use of the dunes in the area - currently, the main impact is the destruction by all-terrain and 4 x 4 vehicles, primarily at the Klondike Highway dune system (at Carcross) - future changes due to climate changes may pose a real threat in northern mountains and the arctic (Kluane Glaciers are retreating dramatically) 	

Rescue Effect (immigration from an outside source)	
<ul style="list-style-type: none"> • <i>Status of outside population(s)?</i> • USA: Critically imperiled in Alaska; Asia? 	
• <i>Is immigration known or possible?</i>	Unlikely
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	No
• <i>Is rescue from outside populations likely?</i>	No
Quantitative Analysis [provide details on calculation, source(s) of data, models, etc]	N/A
Current Status COSEWIC: Threatened (May 2005)	

Status and Reasons for Designation

Status: Threatened	Alpha-numeric code: Met criterion for Endangered B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v), but designated Threatened because there are large numbers in protected areas and because of the low level of threats within these localities. Criteria met for Threatened B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v); D2.
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Reasons for Designation:

A geographically restricted species of three sand dune areas that serve as habitat for five populations. These consist of several million shoots produced mainly through asexual reproduction. The species has been impacted by declines in population size, area, quality of its habitat and on-going impacts from the recreational use of all-terrain vehicles: at Carcross and Bennett Lake. Such activity and much increased tourist visitations at the Carcross dune systems may result in increased impacts on the habitat with the development of a major resort facility at this location by 2006. If the Alsek River is dammed again by the advance of the Lowell Glacier, as has occurred in recent past, the large population at the confluence of the Dezadeash and Kaskawulsh Rivers could be at risk.

Applicability of Criteria

Criterion A (Declining Total Population): Not met due to very limited decline.

Criterion B (Small Distribution, and Decline or Fluctuation): Meets Endangered B1ab(ii-v)+2ab(ii-v) with a very small extent of occurrence (ca. 200 km²) and area of occupancy (<1 km²); declines are also evident in area of occupancy, quality of habitat, and number of mature plants resulting especially from recreational use of the sand dune habitat. However, in spite of the potential impact of a major resort facility at Carcross, the largest population is within Kluane National Park Reserve (Kaskawulsh/Dezadeash River population), comprising perhaps 80% of the total population. Also, the two Takhini River populations are only accessible by canoe with no or minimal human disturbance at these sites at present and will be protected within the proposed Kusawa Territorial Park. The past overall decline in total habitat has only been in the order of 2-3%.

Criterion C (Small Total Population Size and Decline): Not met due to large population size.

Criterion D (Very Small Population or Restricted Distribution): Meets threatened D2 based on the presence of only 5 populations and on-going and imminently increased threat from recreational activities, particularly at the Carcross dunes.

Criterion E (Quantitative Analysis): None available.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Dr. George Wayne Douglas (1938-2005), well-known and respected British Columbia botanist, whose contribution to COSEWIC has included over 30 status reports, died in Duncan, BC, on 10 February 2005, after a short battle with cancer.

George W. Douglas had an M.Sci. (Forestry) from the University of Washington and a Ph.D. (Botany) from the University of Alberta, Edmonton. George worked with rare plants for over 20 years. He was senior author of *The Rare Plants of the Yukon* (1981), *The Rare Plants of British Columbia* (1985) and *Rare Native Plants of British Columbia* (1998, 2002). He was also the senior editor for the *Illustrated Flora of British Columbia* (1998-2002) and was the program botanist for the British Columbia Conservation Data Centre from 1991 until 2003. George wrote or co-wrote 33 COSEWIC status reports and three update status reports.

COLLECTIONS EXAMINED

Carcross (Klondike Highway)

- 1948/07/01 – Raup and Raup 13327 (UBC)
- 1951/08/25 – Porsild 19489 (V)
- 1978/08/01 – Douglas and Ratcliffe 10906 (V)
- 1982/07 – Ceska, Ceska and Goward 11748 (V)
- 1989/07/24 – Straley and Nicholls 5733 (UBC)
- 1992/08/01 – Douglas and Douglas 12645 (V, UBC)

Carcross (Bennett Lake)

- 2003/08/17 – Douglas and Smith 13704 (V, DAO, UBC)

Kaskawalsh/Dezadeash Rivers

1973/08/01 – Douglas and Douglas 6674 (V)

1974/07/07 – Douglas and Douglas 7837 (V, UBC, DAO)

Christmas Bay, Kluane Lake

1974/07/21 – Brink s.n. (UBC)

Takhini River (south dunes)

1986/07/02 – Kennedy K25 (DAO)

2003/08/16 – Douglas and Smith 13700 (V, UBC, DAO)

Takhini River (north dunes)

2003/08/16 – Douglas and Smith 13703 (V)