

Conservation Assessment for *Carex vaginata* Sheathed sedge



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This Conservation Assessment/Approach was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the US Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

TABLE OF CONTENTS

EXECUTIVE SUMMARY..... 4

ACKNOWLEDGEMENTS..... 5

NOMENCLATURE AND TAXONOMY..... 5

DESCRIPTION OF SPECIES..... 6

LIFE HISTORY AND ECOLOGY..... 6

HABITAT..... 7

DISTRIBUTION, ABUNDANCE AND STATUS..... 9

VIABILITY AND POTENTIAL THREATS 12

RESEARCH AND MONITORING 12

REFERENCES..... 13

APPENDIX I: 16

APPENDIX II:..... 19

EXECUTIVE SUMMARY

This Conservation Assessment provides information pertaining to the life history, habitat, distribution and abundance, potential threats, summary of existing habitat protection and future monitoring of sheathed sedge (*Carex vaginata*).

The name *vaginata* is derived from the Latin vagina, 'a sheath', and refers to the conspicuous 1 - 2 cm-long sheaths formed by the leafy bracts immediately below the spikes (Runesson 2002). *Carex vaginata* is circumboreal, occurring in the northern United States and extending as far south as Maine, Michigan, Minnesota, New York, Vermont, Wisconsin, Montana (FEIS Database: Anderson; Fulten 2003). A monoecious perennial graminoid, *Carex vaginata* can reproduce both sexually and via rhizomes. Plants can be solitary or in a loose grouping of clumps sprouting from rhizomes, with a dense tuft of basal leaves (Baldwin 1997). Present on the Superior, Hiawatha, and Chippewa Forests and listed as sensitive on the Chequamegon-Nicolet National Forest, *Carex vaginata* is common in most of its range and globally secure, but rare in portions of the southern parts of its North American range. In North America, this species occurs on a variety of soils and physiographic substrates from hydric sites of western Canada (Corns 1986) to more mesic sites in the eastern United States (Gleason 1991). Multiple sources list bogs, muskegs, wet coniferous sites with acidic peat, wet sandy sites, as well as calcium rich soils. The species occurs in a wide variety of habitats including tundra in Canada and Alaska, boreal forest in Ontario, white cedar swamps in Wisconsin with occasional occurrence in a mixed lowland conifer cover type of black spruce and tamarack. In Michigan, Voss gives the habitat for this sedge as “mossy swamps of cedar and mixed conifer” (Voss 1972). In Minnesota habitat is described as: Poor black spruce swamp with *Picea mariana*, *Thuja occidentalis* and occasionally, *Abies balsamea* (Gleason 1991).

Potential threats include loss of cedar habitat through high fire intensity or mechanical damage, change in drainage pattern by human development such as roads, borrow pits. The decline of *Thuja* swamps as a viable community and the high deer populations are also threats for this species on the Chequamegon-Nicolet National Forest, future influences of global warming may affect the ability of cedar communities to adapt to changing microclimatic conditions and to compete with communities shifting to the north [Fewless and Spickerman (pers. comm., April 2003)].

ACKNOWLEDGEMENTS

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- Department of Natural Resources Ecological Services - Steve Wilson
- Michigan Natural Features Inventory
- Wisconsin Biomapper
- Wisconsin Department of Natural Resources Natural Heritage Inventory
- University of Minnesota – J. F. Bell Museum of Natural History Herbarium
- Linda Parker, Forest Ecologist Chequamegon-Nicolet National Forest
- Susan Trull, Forest Botanist, Ottawa National Forest
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- Gary Fewless, Cofrin Center for Biodiversity, U of Wisconsin – Green Bay

NOMENCLATURE AND TAXONOMY

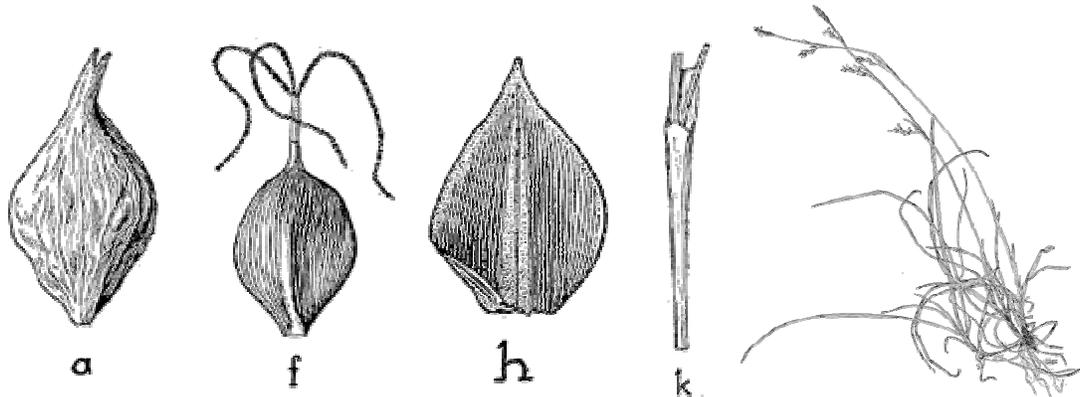
(reference Integrated Taxonomic Information System (ITIS) for ITIS Taxonomic Serial Number – 39859)

Kingdom	- <i>Plantae</i> – Plants
Subkingdom	- <i>Tracheobionta</i> – Vascular plants
Superdivision	- <i>Spermatophyta</i> – Seed plants
Division	- <i>Magnoliophyta</i> – Flowering plants
Class	- <i>Liliopsida</i> – Monocotyledons
Subclass	- <i>Commelinidae</i>
Order	- <i>Cyperales</i>
Family	- <i>Cyperaceae</i> – Sedge family
Genus	- <i>Carex</i> L. – Sedge
Species	- <i>Carex vaginata</i> Tausch
Common name:	- Sheathed sedge
USDA symbol	- CAVA2
Plant Synonyms:	- CASA14 (<i>Carex saltuensis</i> Bailey)

DESCRIPTION OF SPECIES

The Natural Resource Conservation Service Plant database (http://plants.usda.gov/cgi_bin/topics.cgi) lists 35 genera in Cyperaceae and 490 species of *Carex* in North America. Identification of *Carex* can be difficult and is usually dependent upon a mature specimen with roots, fruits, and shoots. This species is distinguished by the straight, prominent short beak of the hairless triangular perigynia, phyllopodic culms (lower sheathes bearing elongate blades), and 2-3 spreading pistillate spikes with long-sheathed bracts below. The terminal spike is club shaped and has only male flowers, and the lateral spikes are cylindrical, 1-2 cm long, and have only female flowers with 3 stigmas. The greenish to brownish perigynia are 3.5-4.5 mm long with short 2 toothed beaks, subtended by shorter light brown scales with broad green mid-veins. Achenes are 3-sided. Diagnostic characters of *Carex vaginata* include the rhizomatous habit and well-developed basal stem leaves. A hand lens or microscope and technical key are needed for positive identification.

References for Key Characteristics: An Illustrated Flora of the Northern United States and Canada:
Volume 1 – Britton and Brown



a - perigynium, dorsal view; f – achene; h - pistillate scale; k - sheath of bract

Figure 1. Illustrations by Harry Charles Creutzburg of *Carex vaginata*

From: North American Cariceae by Kenneth Kent Mackenzie (1940, plate 279)

Web access: <http://www.csdl.tamu.edu/FLORA/carex/k2416600.htm>

LIFE HISTORY AND ECOLOGY

Limited information is available on the life history of *Carex vaginata*. Like many sedges, *Carex vaginata* reproduces both sexually and asexually by rhizomatous growth from perennating buds at the base of the culms (Gleason 1991). Pollination in the genus *Carex* is described as anemophilous (wind-pollinated) by Gleason and Cronquist (1991). Sexual reproduction in the wild is probably episodic and may be stimulated by disturbance such as fire or clearing (Wein 1974). The USDA Forest Service Fire Effects Information System discusses the likelihood of *Carex vaginata* sprouting from rhizomes after aerial portions are burned. Research suggests that long rhizomes and groups of thicker tufts may protect basal buds from fire damage (FEIS database 2003).

Seed dormancy is a reproductive strategy in which seed germination is postponed until periods favorable for seedling growth. Seeds of many *Carex* display this characteristic and are dormant at the time of dispersal (Baskin 1996). Germination is influenced by temperature changes, light regimes, and moisture levels. Recent studies referenced by Schütz & Rave (1999) suggest that there may be a trigger to release a seed from dormancy based on a period of cold stratification. This dormancy cycle may be a mechanism to avoid vegetative competition during the summer period when other plants may establish themselves. If seeds do not germinate, they may remain in the soil and form a seed bank (Schütz 2000).

In a study correlating Arctic vegetation and snow cover in southeastern Victoria Island, Schaefer and Messier (1995) found that *Carex vaginata* exhibited positive associations with various measures of snow cover. It is thought that snow cover may reduce the rate of desiccation, protect plants from abrasion, and insulate from low temperatures.

Most information on the role of sheathed sedge in succession is related to fire and the references are located in the Fire Effects Information System database. The following excerpt is from this database:

“...Vegetation regrowth after fire is very fast in low arctic tundra sedge (Carex spp.)-dominated communities (Wein 1975). Sedges increase in importance following fire in these habitats (Wein 1974). Sheathed sedge in northern Ontario was sparse at the beginning of succession after fire. Its numbers continued to rise for 10 years. It then disappeared over about a 2-year period as black spruce and jack pine (Pinus banksiana) began to regenerate. Sheathed sedge occurs in the central Saskatchewan boreal forest, which has had a history of frequent fire. Sheathed sedge in previously burned sites in this region occurred at a frequency of 31 percent in balsam poplar stands. Balsam poplar is considered a pioneer species. Sheathed sedge occurred at a frequency of 1 to 9 percent in later successional stands, dominated by jack pine and black spruce, and did not occur at all in climax vegetation...”

This common sedge is said to have moderate value as winter forage for wildlife (Runesson 2002). Baldwin, 1997, states its use with other sedges and *Calamagrostis canadensis* as components in “Beaver Hay”, harvested from wet natural meadows in Ontario.

HABITAT

Range wide *Carex vaginata* occurs on a wide variety of sites ranging from hydric to mesic. It can be found in acid peat substrates throughout Canada, (Hitchcock 1973) and in sandy soils in Alaska (Viereck 1966). In the northeastern United States, Gleason 1991 references presence of *Carex vaginata* on calcareous soils. The U.S. Fish and Wildlife Service gives the wetland indicator status for sheathed sedge as obligate throughout its range in the U.S., indicating that it almost always occurs in wetlands under natural conditions.

The US Forest Service Fire Effects Information Systems (FEIS) database identifies the following ecosystem associations for *Carex vaginata*.

ECOSYSTEMS:

FRES10 White - red - jack pine

FRES11 Spruce – fir

KUCHLER PLANT ASSOCIATIONS (with referenced definitions):

K093 Great Lakes spruce - fir forest

K094 Conifer bog

K095 Great Lakes pine forest

K096 Northeastern spruce - fir forest

SAF COVER TYPES:

- 1 Jack pine
- 5 Balsam fir
- 12 Black spruce
- 13 Black spruce - tamarack
- 37 Northern white-cedar
- 107 White spruce

According to the USDA Fire Effects Data base (FEIS 2003), *Carex vaginata* occurs in tundra communities and boreal forest communities in its North American range. Aiken *et al.* describe the Alaskan habitat of *Carex vaginata* as substrates that have depressions of low center polygons, tundra, slopes (and ledges); imperfectly drained moist areas; calcareous; silt, till. In the western Northwest Territories, *Carex vaginata* can be found in white spruce (*Picea glauca*)-green alder (*Alnus crispa*)-willow (*Salix* spp.) communities and in sub arctic black spruce (*Picea mariana*) ecosystems, where sheathed sedge is one of nine species that form the dominant understory cover and biomass of the vascular plants. In south central Alaska, sheathed sedge occurs in low shrub birch (*Betula glandulosa*)-willow-green alder communities and white spruce (*Picea glauca*)-balsam poplar (*Populus balsamifera*) communities. It also occurs in the boreal forest of eastern Ontario and western Quebec, northern Ontario, and central Saskatchewan, Canada.

Table 1 shows occurrence data from the Bell Herbarium for sites within the Chippewa and Superior National Forests.

Table 1. Habitat data for *Carex vaginata* collected in the Superior and Chippewa NF

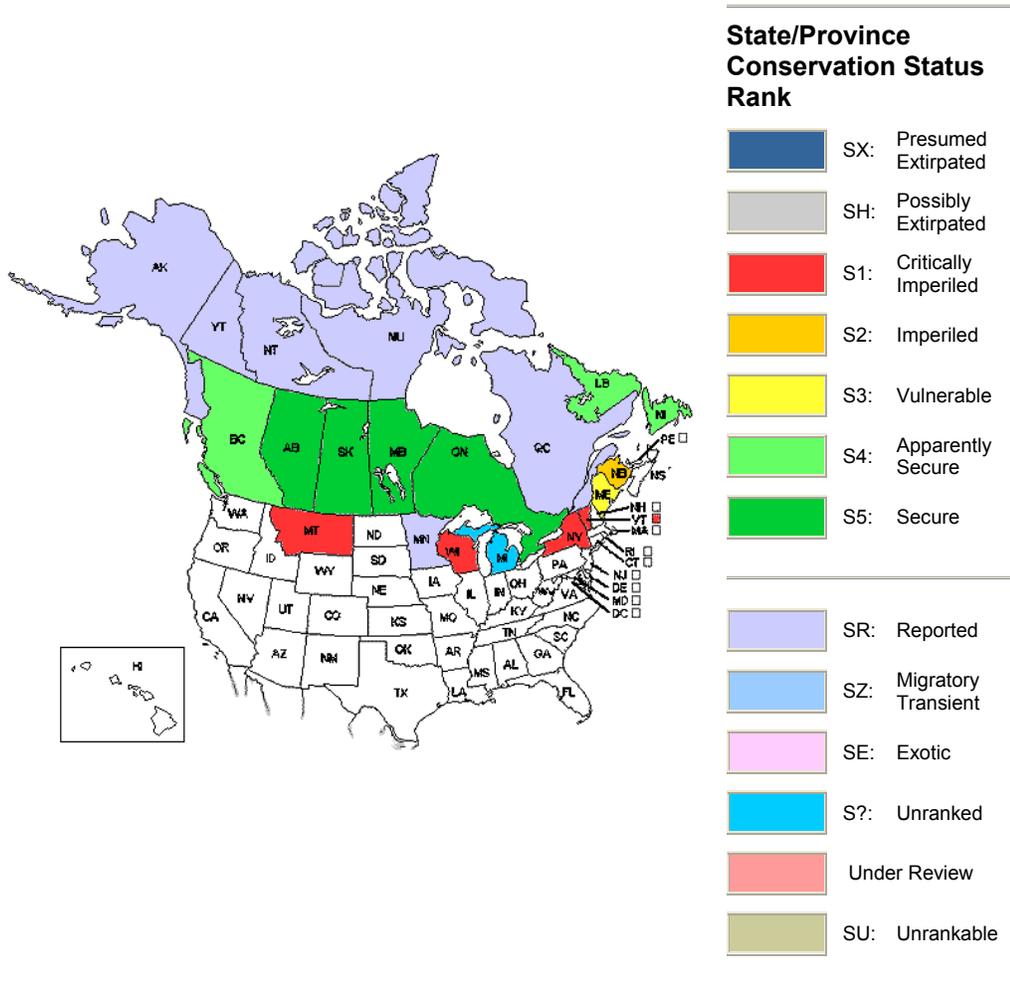
Collection Year	Forest	Description of Habitat
1994	Chippewa	Habitat: Conifer swamp. Thuja occidentalis and Abies balsamea. Associated with Smilacina trifolia, Carex disperma, C. leptalea, C. deweyana, C. tenuiflora.
1944	Superior	Habitat: Growing in Sphagnum.
2000	Superior	Habitat: Picea mariana swamp w/Sphagnum covers 50-60%. Patchy Acer spicatum, Alnus incana, Sorbus decora, Rubus idaeus. Herbs: Clintonia borealis, Carex leptalia [sic], C.disperma, Coptis groenlandicum, Smilacina racemosa.
2000	Superior	Habitat: Poor black spruce swamp with Picea mariana, Larix laricina, Ledum groenlandicum, Betula glandulifera, Alnus incana, Gaultheria hispidula, Calamagrostis canadensis, Kalmia polifolia (in bloom), Rubus pubescens, etc
2000	Superior	Habitat: Poor black spruce swamp with Picea mariana Larix laricina, Ledum groenlandicum, Betula glandulifera, Alnus incana, Gaultheria hispidula, Calamagrostis canadensis, Kalmia polifolia (in bloom), Rubus pubescens, etc.

In Michigan, Voss 1972, gives the habitat for this sedge as “mossy swamps of cedar and mixed conifer”. Specific habitat data is not available from the Michigan Natural Features Inventory as this species is not tracked and there are no collections [Schools (pers. comm., March 2003)].

The Wisconsin Herbarium gives a generalized description of the habitat at specimen collection sites (see Appendix II). The majority of these sites are forested wetlands dominated by white cedar. Other common species include black spruce, balsam fir, and white spruce. Spickerman reported *Carex vaginata* requires closed canopy cedar swamps, generally on the eastern half of the Chequamegon-Nicolet National Forest by the edge of the Niagara Escarpment, with calcareous soils (pers. comm., March 2003). March 2003 Fewless cautioned claims suggesting *Carex vaginata* prefers openings and edges. He states that the plant may expand conspicuously into such areas following a cut or storm damage but that these populations quickly collapse over a few years and may even disappear entirely from such sites in the years after the canopy is dramatically opened (pers. comm., March 2003).

DISTRIBUTION, ABUNDANCE AND STATUS

Carex vaginata is distributed chiefly throughout the boreal regions of North America and Eurasia. It extends south in the United States to Maine and west to northern Minnesota. It extends across Canada, in both tundra and boreal ecosystems.



The Map references the State/Province Conservation Status Rank and shows the North American Distribution of *Carex vaginata*.

A Global Heritage Status Rank of G5 has been assigned to *Carex vaginata*. According to the Natureserve website, the rank data is defined as:

“The conservation rank of an element known or assumed to exist within a jurisdiction is designated by a whole number from 1 to 5, preceded by a G (Global), N (National), or S (Subnational) as appropriate. The numbers have the following meaning:

- 1 = critically imperiled*
- 2 = imperiled*
- 3 = vulnerable to extirpation or extinction*
- 4 = apparently secure*
- 5 = demonstrably widespread, abundant, and secure.*

The G5 rank indicates that *Carex vaginata* is widespread, abundant and secure in the global distribution. *Carex vaginata* has the following State/Province Conservation Status Rank located at NatureServe Explorer 2001 as shown in Table 3.

Table 3: State and Province Rank

State or Province	Status Ranking	Definition of Status
NY, VT, WI, MT	S1	Critically Imperiled
Canada: NB	S2	Imperiled
ME Canada: LB*, Newfoundland Island*	S3	Vulnerable *S3 S5
Canada: BC	S4	Apparently Secure
Canada: AB, MB, ON, SK, NL*	S5	Secure except * Newfoundland Island is classified as Vulnerable
MI	S?	Unranked
AK, MN Canada: NT, QC, YT, NU	SR	Reported

Carex vaginata is listed as a Regional Forester’s Sensitive Species on the Chequamegon-Nicolet National Forest and is present but not listed as sensitive on the Superior, Chippewa, and Hiawatha National Forests.

Minnesota Distribution:

Carex vaginata is found in the northern third of Minnesota. The University of Minnesota – Bell Museum Herbarium has forty-one specimens representing eleven counties shown in Table 4. Five of these collections occurred in the Chippewa and Superior National Forests.

Table 4. Minnesota County with *Carex vaginata* sample # Specimens

Beltrami	1
Cass	1
Clearwater	10
Cook	3
Hubbard	3
Kittson	2
Lake	2
Lake of the Woods	10
Mahnomen	1
Roseau	3
St. Louis	5

Wisconsin Distribution:

The Wisconsin Distribution map for *Carex vaginata* was shown at the Natural Resource Conservation Service Plant database website. (http://plants.usda.gov/cgi_bin/topics.cgi). This map shows *Carex vaginata* distribution in Douglas, Florence, Marinette, Forest, Oconto, Door and Oneida Counties.



Natural Resource Conservation Service Plant database
(http://plants.usda.gov/cgi_bin/topics.cgi)

Wisconsin State Herbarium has fourteen *Carex vaginata* specimens collected from the counties shown in the following table.

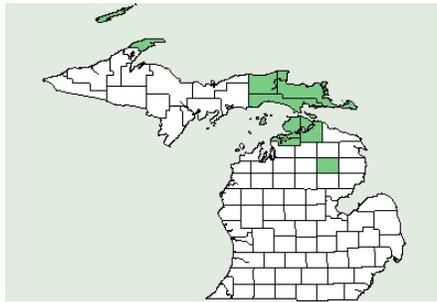
Table 5. Wisconsin County with *Carex vaginata* sample # Specimens

Wisconsin County with <i>Carex vaginata</i> sample	# Specimens
Douglas	11
Oconto	2
Florence	1

The Wisconsin Natural Heritage program has documented 28 total occurrences of *Carex vaginata* in the State of Wisconsin with at least two of those occurrences recorded as historical. Of those 28 occurrences, five occurrences are documented on the Chequamegon-Nicolet National Forest. Spickerman stated that these occurrences are restricted to the eastern half (old Nicolet National Forest) of the Chequamegon-Nicolet National Forest.

Michigan Distribution:

The Michigan Distribution map for *Carex vaginata* was referenced from The Natural Resource Conservation Service Plant database (http://plants.usda.gov/cgi_bin/topics.cgi) Voss 1972. This map shows *Carex vaginata* distribution in the following Upper and Lower Peninsula Counties: Keweenaw, Luce, Chippewa, Mackinac, Oscada, Charle Voix, Emmet, Cheboygan. The Michigan Natural Features Inventory program does not track occurrences of *Carex vaginata* limiting specific occurrence data. ([Schools (pers.comm., March 2003)].



Natural Resource Conservation Service Plant database
Carex vaginata distribution
(http://plants.usda.gov/cgi_bin/topics.cgi)

Viability and Potential Threats

Although this species is widespread, abundant, and secure globally, there are concerns for its viability at the southern edge of its North American range.

Forest management activities may not be a significant impact as this type of disturbance will revert a stand to a pioneer status. Threats may occur from high fire intensity or mechanical damage due to summer harvests that may impact dormant seed beds or the rhizomes that play a role in reproduction or. Any change in drainage pattern such as roads, borrow pits, or development may impact the frequency of species presence, although the species has been documented on multiple substrates and impacts to populations on one substrate do not necessarily imply impacts to the population on another. The Field Guide to the Common Forest Plants in Northwestern Ontario 1999, states that *Carex vaginata* is an important component of “Beaver Hay”, harvested from wet, natural meadows (Baldwin1997). While no documented practice of “Beaver Hay” harvests were located in the Great Lakes Region, anecdotal evidence of sedge swamp agriculture grazing and swathing may have a negative impact to the species.

According to Spickerman, the primary threat to this species on the Chequamegon-Nicolet National Forest relates to the loss of cedar as a viable community. He indicates very little to no recruitment of cedar types. The primary reason is herbivory, but impact of global warming may also influence the status of cedar on the forest. Other threats may include hydrologic changes by beaver, land use actions and continued logging of cedar. Although there is no logging of cedar on national forest land in Wisconsin, logging still occurs on private or industrial forest lands for cedar poles and localized lumber production.

Research and Monitoring

The Chequamegon-Nicolet National Forest, as do the other National Forests in MN and MI periodically revisits know rare plant occurrences, but there is not a specific protocol [Parker (pers.comm., February 2003)]. All new occurrences and new findings are reported to the Natural Heritage Inventory, with a file maintained at the forest where the specimen was located. New occurrences are mapped on the forest as well as in the Wisconsin Natural Heritage database. Spickerman reiterates the need to maintain cedar as a viable community, specifically by researching regeneration success and or failure.

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Appendix I:

Collection data for forty-one *Carex vaginata* specimens from the Bell Herbarium
Species data is presented as it appeared in the Herbarium records without edits

1. Location: Beltrami County Habitat: Growing in an open bog (ombrotrophic area) Collector 1: Wheeler, Gerald A. Collector 2: Glaser, Paul H. Collector Date: Saturday, July 1, 1978
2. Location: Cass Lake * Chippewa National Forest Habitat: Conifer swamp. <i>Thuja occidentalis</i> and <i>Abies balsamea</i> . Associated with <i>Smilacina trifolia</i> , <i>Carex disperma</i> , <i>C. leptalea</i> , <i>C. deweyana</i> , <i>C. tenuiflora</i> . Collector 1: Boe, J.S. Collector Date: Friday, June 10, 1994
3. Location: Clearwater County * Itasca State Park Habitat: In spruce swamp growing in Sphagnum Collector 1: Rosendahl, C.O. Collector Date: Saturday, June 29, 1929
4. Location: Clearwater County- Iron Springs Bog SNA Habitat: Peat soil in spruce bog Collector 1: Rosendahl, C.O. Collector 2: Buell, Murray F. Collector Date: Saturday, June 18, 1932
5. Location: Clearwater County * Itasca State Park Habitat: N/A Collector 1: Lyon, H.L. Collector 2: Rosendahl, C.O. Collector 3: et al. Collector Date: 00 May 1902
6. Location: Clearwater County * Itasca State Park Habitat: In spruce swamp Collector 1: Rosendahl, C.O. Collector Date: Wednesday, July 16, 1924
7. Location: Clearwater County * Itasca State Park Habitat: Open bog, peat soil Collector 1: Moyle, J.B. Collector Date: Thursday, June 29, 1933
8. Location: Clearwater County * Iron springs Bog SNA Habitat: On Sphagnum hummocks Collector 1: Ownbey, Gerald B. Collector Date: Tuesday, June 19, 1962
9. Location: Clearwater County * Itasca State Park Habitat: N/A Collector 1: Lyon, H.L. Collector 2: Rosendahl, C.O. Collector 3: et al. Collector Date: 00 May 1902
10. Location: Clearwater County * Itasca State Park Habitat: <i>Stoloniferous</i> , growing in Sphagnum, spruce, tamarack swamp Collector 1: Rosendahl, C.O. Collector Date: Friday, June 17, 1927
11. Location: Clearwater County * Itasca State Park Habitat: Ash-fir-cedar, loam soil Collector 1: Grant, Martin L. Collector Date: Wednesday, September 4, 1929
12. Location: Clearwater County * Itasca State Park Habitat: Boggy forest Collector 1: Thorne, Robert F. Collector Date: Saturday, June 16, 1962
13. Location: Cook County * Superior National Forest BWCA Habitat: Growing in Sphagnum Collector 1: Butters, F.K. Collector 2: Abbe, E.C. Collector Date: Sunday, July 30, 1944

<p>14. Location: Cook County * Grand Portage Reservation Habitat: Growing in hummocks of Sphagnum, Spruce forest Collector 1: Rosendahl, C.O. Collector Date: Sunday, August 11, 1929</p>
<p>15. Location: Cook County * Superior National Forest Habitat: <i>Picea mariana</i> swamp w/Sphagnum cover 50-60%. Patchy <i>Acer spicatum</i>, <i>Alnus incana</i>, <i>Sorbus decora</i>, <i>Rubus idaeus</i>. Herbs: <i>Clintonia borealis</i>, <i>Carex leptalia</i> [sic], <i>C. disperma</i>, <i>Coptis groenlandicum</i>, <i>Smilacina racemosa</i>. Collector 1: Gerdes, D.L. Collector Date: Thursday, June 15, 2000</p>
<p>16. Location: Hubbard County Habitat: Bog forest Collector 1: Thorne, Robert F. Collector Date: Monday, June 18, 1962</p>
<p>17. Location: Hubbard County Habitat: In bog Collector 1: Ownbey, Gerald B. Collector Date: Monday, June 18, 1962</p>
<p>18. Location: Hubbard County * Itasca State Park Habitat: Near edges of swamp Collector 1: Rosendahl, C.O. Collector Date: Sunday, May 31, 1931</p>
<p>19. Location: Kittson County * Twin Lakes Wildlife Area Habitat: Seepage swamp at base of Glacial Lake Agassiz beach ridge; growing in partial shade under <i>Populus tremuloides</i> and <i>Viburnum trilobum</i>; growing on hummocks. Associated with <i>Equisetum fluviatile</i>, [etc.] Collector 1: Dana, R. Collector Date: Friday, August 7, 1992</p>
<p>20. Location: Kittson County Habitat: Wet woods of mature and young <i>Populus tremuloides</i> on E margin of open, marshy meadow. Well-shaded spot. Major shrubs were <i>Cornus stolonifera</i> and <i>Ribes americanum</i>; on one small higher area; [etc.] Collector 1: Dana, R. Collector Date: Thursday, July 23, 1992</p>
<p>21. Location: Lake County * Superior National Forest Habitat: Poor black spruce swamp with <i>Picea mariana</i>, <i>Larix laricina</i>, <i>Ledum groenlandicum</i>, <i>Betula glandulifera</i>, <i>Alnus incana</i>, <i>Gaultheria hispida</i>, <i>Calamagrostis canadensis</i>, <i>Kalmia polifolia</i> (in bloom), <i>Rubus pubescens</i>, etc. Collector 1: Gerdes, L.B. Collector Date: Sunday, June 4, 2000</p>
<p>22. Location: Lake County * Superior National Forest Habitat: Poor black spruce swamp with <i>Picea mariana</i>, <i>Larix laricina</i>, <i>Ledum groenlandicum</i>, <i>Betula glandulifera</i>, <i>Alnus incana</i>, <i>Gaultheria hispida</i>, <i>Calamagrostis canadensis</i>, <i>Kalmia polifolia</i> (in bloom), <i>Rubus pubescens</i>, etc. Collector 1: Gerdes, L.B. Collector Date: Sunday, June 4, 2000</p>
<p>23. Location: Lake of the Woods County Habitat: Open cutover area, with old <i>Picea mariana</i> stumps, Sphagnum hummocks, growing on Sphagnum hummock Collector 1: Boe, J.S. Collector Date: Thursday, June 7, 1979</p>
<p>24. Location: Lake of the Woods County * Northwest Angle Habitat: Growing in Sphagnum, white cedar bog Collector 1: Moore, John W. Collector 2: Moore, Marjorie F. Collector Date: Tuesday, July 25, 1939</p>
<p>25. Location: Lake of the Woods County Habitat: Near burned area with Sphagnum hummocks Collector 1: Boe, J.S. Collector Date: Wednesday, June 27, 1979</p>
<p>26. Location: Lake of the Woods County Habitat: <i>Populus balsamifera</i>-<i>Populus tremuloides</i> stand, moist soil, edge of stand Collector 1: Boe, J.S. Collector Date: Wednesday, June 13, 1979</p>
<p>27. Location: Lake of the Woods County Habitat: <i>Thuja-Abies-Picea</i> stand, moist soil, Sphagnum hummocks, pools of water Collector 1: Boe, J.S. Collector Date: Thursday, July 5, 1979</p>

<p>28. Location: Lake of the Woods County Habitat: <i>Picea mariana</i> cutting with Sphagnum hummocks Collector 1: Boe, J.S. Collector Date: Sunday, June 17, 1979</p>
<p>29. Location: Lake of the Woods County Habitat: <i>Populus balsamifera</i>-<i>Populus tremuloides</i> stand, moist soil Collector 1: Boe, J.S. Collector Date: Thursday, June 21, 1979</p>
<p>30. Location: Lake of the Woods County Habitat: <i>Populus balsamifera</i>-<i>Populus tremuloides</i> stand, moist soil Collector 1: Boe, J.S. Collector Date: June 21, 1979</p>
<p>31. Location: Lake of the Woods County Habitat: Wet clearing between <i>Abies balsamea</i> stands Collector 1: Boe, J.S. Collector Date: Sunday, June 24, 1979</p>
<p>32. Location: Lake of the Woods County Habitat: <i>Picea mariana</i> cutover, moist soil, Sphagnum hummocks Collector 1: Boe, J.S. Collector Date: Thursday, June 7, 1979</p>
<p>33. Location: Mahanomen County * White Earth Reservation Habitat: Growing in a tamarack-alder swamp Collector 1: Wheeler, Gerald A. Collector Date: Tuesday, August 10, 1982</p>
<p>34. Location: Roseau County Habitat: Growing in small, disturbed, fairly open, balsam fir stand on flat, low-lying upland with slender black ash; with <i>Aralia nudicaulis</i>, <i>Mitella nuda</i>, <i>Rubus strigosus</i>, <i>Carex deweyana</i> Collector 1: Delaney, B. Collector Date: Tuesday, September 3, 1991</p>
<p>35. Location: Roseau County Habitat: Growing in small, shady area of white cedar in a rich, hummocky, balsam fir swamp. Nearly continuous moist bryophyte layer, sphagnum on hummocks, about 45% cover; on hummocks in small openings etc. Collector 1: Delaney, B. Collector Date: Tuesday, September 3, 1991</p>
<p>36. Location: Roseau County Habitat: Growing in small, rich, hummocky, balsam fir swamp. Nearly continuous moist moss layer; on raised, woody hummocks in canopy gaps. With <i>Carex disperma</i>, <i>Carex leptalea</i>, <i>Carex eburnea</i>, & <i>Carex brunnescen</i> Collector 1: Delaney, B. Collector Date: Wednesday, September 4, 1991</p>
<p>37. Location: St. Louis County Habitat: On RR track, Drying swale Collector 1: Lakela, O. Collector Date: Thursday, July 27, 1950</p>
<p>38. Location: St. Louis County Habitat: Collector 1: Arthur, J.C. Collector 2: Bailey, L.H., Jr. Collector 3: Holway, E.W.D. Collector Date: Saturday, July 24, 1886</p>
<p>39. Location: St. Louis County Habitat: <i>Arbor-vitae</i> bog Collector 1: Lakela, O. Collector Date: Saturday, May 31, 1941</p>
<p>40. Location: St. Louis County Habitat: Headwaters of St. Louis River, Seven Beaver Lake area Collector 1: Ahlgren, Clifford Collector Date: Thursday, June 28, 1951</p>
<p>41. Location: St. Louis County Habitat: White cedar forest Collector 1: Lakela, O. Collector Date: Tuesday, June 12, 1956</p>

Appendix II:

Collection data for fourteen *Carex vaginata* specimens from the Wisconsin Herbarium
Species data is presented as it appeared in the Hebarium records without edits

<p>1. Location: Douglas County Habitat: Complex conifer (cedar, tamarack, black spruce, black ash) swamp/bog Collector: Nekola, Jeff Addl. Collectors: Date Observed or Collected: 6/10/1996</p>
<p>2. Location: Douglas County Habitat: No data Collector: Judziewicz, Emmet J. Date Observed or Collected: 6/25/1995</p>
<p>3. Location: Douglas County Habitat: White cedar, balsam fir, black spruce swamp. With Sphagnum, <i>Alnus incana</i>, <i>Calypso</i>, <i>Ranunculus lapponicus</i>, <i>Ribes hudsonianum</i>, <i>Coptis</i>, <i>Moneses</i>, <i>Mitella nuda</i>, <i>Carex disperma</i>, <i>C. trisperma</i>, <i>C. leptalea</i>. Collector: Clark, Andy Date Observed or Collected: 5/26/1996</p>
<p>4. Location: Douglas County Habitat: White cedar, black & white spruce, balsam fir swamp. With Sphagnum, <i>Alnus incana</i>, <i>Calypso</i>, <i>Ranunculus lapponicus</i>, <i>Ribes hudsonianum</i>, <i>Coptis</i>, <i>Moneses</i>, <i>Mitella nuda</i>, <i>Carex disperma</i>, <i>C. trisperma</i>, <i>C. leptalea</i>. Collector: Clark, Andy Date Observed or Collected: 5/31/1996</p>
<p>5. Location: Douglas County Habitat: White cedar, black & white spruce, balsam fir swamp. With Sphagnum, <i>Alnus incana</i>, <i>Listera cordata</i>, <i>Ribes hudsonianum</i>, <i>R. hirtellum</i>, <i>Mitella nuda</i>, <i>Clintonia</i>, <i>Trientalis</i>, <i>Carex disperma</i>, <i>C. trisperma</i>, <i>C. leptalea</i>. Collector: Clark, Andy Date Observed or Collected: 6/6/1996</p>

<p>6. Location: Douglas County Habitat: White cedar, balsam fir, black & white spruce swamp. With Sphagnum, <i>Lonicera oblongifolia</i>, <i>L. villosa</i>, <i>Coptis</i>, <i>Clintonia</i>, <i>Mitella nuda</i>, <i>Ribes hudsonianum</i>, <i>Carex trisperma</i>, <i>C. disperma</i>. Collector: Clark, Andy Date Observed or Collected: 6/12/1996</p>
<p>7. Location: Douglas County Habitat: White cedar swamp & white cedar-dominated seepage slopes. With white & black spruce, balsam fir, red and white pine, mt. maple, alder. Sphagnum, <i>Cornus canadensis</i>, <i>Clintonia</i>, <i>Mitella nuda</i>, <i>Carex trisperma</i>, <i>C. disperma</i>, <i>Ribes hudsonianum</i>, <i>Calypso</i>, <i>Cypripedium parviflorum</i> Collector: Clark, Andy Date Observed or Collected: 6/14/1996</p>
<p>8. Location: Douglas County Habitat: White cedar, black & white spruce, balsam fir, tamarack swamp. With Sphagnum, <i>Fraxinus nigra</i>, <i>Carex trisperma</i>, <i>C. disperma</i>, <i>Alnus incana</i>, <i>Coptis</i>, <i>Lonicera villosa</i>, <i>L. oblongifolia</i>. Collector: Clark, Andy Date Observed or Collected: 6/13/1996</p>
<p>9. Location: Douglas County Habitat: White cedar, black spruce, balsam fir swamp. With Sphagnum, <i>Carex trisperma</i>, <i>C. disperma</i>, <i>Ledum</i>, <i>Alnus incana</i>, <i>Coptis</i>, <i>Mitella nuda</i>, <i>Cornus canadensis</i>, <i>Pyrola secunda</i>, <i>Lycopodium lucidulum</i>. Collector: Clark, Andy Date Observed or Collected: 5/31/1996</p>
<p>10. Location: Douglas County Habitat: Old growth white cedar swamp with balsam fir, white & black spruce, tamarack, <i>Fraxinus nigra</i>, <i>Alnus incana</i>, <i>Rhamnus alnifolia</i>, <i>Ledum</i>, <i>Sphagnum</i>, <i>Mitella nuda</i>, <i>Gymnocarpium</i>, <i>Mosses</i>, <i>Pyrola secunda</i>, <i>Luzula acuminata</i>, <i>Smilacina trifolia</i>, <i>Coptis</i>, <i>Carex trisperma</i>, <i>C. disperma</i>, <i>Clintonia</i>, <i>Ranunculus lapponicus</i>, <i>Calypso</i>, <i>Cypripedium parviflorum</i>, <i>Ribes hudsonianum</i>. Collector: Clark, Andy Date Observed or Collected: 6/5/1996</p>
<p>11. Location: Oconto County Habitat: Open area under cedars. Colony. Collector: Judziewicz, Emmet Date Observed or Collected: 7/1/1982</p>
<p>12. Location: Oconto County Habitat: Open area under Thuja. With <i>Carex leptalea</i>, <i>Smilacina trifolia</i>. Sphagnum moss not prominent. Large colony. Collector: Judziewicz, Emmet Date Observed or Collected: 7/1/1996</p>
<p>13. Location: Douglas County Habitat: Long-undisturbed cedar swamp dominated by <i>Thuja</i>, with some <i>Abies</i>, few adult <i>Betula papyrifera</i>, <i>Alnus rugosa</i> in open areas. With <i>Onoclea</i>, <i>Gymnocarpium dryopteris</i>, <i>Osmunda</i> (all 3 spp.), <i>Botrychium virginianum</i>, <i>Lycopodium lucidulum</i>, <i>L. annotinum</i>, <i>Coptis</i>, <i>Cornus canadensis</i>, <i>C. stolonifera</i>, <i>Trientalis</i>, <i>Clintonia</i>, <i>Maianthemum</i>, <i>Galium</i>, <i>Aralia nudicaulis</i>, <i>Mitella nuda</i>, <i>Iris</i> sp., <i>Impatiens</i> seedlings, <i>Ledum</i>, <i>Moneses</i>, <i>Fragaria</i> cf. <i>vesca</i>, <i>Ribes americanum</i>, <i>R. glandulosum</i>, <i>R. Lacustre</i> (?), <i>Chiogenes</i>... Few plants (3 clusters, ca 5 culms each) at lower edges of moss mats around small open pools. Plants have delicate, almost fleshy appearance with pale lustre on surface. Styles long, white, bearded... (more data on label). Collector: Alverson, William Date Observed or Collected: 5/25/1981</p>
<p>14. Location: Florence County Habitat: Mossy sedgy boggy hummocks, in opening of damp open coniferous <i>Thuja-Abies-Picea mariana-P. glauca</i> forest with Sphagnum-<i>Linnaea-Coptis-Pyrola chlorantha-Cornus Canadensis</i> understory. Collector: Illtis, Hugh H. Date Observed or Collected: 7/3/1964</p>