

New England Plant Conservation Program  
Conservation and Research Plan

*Carex atherodes* Sprengel  
Awned Sedge

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## SUMMARY

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*Carex atherodes* Sprengel (Cyperaceae) is an obligate wetland plant, a perennial capable of forming large rhizomatous colonies. There are no major problems with its identification or taxonomy. It is distributed mostly west of New England, becoming more frequent in Ontario and Michigan, extending northwest to Yukon Territory and south to Arizona in the west, and to Ohio and West Virginia in the east. Only one population is known from Maine and one from Vermont; otherwise the species has not been found in New England. The taxon is Endangered in New York. Current species status is Endangered in Maine. It is a new record for Vermont and has no official status yet.

There is potential that each site contains only one or a few genotypes. Vulnerability to threat is not understood because its population structure is unknown. Both sites contain what appear to be somewhat stable populations in habitat that is not intended for land use change in the near future, so threat could be relatively low. Development and forest succession are possible long-term threats. There are no known diseases or pests that cause population decline.

A primary conservation objective is to retain the populations in their natural habitats. Additional inventory in the vicinity of the known populations could lead to discovery of new populations, and this would help alleviate concern that a single catastrophic event would eradicate a population. Ideally, five distinct populations at least 0.5 km apart could be found in each of the two states. More detailed documentation of the known sites is necessary.

Recommendations for conservation actions include:

1. working with the private landowners to establish a conservation plan for each site;
2. controlling illegal dumping and invasive plants at the Maine site;
3. surveying areal extent, number of stems, and proportion of reproductive stems at each site;
4. conducting inventory to find new populations in the vicinity of known sites;
5. establishing a monitoring program to follow population dynamics and determine if populations are increasing or decreasing;
6. assessing threats due to invasive exotic plants;
7. mowing part of the population and adjacent habitat during dormant season in a replicated experiment at the Maine site to keep woody vegetation from encroaching; and
8. examining population structure.

## PREFACE

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This document is an excerpt of a New England Plant Conservation Program (NEPCoP) Conservation and Research Plan. Full plans with complete and sensitive information are made available to conservation organizations, government agencies, and individuals with responsibility for rare plant conservation. This excerpt contains general information on the species biology, ecology, and distribution of rare plant species in New England.

The New England Plant Conservation Program (NEPCoP) is a voluntary association of private organizations and government agencies in each of the six states of New England, interested in working together to protect from extirpation, and promote the recovery of the endangered flora of the region.

In 1996, NEPCoP published “*Flora Conservanda: New England.*” which listed the plants in need of conservation in the region. NEPCoP regional plant Conservation Plans recommend actions that should lead to the conservation of *Flora Conservanda* species. These recommendations derive from a voluntary collaboration of planning partners, and their implementation is contingent on the commitment of federal, state, local, and private conservation organizations.

NEPCoP Conservation Plans do not necessarily represent the official position or approval of all state task forces or NEPCoP member organizations; they do, however, represent a consensus of NEPCoP’s Regional Advisory Council. NEPCoP Conservation Plans are subject to modification as dictated by new findings, changes in species status, and the accomplishment of conservation actions.

Completion of the NEPCoP Conservation and Research Plans was made possible by generous funding from an anonymous source, and data were provided by state Natural Heritage Programs. NEPCoP gratefully acknowledges the permission and cooperation of many private and public landowners who granted access to their land for plant monitoring and data collection.

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## I. BACKGROUND

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### INTRODUCTION

A conservation plan is needed for *Carex atherodes* Sprengel, the awned sedge or slough sedge, because the plant is extremely rare in the northeastern United States. There are only two extant sites in New England, one each in Maine and Vermont. Each of these sites is on private land and not currently under any formal protection. Each of the two landowners is working with a (different) private consulting firm, and each firm is a potential liaison through which site-specific conservation plans might be written and implemented.

At both sites, it seems possible that a single catastrophic event or change in land use could eradicate a population. Little is known of the population sizes and even a modest monitoring effort could help uncover whether the populations are expanding or decreasing. Degree of threat to this species in New England is difficult to pinpoint until population genetic structure is known. The two New England sites could each be one or many genetic individuals, and threat would be much greater in the former case because of low variability with which to adapt to disease, climate change, or other environmental conditions. Perceived threats such as succession by woody vegetation, invasion by exotic species, or development and quarrying activities, might be alleviated in part if additional surveys lead to discovery of more populations.

*Carex atherodes* is a perennial of wet habitats that is distributed from mid-coast Maine westward through upper Midwestern North America to the Yukon, and in northern Eurasia. It has only two known sites in New England, is endangered in New York (Mitchell and Tucker 1997), and has three sites in northwest Pennsylvania. Until 1998, there was a single historic record from 1920 in Thomaston, Knox County, Maine. In 1998, a new population was found in Vermont where the species had not been known previously. Otherwise, the species has not been seen in New England. A conservation objective is to retain the populations in their natural habitats. To do this, more detailed documentation of the known sites is necessary.

The species is distinctive in the field in its pubescence on the inner band of the leaf sheath and on the underside of the leaves. It grows in large rhizomatous colonies, often in deeper water than other wetland sedges in the genus *Carex*. In October, the dense colonies turn a rich golden-green color and can be relatively easy to spot because of the plant's height (to 1 m tall) and because most of the other vegetation around it is likely to be faded.

Anton Reznicek, systematist at the University of Michigan Herbarium (MICH) and international *Carex* expert, became curious about the status of *Carex atherodes* in New England while he was working on the *Carex* volume for Flora of North America, and his interest prompted greater awareness of this species by New England botanists.

## DESCRIPTION

*Carex atherodes* Sprengel (Syst. Veg. 3: 827. 1826), is in Section *Carex* of the genus *Carex* (Cyperaceae) (A. A. Reznicek, personal communication), though it has also been placed in Section *Paludosae* (Haines and Vining 1998). It is a tall, coarse perennial that can form large colonies by long creeping rhizomes. The vegetative stems are true culms, thus they have nodes and internodes. The leaves are typically produced toward the top of the culm, so stems appear tall, narrow, and full toward the top. The horizontal, scale-bearing rhizomes are typically 4-6 mm in diameter. Culms are smooth, angled, 4-20 dm tall, 10-15 mm thick at the base. Basal sheaths are few, reddish-brown or purplish, pubescent, and bladeless; a few of the previous season's leaves may persist at the base. Sheaths are deeply concave, and those of the current season are usually pilose. If growing in shallow water, the leaves and sheaths may be mostly glabrous but will have some hairs at the summit of some leaf sheaths. Sheaths become fibrillose with age; the lowest are 1-2 cm long with a firm inner band that has darker pigment (either purplish or reddish-brown) at the mouth of the sheath. The ligule is conspicuous and longer than wide. Leaves are deep green, up to 2 dm long, 0.4-0.8 (1.2) cm wide, long-tapering at the tip, notably septate-nodulose, with scabrous margins; usually they are pubescent on the abaxial (underneath) side except in the glabrous form.

Bracts on spikes resemble the leaves; those subtending the pistillate spikes about equal the spikes in length and are nearly sheathless, while those subtending the staminate spikes are greatly reduced or lacking. Two to five (rarely 1 or 6) staminate spikes are pale, borne at or near the apex, overlapping, typically 4-10 cm long and 3-5 mm wide, the terminal spike largest, to 7 cm long; the staminate spikes may have a few perigynia. Pistillate spikes may be androgynous, borne below the staminate spikes, 2-4, not overlapping, attached 1-2 dm apart, mostly sessile or subsessile except the lower one which can be borne on a stiff peduncle longer than the spike itself. Spikes are erect, oblanceolate, cylindric, 3-6 cm long and 1-1.5 cm in diameter. Staminate scales are awned, light yellow-brown with pale margins and light center. Pistillate scales are lanceolate, pale brown to dull reddish-brown with hyaline margins and 3-nerved green center, scarious, acute to short-awned, shorter than to longer than the perigynia. Perigynia number (30) 50-100 (150) per spike, and are crowded, firm, lanceolate, glabrous, (7) 8-10 (12) mm long, 1.5-2 mm wide, with (12) 15-20 pronounced ribs, substipitate, widest about 1/4 of length from base, tapering to base of slender, glabrous beak. Beak teeth are slender, firm, (1.6) 2-3 mm long, spreading widely ( $\geq 45^\circ$  angle), often recurved at the tip even if immature, and may be twisted. The achene loosely fills the lower part of the perigynium, and is three-angled with concave sides and blunt angles, 2.5 mm long, 1.24 mm wide, substipitate, continuous with the straight or curving stiff and persistent style. There are 3 long, blackish stigmas. This description is based on personal observations by Dibble from a single population, and by Fernald (1950), Hermann (1970), Hitchcock et al. (1969), Hudson (1977), Mackenzie (1940), Seymour (1982), and Voss (1972).

In New England, it would be difficult to confuse *Carex atherodes* with other sedges in the genus *Carex* because the hairs on sheaths and undersides of leaves are not present in the other wetland sedges with which it might occur here. Based on identifications on herbarium

labels for specimens that have been annotated as *C. atherodes*, this species may be confused in some parts of its range with *C. laeviconica*, especially if *C. atherodes* is growing in standing water and then has little or no pubescence. *Carex atherodes* has been collected as *C. aristata*, *C. lacustris*, and *C. vesicaria*.

Reznicek has collected from a single large clone some material that he refers to as “oddball,” a hybrid between *C. atherodes* and *C. ? trichocarpa* in Michigan. This plant had very few reproductive culms. The upcoming *Flora of North America* treatment of Cyperaceae will mention that *C. atherodes* “rarely hybridizes with *Carex trichocarpa*” (A. A. Reznicek, personal communication).

*Carex atherodes* can be distinguished from other species in part by habitat because it grows in deeper water than other *Carex*. Vegetative characters that separate *C. atherodes* from related species in Section *Carex* are especially the vegetative stems that are true culms, pubescence on the inner band of the leaf sheath and long hairs on the undersides of the leaves. Vegetative stems as true culms are present also in *C. hirta* and *C. trichocarpa*. Pubescence on leaf sheath and leaves are found in *C. atherodes*, *C. hirta* and *C. sheldonii* and lacking in *C. laeviconica* and *C. trichocarpa*. *Carex atherodes* can be glabrous, and then identification requires reproductive features to make a definitive determination; however, perigynia can be completely lacking in a large clone. Of the above species, only *C. trichocarpa* and *C. hirta* (a Eurasian adventive) have been found in New England (A. A. Reznicek, personal communication).

Fall color is an important field character, as large colonies can be recognized from afar by their striking greenish-gold hue when surrounding wetland vegetation has faded to tan and brown. The plant apparently can hold this color until after a few frosts, so this facilitates a late-September survey in the North temperate zone (A. A. Reznicek, personal communication).

The habit of *Carex atherodes* is colonial, and a single patch can consist of hundreds, or even thousands, of culms. Some collections have been made from populations that had only one or a few culms. Some collectors of the specimens at MICH noted on the herbarium labels that only vegetative culms were found at the site where they sampled.

## **TAXONOMIC RELATIONSHIPS, HISTORY, AND SYNONYMY**

It appears that there are no ongoing disputes or doubts regarding the taxonomy of *Carex atherodes*. In the yet unpublished *Flora of North America* (FNA) volume on Cyperaceae, Section *Carex* is distinguished by perigynia having long beaks, with long beak teeth, vegetative shoots that are elongate and that are true culms with leaves mostly clustered at the apex, lack of red dots on inner bands of sheaths (though may be reddish-tinged at summit), and presence of a high chromosome number (to the extent known). Species in this Section include *C. atherodes*, *C. hirta*, *C. sheldonii*, *C. laeviconica*, and *C. trichocarpa* (A. A. Reznicek, personal communication).

Because most botanists do not yet have access to the Cyperaceae volume of FNA, they can refer for the present to Gleason and Cronquist (1991), in which *C. atherodes* shares with other sedges in Section *Paludosae* the following characters: 3 stigmas instead of 2, pistillate spikes that are erect or ascending and either sessile or with short peduncles, and perigynia that are fairly broad but not inflated, with firm walls. By Gleason and Cronquist's (1991) taxonomy, in eastern North America this Section includes *C. atherodes*, *C. melanostachya*, *C. acutiformis*, *C. lacustris*, *C. hyalinolepis*, *C. laeviconica*, and *C. trichocarpa*. Of these, all but *C. trichocarpa* have glabrous perigynia. According to Gleason and Cronquist (1991), only *C. atherodes* has pubescent leaves and sheaths.

Synonyms given for *Carex atherodes* include:

*C. aristata* R. Br. in Richards. App. Frankl. Journ. 751. 1823.

*C. trichocarpa* var. *aristata* L. H. Bailey, Bot. Gaz. 10:294. 1885.

*C. aristata* var. *browniana* Asch. Ber. Beuts. Bot Ges. 6:290. 1888.  
(Hitchcock et al. [1969] indicate that the type was not provided in the original description, but they thought it was "doubtless based on Richardson, Cumberland House, northwestern Canada", p. 241).

*Carex atherodes* is not synonymous with *C. aristata* Honck. 1792. It has also been referred to as *Carex trichocarpa* var. *imberbis* Gray, but Dibble found no reference associated with this synonym. In Europe *C. atherodes* has often been referred to as *C. trichocarpa* var. *aristata* R. Br. (Hermann 1970).

## **SPECIES BIOLOGY**

Notes from herbarium labels and information from Fernald (1950), Gleason (1953), and Mackenzie (1940) indicate that *C. atherodes* is a perennial sedge capable of self-perpetuating through vigorous spread by stolons. It may or may not produce flowers in a given season. Flowering takes place in May-July and fruiting in June-August depending on elevation and latitude. It is wind-pollinated. The seeds are presumably dispersed by gravity and water, and long, spreading beak teeth suggest the possibility of dispersal on fur of mammals. As with many sedges, its seeds could be capable of long storage in the soil seed bank, enabling it to take advantage of opportunities such as floods for dispersal and droughts for colonization of formerly flooded habitats. Its ability to grow in water up to 1 m deep suggests it may be adapted for anaerobic conditions, though Dibble found no anatomical study of the roots, stolons or stems. One can speculate that longevity of an individual could be many, perhaps even hundreds, of years, given that a clone might persist over some portion of available habitat despite (or because of) numerous disturbances and hydrologic fluctuations through the decades. In prairie populations, fire is an important disturbance, though that might not be the case in New England. No mention has been made in the literature of predators or diseases associated with *C. atherodes*.

## **HABITAT/ECOLOGY**

*Carex atherodes* is an obligate wetland plant (U.S. Fish and Wildlife Service 1988). Notes from herbarium labels and from Hermann (1970), Fernald (1950), and Mackenzie (1940) indicate that it has been found in: calcareous meadows and swales; prairie sloughs; floodplain meadows; wetlands in the Rocky Mountains at 5000-8000' elevation; old fields; wet ditches; stream sides; open river and lake shores where it can grow out into the shallow water to 1 m depth; dry lake beds; marshes of relatively constant water level; willow shrub-swamps; floodplain woods; power line cuts or utility corridors; other wet, open habitats; railroad sides; and roadsides. Substrates include clay, marl, and calcareous soils. In Saskatchewan, it is less typical of fens and bogs than of marshes; however, in Montana, it has been found at the edge of a fen.

In New England, the Maine site is a moist meadow and roadside ditch with nearby outcrops of calcareous rock in an area that has been quarried for limestone since the 1800s (Dibble, personal observation). In Vermont, the habitat is a wet meadow and former field of an old farm in association with a natural gas pipeline corridor (Errol Briggs, personal communication).

### ***Associated vegetation throughout overall range***

Herbarium labels indicate that throughout its overall range, other plants in the genus *Carex* that may grow with *C. atherodes* include: *Carex aquatilis*, *C. emoryi*, *C. frankii*, *C. granularis*, *C. lacustris*, *C. lanuginosa*, *C. molesta*, *C. rostrata*, *C. sortwellii*, *C. stipata*, *C. trichocarpa*, *C. "trichodes"* (sic), and *C. utriculata*. Typical associated plants include other large sedges, especially *Dulichium arundinaceum*, *Schoenoplectus acutus*, and various unspecified *Scirpus* spp., and *Schoenoplectus* sp. Grasses such as *Agrostis* spp., *Festuca pratensis*, *Leersia oryzoides*, *Spartina* spp., and *Phalaris arundinacea* are found with *C. atherodes*. Other plants noted by collectors include *Typha latifolia*, *Juncus canadensis*, *J. brevicaudatus*, *Polygonum amphibium*, *Aster occidentalis*, *Solidago* spp., *Salix* spp., and *Cornus* spp. Apparently the plant can persist under a layer of woody shrubs or even trees in wet areas if shade is not too dense, and it can form dense monospecific colonies where it has no competition.

## **THREATS TO TAXON**

One can speculate that *Carex atherodes* might have declined in some parts of its range due to drainage of wet areas for agriculture over the past 100 years, leading to a lack of habitat. This seems especially likely for prairie sloughs and areas where impoundments have changed natural dynamics of lakes and streams. High-elevation populations in the Rocky Mountains and high-latitude wetlands that are unsuitable for most human activities could be relatively free of

threats, beyond global warming. In rangelands, overgrazing could impact *C. atherodes* populations along streams and in wet areas.

Both *C. atherodes* sites in New England have potential to consist of a single genetic clone, though this is not known. Both appear to be self-perpetuating and perhaps even increasing in areal extent but there are no baseline measurements against which to quantify this. No assessment of genetic variability has yet been undertaken.

## **DISTRIBUTION AND STATUS**

### ***General Status***

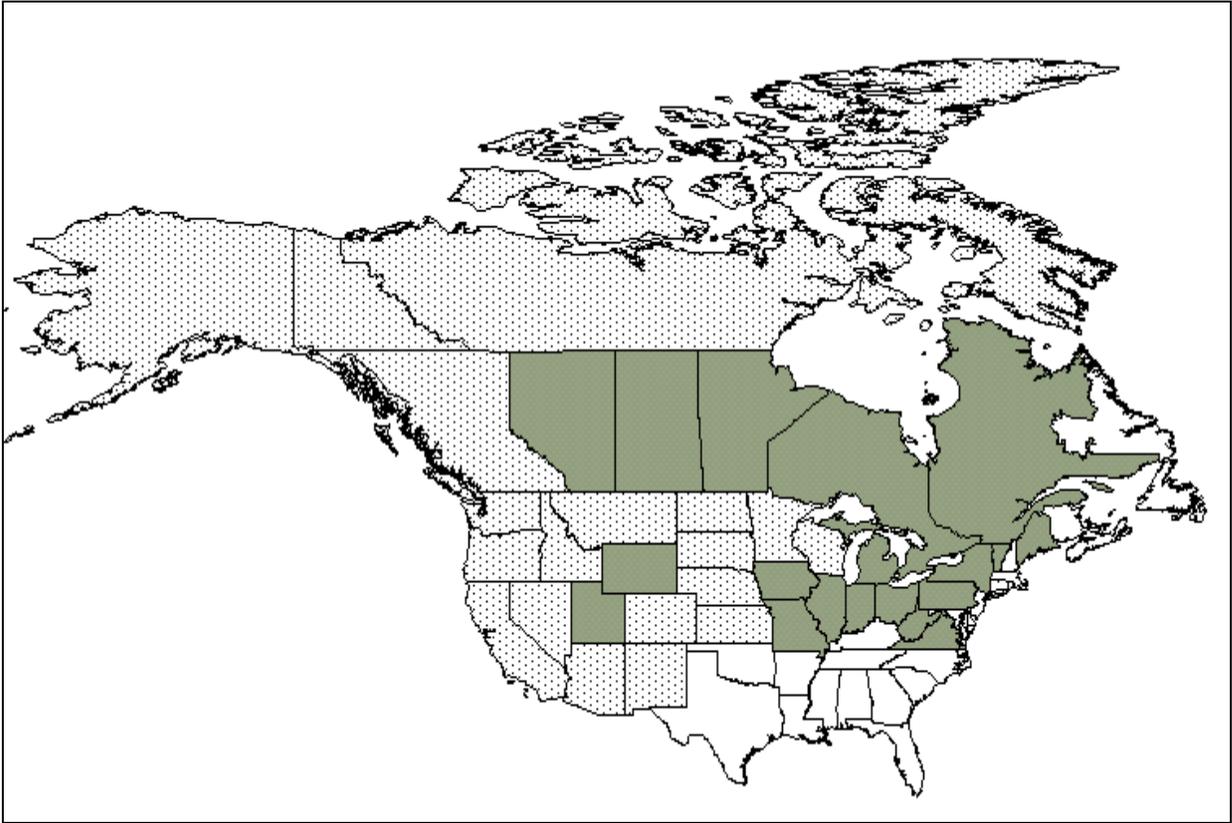
The global range of *Carex atherodes* is circumboreal, and includes northern Eurasia (A. A. Reznicek, personal communication). A survey of boreal and arctic floras indicates it is apparently not a typical component of tundra vegetation in North America, unless it is found in this vegetation type in the Yukon and Alaska. Collections at MICH have been made in the following states: Arizona, Illinois, Indiana, Iowa, Maine, Minnesota, Montana, New York (as far east as Watertown), Ohio, Oregon, Pennsylvania (only the extreme western part), South Dakota, Tennessee, Vermont, West Virginia, and Wisconsin. The map for *Flora of North America* will also show California, New Mexico, Nevada, and Washington. *Carex atherodes* is in a checklist for Wyoming, and is shown by Crow and Hellquist (2000) as found in Alaska, Idaho, Missouri, Nebraska, Utah and Manitoba, in addition to some of the other states and provinces listed above. The MICH collection includes specimens from the following Canadian provinces: Alberta, British Columbia, Northwest Territories, Ontario, Saskatchewan, and Yukon Territory (along the Alaskan Highway). In the MICH collection, there are many more specimens from Ontario and Michigan than elsewhere, though Reznicek regards this as a collection bias and thinks *C. atherodes* is more frequent west of Ontario and Michigan. It seems from Dibble's informal survey of state and provincial floras that the species is either not common through much of its range, or it is not often collected.

*Carex atherodes* is ranked as G5 (secure) globally and N5? nationally by the Association for Biodiversity Information. The general status of *C. atherodes* appears to be rare (see Table 1), though in some states, especially in the Midwest, it is collected fairly often.

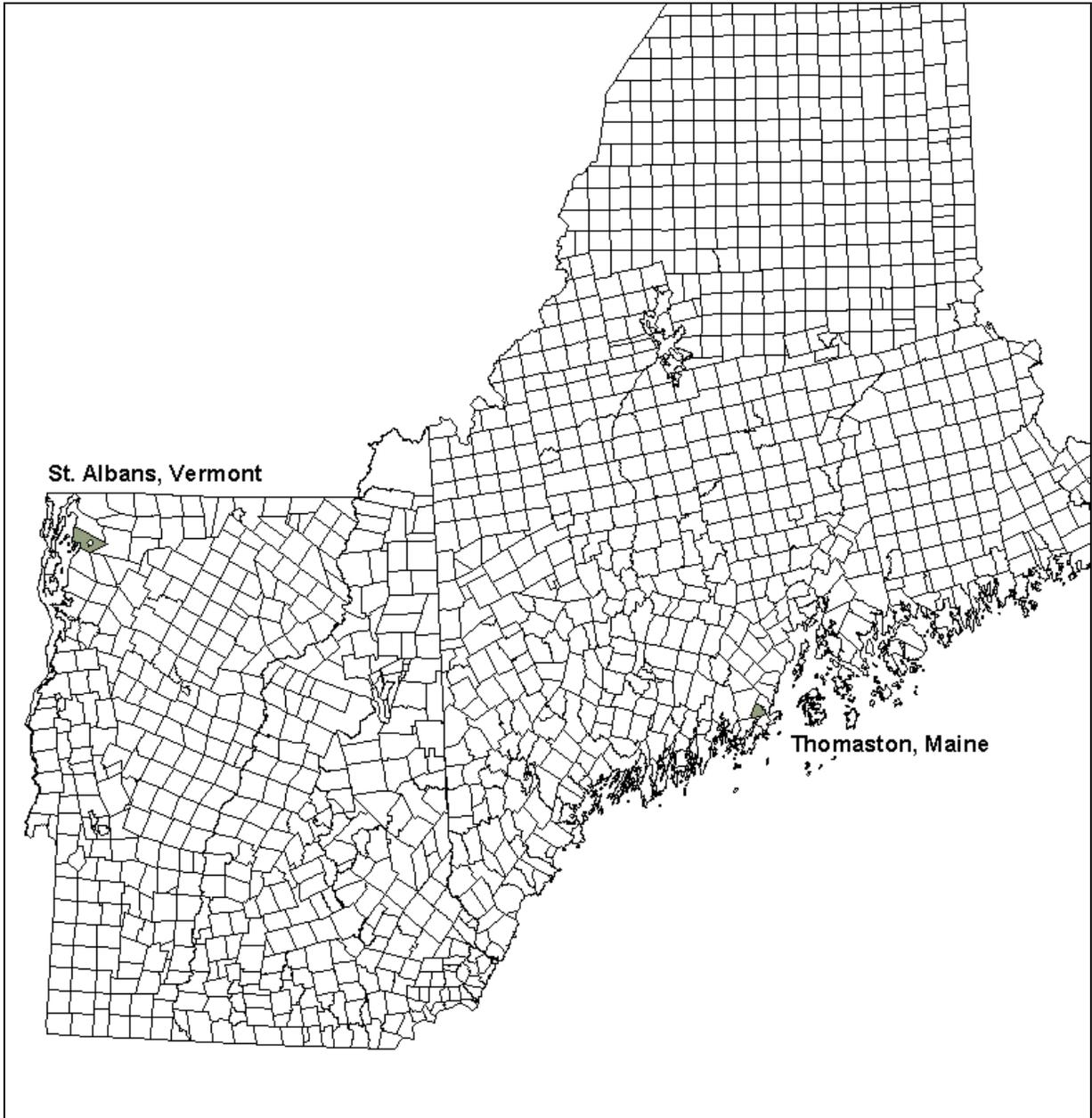
<b>Table 1. Occurrence and status of <i>Carex atherodes</i> in the United States and Canada based on Information from Natural Heritage Programs.</b>		
<b>OCCURS &amp; LISTED (AS S1, S2, OR T &amp;E)</b>	<b>OCCURS &amp; NOT LISTED (AS S1, S2, OR T &amp; E)</b>	<b>OCCURRENCE UNVERIFIED</b>
Alberta (S5)	Michigan: somewhat common, S?	Alaska (SR)
Illinois (S3S4)	Saskatchewan (S?)	Arizona (SR)
Indiana (S1)	Vermont (1 occurrence)	British Columbia (SR)
Iowa (S4)		California (SR)
Maine (S1; proposed E) (1 current occurrence)		Colorado (SR)
Manitoba (S5)		District of Mackenzie (NW Terr.) (SR)
Missouri (S1)		Idaho (SR)
New York (S1)		Kansas (SR)
Ohio (S1)		Minnesota (SR)
Ontario (S4S5)		Montana (SR)
Pennsylvania (S1)		Nebraska (SR)
Quebec (S1)		Nevada (SR)
Utah (S1)		New Mexico (SR)
Virginia (S1)		North Dakota (SR)
West Virginia (S1)		Oregon (SR)
Wyoming (S2)		South Dakota (SR)
		Washington (SR)
		Wisconsin (SR)
		Yukon Territory (SR)

. The *Flora Conservanda: New England* (Brumback and Mehrhoff et al. 1996) ranked the taxon as Division 4 (historic in the region); with recent new discoveries, this ranking will have to be revised. In Maine, *C. atherodes* was moved from Possibly Extirpated and SH, state historic, to proposed Endangered in 1999. In Vermont, *C. atherodes* is a new addition to the flora and has not received official status (The Nature Conservancy and Association for Biodiversity Information 2001). In New York, *C. atherodes* is listed as state Endangered, G5 S1. In Quebec, the plant has been found along the St. Lawrence River and in eastern towns across the border and to the north of the Vermont site. It has not been found the eastern Maritime provinces.

See Figures 1 and 2 for maps of the North American and New England distributions of *C. atherodes*, respectively.



**Figure 1. Occurrences of *Carex atherodes* in North America.** Shaded states and provinces have confirmed, extant occurrences of the taxon. Stippling shows states and provinces in which the taxon is ranked as "SR" (occurrence unverified, see Appendix).



**Figure 2. Occurrences of *Carex atherodes* in New England.** Towns labeled and shaded in gray have one current occurrence of the taxon. The only known historic occurrence of *Carex atherodes* is also in Thomaston, Maine, so a separate map for historic occurrences is not shown.

**Table 2. New England Occurrence Records for *Carex atherodes*. Shaded occurrences are considered extant.**

<b>State</b>	<b>Element Occurrence Number</b>	<b>County</b>	<b>Town</b>
ME	.001	Knox	Thomaston
<b>ME</b>	<b>.001</b>	<b>Knox</b>	<b>Thomaston</b>
<b>VT</b>	<b>None</b>	<b>Franklin</b>	<b>St. Albans</b>

## II. CONSERVATION

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### **CONSERVATION OBJECTIVES FOR TAXON IN NEW ENGLAND**

The overriding objective is to prevent loss of this species from its known two sites. Protection of the Maine site might include a conservation easement or other tax benefits that lead to setting aside the area where *C. atherodes* grows. In Vermont, the opening required by the gas pipeline appears to be compatible with the needs of the sedge, but a long term protection plan might include a conservation easement here, also.

Inventory in the vicinity of each of the known sites would ideally lead to discovery of new populations. As a measurable goal, this plan proposes that a target of at least five distinct populations, separated by at least 0.5 km, will be found as natural populations in each of the two states where the species has been found. This would alleviate some concern that a single event could eradicate the species from a known population.

Translocation should be a last resort because this reduces the priority of protecting the natural habitat and the biotic and abiotic features that contributed to success of the original population (such features might include the soil seed bank, fungal symbionts, associated plants, pollinators, dispersal agents, forest succession, microclimate, unusual substrate conditions, and hydrology). Establishment of artificial populations also carries risk in that weed seeds, insect pests, or disease could be inadvertently brought with the desired plants. Also, artificial new populations might appear to be successful over the short term, leading to less incentive to protect the original natural population. Later, these new colonies might conceivably fail; if the original population has been destroyed for development purposes in the meantime, then the translocation experiment is counterproductive. Another risk is that genetic swamping could occur between the introduced material and some nearby natural population, though this is unlikely in the case of *C. atherodes* in New England due to lack of close relatives. In summary, translocation is not a panacea and should be undertaken with caution and rigorous planning only if there is no possible way to keep the original population in its habitat.

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## **Appendix 1. An explanation of conservation ranks used by The Nature Conservancy and the Association for Biodiversity Information**

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.

G1, for example, indicates critical imperilment on a range-wide basis -- that is, a great risk of extinction. S1 indicates critical imperilment within a particular state, province, or other subnational jurisdiction -- i.e., a great risk of extirpation of the element from that subnation, regardless of its status elsewhere. Species known in an area only from historical records are ranked as either H (possibly extirpated/possibly extinct) or X (presumed extirpated/presumed extinct). Certain other codes, rank variants, and qualifiers are also allowed in order to add information about the element or indicate uncertainty.

Elements that are imperiled or vulnerable everywhere they occur will have a global rank of G1, G2, or G3 and equally high or higher national and subnational ranks. (The lower the number, the "higher" the rank, and therefore the conservation priority.) On the other hand, it is possible for an element to be rarer or more vulnerable in a given nation or subnation than it is range-wide. In that case, it might be ranked N1, N2, or N3, or S1, S2, or S3 even though its global rank is G4 or G5. The three levels of the ranking system give a more complete picture of the conservation status of a species or community than either a range-wide or local rank by itself. They also make it easier to set appropriate conservation priorities in different places and at different geographic levels. In an effort to balance global and local conservation concerns, global as well as national and subnational (provincial or state) ranks are used to select the elements that should receive priority for research and conservation in a jurisdiction.

Use of standard ranking criteria and definitions makes Natural Heritage ranks comparable across element groups -- thus, G1 has the same basic meaning whether applied to a salamander, a moss, or a forest community. Standardization also makes ranks comparable across jurisdictions, which in turn allows scientists to use the national and subnational ranks assigned by local data centers to determine and refine or reaffirm global ranks.

Ranking is a qualitative process: it takes into account several factors, including total number, range, and condition of element occurrences, population size, range extent and area of occupancy, short- and long-term trends in the foregoing factors, threats, environmental specificity, and fragility. These factors function as guidelines rather than arithmetic rules, and the relative weight given to the factors may differ among taxa. In some states, the taxon may receive a rank of SR (where the element is reported but has not yet been reviewed locally) or SRF (where a false, erroneous report exists and persists in the literature). A rank of S? denotes an uncertain or inexact numeric rank for the taxon at the state level.

Within states, individual occurrences of a taxon are sometimes assigned element occurrence ranks. Element occurrence (EO) ranks, which are an average of four separate evaluations of quality (size and productivity), condition, viability, and defensibility, are included in site descriptions to provide a general indication of site quality. Ranks range from: A (excellent) to D (poor); a rank of E is provided for element occurrences that are extant, but for which information is inadequate to provide a qualitative score. An EO rank of H is provided for sites for which no observations have been made for more than 20 years. An X rank is utilized for sites that are known to be extirpated. Not all EOs have received such ranks in all states, and ranks are not necessarily consistent among states as yet.