New England Plant Conservation Program

# *Carex wiegandii* Mackenzie
# Wiegand's Sedge

## Conservation and Research Plan
## for New England

Prepared by:
William F. Nichols
Ecologist/Botanist
New Hampshire Natural Heritage Inventory

For:

New England Wild Flower Society
180 Hemenway Road
Framingham, MA 01701
508/877-7630
e-mail: conserve@newfs.org • website: www.newfs.org

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# SUMMARY

*Carex wiegandii* (Wiegand's sedge) is a perennial graminoid of the Cyperaceae (sedge family). It is a globally vulnerable (G3), mostly maritime species of northeastern North America, typically found in boggy or peaty soils, but it may also inhabit acidic sandy soils. The sedge's range extends inland to Ontario, through the eastern maritime provinces, and south to Michigan, northern New York, and central New England, with a disjunct occurrence in northwestern Pennsylvania. Outside of New England, the status of *Carex wiegandii* is SR (Labrador, New Brunswick, and Newfoundland Island), S1 (New York, Pennsylvania, Nova Scotia, Ontario, and Prince Edward Island), S2 (Michigan), S2S3 (Quebec), and S? (New Jersey).

Known population sizes range from small to moderate, the largest exceeding 1000 plants at two sites in Pennsylvania. However, habitat size and diversity and dynamic ecosystem processes may be more important to population persistence than the actual number of plants present at one instant in time. In larger habitats, the plant is more likely to survive periods without disturbance, either in the seed bank or as scattered individuals in small patches along trails, around blowdowns, or along small beaver ponds.

In New England, *Carex wiegandii* has been documented in Maine, New Hampshire, Massachusetts, and Vermont, where its state rank is S2, S1S2, S1, and S1, respectively. Of the 57 New England occurrences, 34 are extant and 23 are historical (last seen before 1982). The location of one additional historical population is uncertain, occurring in either Massachusetts or Nova Scotia. Along the southern margin of its range, *C. wiegandii* is disjunct in relatively cooler microhabitats. *Flora Conservanda* lists the sedge in Division 1, a category for globally rare taxa occurring in New England.

Threats to *Carex wiegandii* that result from human activities include the loss and degradation of wetland habitat supporting or suitable for sedge populations. Factors that may contribute to the loss and degradation of these habitats include wetland filling, nutrient runoff, and alteration to hydrological and disturbance regimes. Natural events, including certain types of beaver activity, herbivory, woody-plant encroachment, and increased vulnerability associated with species distribution, can also pose a threat to *C. wiegandii* populations.

The primary conservation objective for the taxon in New England is maintaining or increasing the sedge's long-term viability through recommended conservation actions. Primary conservation actions for the taxon in New England are land acquisition or protection of occurrences, surveying extant populations, relocating historical occurrences, *de novo* searches, research, habitat or site management, and information management. Secondary objectives include *ex-situ* activities and increasing public awareness. If few new populations are discovered after extensive *de novo* searches, then augmentation, introduction, and reintroduction should be considered a primary objective at suitable sites.

# PREFACE

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) of the New England Wild Flower Society 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.

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# I. BACKGROUND

## INTRODUCTION

*Carex wiegandii* (Wiegand's sedge) is a perennial graminoid of the Cyperaceae (sedge family), one of eight members of the complex section *Stellulatae* in North America north of Mexico (Reznicek and Ball 1980). It is a globally vulnerable (G3), mostly maritime species of northeastern North America, typically found in boggy or peaty soils, but it may also inhabit acidic sandy soils. Caricologist A. A. Reznicek feels it may be more common than collection records indicate, although he believes the sedge is truly globally rare (Maine Department of Conservation 1999). *Carex wiegandii* has a national rank of N3 in the United States and N2N3 in Canada (NatureServe 2000).

In New England, the state rank of *Carex wiegandii* is S1, S1S2, or S2. The primary threat to its long-term viability is habitat loss or degradation. This conservation plan summarizes existing information on the ecology, taxonomy, location, status, and conservation requirements of *C. wiegandii* in New England. It recommends conservation actions, including habitat protection, monitoring, relocating historical occurrences, *de novo* searches, research, management, *ex-situ* activities, increasing public awareness, and information management.

## DESCRIPTION

### *Carex wiegandii*

*Carex wiegandii* is a member of the sedge family (Cyperaceae) in *Carex* section *Stellulatae*. Species in this section can be difficult to distinguish from one another, even for many competent botanists. *C. wiegandii* was first recognized and described by Mackenzie (1931). The following description of *C. wiegandii* is provided by Reznicek and Ball (1980: 184-186):

> **Rhizomes** short; **plants** cespitose; **roots** smooth, pale yellow-brown to dark grey-brown; **culms** 10–105 cm, erect, elongating in fruit, aphyllopodic, smooth to slightly scabrous above; **basal sheaths** persistent, brown. **Leaves** 3–8 per culm, all in basal third, usually shorter than culms in fruit; **blades** 11–45 cm × 1.7–5.0 mm, plicate, antrorsely scabrous above, upper blades of culm much longer than lower and blades of sterile shoots longer; **widest leaf** 2.8–5.0 mm. **Sheaths** covering nodes, tight, glabrous or sometimes hispidulous on the veins, that of uppermost leaf 4–23 cm; **inner band hyaline**, rarely purple dotted; **sheath apex** concave, strongly thickened; **ligule** 0.9–2.5 mm, rounded to obtuse. **Infructescence** 8.6–30 mm, dense; **spikes** 4–6. **Terminal spike** 6.1–14.5 mm,

staminate at base, pistillate above; staminate portion 2–8.6 mm × 0.8–1.3 mm, 5–20 flowered; pistillate portion 3.0–8.0 mm × 5.0–7.3 mm, 7–25 flowered. **Lateral spikes** 4.5–8.0 mm, sessile, pistillate at apex and staminate at base; staminate portion (0) 0.5–2.0 mm, (0) 1–3 flowered; pistillate portion 3.0–8.0 mm, 5–21 flowered. Distance between upper 2 spikes 0.8–3.0 mm, distance between lower 2 spikes 1.3–9.5 mm; lateral spikes with short, scale-like bracts. **Pistillate scales** 1.45–2.0 (2.2) mm × 1.3–1.9 mm, ovate, one-veined, obtuse to subacute, sometimes shortly mucronate, castaneous with green center and hyaline margins. **Staminate scales** 1.2–2.3 mm × 1.4–1.8 mm, ovate, one-veined, obtuse to acute, castaneous with green center and hyaline margins. **Lower perigynia** of spikes spreading to reflexed, broadly ovate, 2.55–3.75 mm × (1.25) 1.4–2.0 (2.1) mm, (1.4) 1.6–2.5 times as long as wide, tapering to a beak, plano-convex, green to castaneous when first ripe, dark brown when over-mature, sessile, spongy-thickened at base surrounding achene; adaxial veins absent or up to 10, faint; abaxial veins 5–18; serrulate on margins to 0.1–0.8 mm below base of beak. **Beak** 0.55–1.1 (1.35) mm, 0.25–0.55 times as long as body, serrulate on margins, toothed apically; teeth more or less blunt, 0.2–0.5 mm. **Achenes** 1.4–1.9 mm × 1.1–1.55 mm, ovate, biconvex, sessile; **style** deciduous; **stigmas** 2. **Anthers** 3, 0.7–1.3 mm.

## *Closely Related Species in Stellulatae*

Prior to being described, *Carex wiegandii* was identified as either *C. atlantica* or *C. echinata* (Reznicek and Ball 1980). It is also similar in habit to *C. interior*. *Carex wiegandii* is generally a more robust sedge (in height, leaf width, and perigynium width) than the more abundant *C. interior* and *C. echinata*, but not as large as *C. atlantica*. Reznicek and Ball (1980: 186) describe how *C. wiegandii* is related to some of the other members of *Stellulatae*:

> Its relationships in the rest of the *Stellulatae* are with *Carex interior* … and to some extent, *C. atlantica*. Occasional specimens with very broad perigynia may resemble *C. atlantica* but they can usually be separated by the dense infructescence of *C. wiegandii*. As well, the perigynia of *C. wiegandii* are sometimes only faintly nerved or even nerveless on the adaxial surface. The ranges of the two species barely overlap. As *C. wiegandii* is similar in some of its features to *C. interior* it provides an interesting connection between *C. interior* and *C. atlantica*. It is possible that *C. wiegandii* may have been derived from past hybridization of *C. interior* and a broad-leaved race of *C. atlantica*.

Because *Carex wiegandii* is morphologically similar to other members of *Stellulatae*, Appendix 2 provides a key to *Stellulatae* of North America from Reznicek and Ball (1980).

### *Closely Related Sections in* Carex

Three other sections of *Carex* are closely related to *Stellulatae* as defined by Mackenzie (1931): *Ovales*, *Heleonastes*, and *Deweyanae*. Reznicek and Ball (1980: 155) describe the similarities and differences among these four sections:

> These groups and the *Stellulatae* all have in common gynecandrous, simple spikes and a usually cespitose habit. The *Ovales* characteristically have more or less scale-like perigynia appressed and more or less overlapping in a dense head. The perigynia are thin-margined, sometimes even winged and often stramineous. The *Heleonastes*, excluding *C. disperma* Dewey (Ohwi 1936; Toivonen and Timonen 1976), characteristically have short-beaked or essentially beakless, plump, ascending to spreading perigynia that are not spongy-thickened at the base and usually appear minutely whitish puncticulate. The *Deweyanae* have ascending or even appressed-ascending perigynia. The plants themselves have a lax and spreading habit. The *Stellulatae* are characterized by spreading to reflexed perigynia that are prominently beaked, spongy at base, thick-margined, not white puncticulate and with a usually serrulate beak.

## TAXONOMY, HISTORY AND SYNONYMY

Kenneth Kent Mackenzie (1931) first recognized *Carex wiegandii*. He named the sedge in honor of Karl McKay Wiegand (1873–1942). Type specimen information follows from Reznicek and Ball (1980: 184):

> *Carex wiegandii* Mackenzie, N. Am. Fl. 18: 108. 1931. Lectotype (*des. nobis*): Silurian hills back of Birchy Cove (Curling), Region of Humber Arm, Bay of Islands, Western Newfoundland, M. L. Fernald and K. M. Wiegand 2776, July 21, 1910. GH(!). Isolectotype F(!).

There is no known synonymy associated with *Carex wiegandii* Mackenzie.

## SPECIES BIOLOGY

*Carex wiegandii* is a self-compatible cespitose-perennial sedge, flowering June-August and fruiting into early fall. Flowering begins during the second year (A. A. Reznicek, personal communication with W. Ostlie, 1990). The sedge is wind-pollinated and, therefore, not reliant on biotic pollination. Flowers are imperfect with the staminate borne beneath the pistillate flowers, an arrangement that may limit self-pollination. Within an individual, anthesis and fruit maturation may occur at the same time. Fruits are small achenes enclosed in appressed perigynia. Mature fruit are most abundant from mid-July to mid-August. As a result of seed dispersal, fewer mature fruit may be found in September. Seed dispersal likely involves wind, water, and particularly gravity. Fruiting stems elongate to 0.9–1.2 m (3–4 ft.), eventually toppling to the ground and assisting in seed dispersal (A. A. Reznicek, personal communication with W. Ostlie, 1990). Asexual reproduction is absent in this clumping species (A. A. Reznicek, personal communication with W. Nichols, 2001). Little other information is known concerning the biology of *C. wiegandii*.

## HABITAT/ECOLOGY

*Carex wiegandii* occurs in both stable natural communities with infrequent disturbance (e.g., bogs and poor fens, including ME .016) and dynamic habitats such as successional areas (e.g., openings in forested peatlands and graminoid swales, including ME .036 [Attean Township]) or sites where the soils have been disturbed (e.g., acidic sandy soils, lakeshores, borrow pits, log landings, ditches, trails, power line corridors, and wet circumneutral pastures, including ME .038 [Cherryfield]) (A. A. Reznicek, personal communication with W. Nichols, 2001; Fernald 1933a, 1933b; Sorrie 1987). In naturally dynamic habitats, relatively frequent perturbations (e.g., beaver activity, windthrow, storms, drought, animal trails, herbivory, fire, and other disturbances) can disturb soils and create openings in woody canopies. At sites where populations exist as a result of recent disturbance, habitat size and diversity and dynamic ecosystem processes may be more important to population persistence than the actual number of plants present at one instant in time. In larger habitats, the plant is more likely to survive periods without disturbance, either in the seed bank or as scattered individuals in small patches along trails, around blowdowns, or along small beaver ponds (A. A. Reznicek, personal communication with W. Nichols, 1997, 2001).

Associated woody species in *Carex wiegandii's* rangewide habitats include *Thuja occidentalis* (northern white cedar), *Picea mariana* (black spruce), *Larix laricina* (eastern larch), *Acer rubrum* (red maple), *Pinus banksiana* (jack pine), *Betula papyrifera* (paper birch), *Alnus incana* ssp. *rugosa* (speckled alder), *Kalmia angustifolia* (sheep laurel), and *Lyonia ligustrina* (male-berry). Forbs include *Solidago uliginosa* (bog goldenrod), *Aster nemoralis* (bog aster), *Iris* sp. (an iris), *Drosera rotundifolia* (round-leaved sundew), and *D. intermedia* (spatulate-leaved sundew). Associated graminoids, ferns, and fern allies are *Carex echinata* (prickly sedge), *C. sterilis* (sterile sedge), *C. canescens* (silvery sedge), *C. debilis* (Rudge's sedge), *Glyceria canadensis* (rattlesnake manna-grass), *Lycopodiella inundata* (slender bog clubmoss), *Osmunda cinnamomea* (cinnamon fern), and *O. regalis* var. *spectabilis* (royal fern). Several species of *Sphagnum* (peat mosses) are also common (Ostlie 1990).

In nutrient-poor peatlands in New England, some of the most frequent trees and shrubs associated with *Carex wiegandii* are *Picea mariana* (black spruce), *Larix laricina* (eastern larch), *Thuja occidentalis* (northern white cedar), *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Betula populifolia* (gray birch), *B. papyrifera* (paper birch), *Kalmia angustifolia* (sheep laurel), *K. polifolia* (bog laurel), *Vaccinium corymbosum* (highbush blueberry), *V.*

*macrocarpon* (large cranberry), *V. myrtilloides* (velvet-leaf blueberry), *Rhododendron canadense* (rhodora), *Gaylussacia baccata* (black huckleberry), *Ledum groenlandicum* (Labrador-tea), *Nemopanthus mucronatus* (mountain holly), *Viburnum nudum* var. *cassinoides* (witherod), *Ilex verticillata* (winterberry), *Alnus incana* ssp. *rugosa* (speckled alder), *Myrica gale* (sweet gale), *Rubus hispidus* (bristly dewberry), *Aronia melanocarpa* (black chokeberry), *Spiraea alba* var. *latifolia* (eastern meadow-sweet), *S. tomentosa* (steeple-bush), and *Lonicera caerulea* var. *villosa* (mountain fly honeysuckle). Associated forbs are *Solidago uliginosa* (bog goldenrod), *Aster radula* (rough-leaved aster), *Sarracenia purpurea* (pitcher-plant), *Drosera rotundifolia* (round-leaved sundew), *D. intermedia* (spatulate-leaved sundew), *Cornus canadensis* (bunchberry), *Gaultheria hispidula* (creeping snowberry), *Smilacina trifolia* (three-leaved false Solomon's seal), *Lysimachia terrestris* (swamp candles), *Lycopus uniflorus* (common water horehound), and *Platanthera* spp. (orchids). Associated graminoids and ferns are *Carex canescens* (silvery sedge), *C. pauciflora* (few-flowered sedge ), *C. paupercula* (bog sedge), *C. echinata* (prickly sedge), *C. trisperma* var. *trisperma* (three-seeded sedge), *C. nigra* (black meadow sedge), *C. folliculata* (follicled sedge), *C. leptalea* (delicate sedge), *C. atlantica* (undiscovered sedge), *C. oligosperma* (few seeded sedge), *C. stricta* var. *strictior* (tussock sedge), *Eriophorum virginicum* (tawny cotton-grass), *Rhynchospora alba* (white beak-rush), *Scirpus cyperinus* (woolly bulrush), *Calamagrostis canadensis* (blue-joint), *Osmunda cinnamomea* (cinnamon fern), and *O. regalis* var. *spectabilis* (royal fern). Several species of *Sphagnum* (peat mosses), including *S. rubellum, S. papillosum, S. magellanicum, S. cuspidatum, S. palustre,* and *S. girgensohnii,* are also common.

*Carex wiegandii* also occurs in wet circumneutral pastures in New England, where it is associated with *C. aurea* (golden-fruited sedge), *C. leptalea* (delicate sedge), *C. granularis* var. *haleana* (granular sedge), *Geum rivale* (purple avens), *Eriophorum viridicarinatum* (green keeled cotton-grass), and other species. One old occurrence, recorded in 1894, locates a population of *C. wiegandii* on a cliff wall.

## THREATS TO TAXON

Threats to *Carex wiegandii* that result from human activities include the loss and degradation of wetland habitat supporting or suitable for sedge populations. Factors that may contribute to the loss and degradation of these habitats include wetland filling, nutrient runoff, and alteration to hydrological and disturbance regimes. Natural events, including certain types of beaver activity, herbivory, woody-plant encroachment, and phytogeography, can also pose a threat to *C. wiegandii* populations.

### *Anthropogenic Threats*

Habitat destruction and degradation

In general terms, development is a significant threat to wetlands and the rare plants they support. One difficulty in quantifying and qualifying potential impacts, however, is that the impacts of a specific activity on a wetland too often are considered in isolation from the cumulative impacts of development around the wetland. Development threats include fragmentation, habitat displacement and degradation, invasion by non-native species, alteration of flood regimes, and impacts to water quantity and quality (including pollution, eutrophication, and reduction through withdrawal). Logging in and near peatlands may influence hydrological patterns, nutrient cycles, habitat integrity and fragmentation, and sedimentation. Because most peatlands supporting *Carex wiegandii* are naturally acidic and low in nutrients, they are particularly susceptible to alteration by elevated nutrient inputs associated with development. Channelized surface runoff should not be allowed to enter acidic peatland systems. Storm drains collecting runoff from impervious surfaces can add nutrients and other pollutants to wetlands and alter their hydrology. While no documentation of this type of degradation in a natural peatland supporting *C. wiegandii* is known to exist, the impact of nutrient inputs to nutrient-poor wetlands can be significant (Shaw and Reinecke 1983).

Another potential threat to peatland populations of *Carex wiegandii* is peat mining. In New England, peat mining has occurred on a small scale for fuel and horticultural and agricultural purposes. Peat mining can significantly degrade bogs through vegetation clearing, draining, and peat removal (Damman and French 1987). Regeneration of peatlands disturbed by mining is slow.

Regulatory agencies should carefully consider proposals that might affect *Carex wiegandii* populations, wetlands supporting the sedge, and the surrounding landscape that influences habitat condition and viability.

Threats to populations in power line corridors

Populations of *Carex wiegandii* in power line corridors (e.g., ME .030 [Saco] and ME .034 [Passadumkeag]) may be threatened by corridor maintenance and recreation activity. Uninformed herbiciding and impacts associated with the mechanical control of woody vegetation can endanger these populations. Off-road vehicle activity can also threaten populations in power line corridors.

Unforeseen negative impacts from conservation activity

Intense sampling (e.g., trampling, soil compaction, residue left on plant tissue from human contact, etc.), experimental management activity intended to promote population growth (prescribed burns, soil scarification, control of competing vegetation, etc.), and other management and research activity can have unforeseen negative impacts. Overall, even though the potential benefits from most conservation action are positive, the possible negative impacts associated with those activities should be considered during the planning stages.

### *Natural Events*

#### Threats and benefits of beaver activity

Understanding the dynamic processes associated with beaver activity can help mitigate potential threats by informing site management decisions. Beavers can significantly alter an ecosystem. Second- to fourth-order streams (Naiman et al. 1988) and lowlands adjacent to these streams are particularly susceptible to beaver activity. A typical sequence occurring after a beaver dam is built includes flooding, loss of most trees and shrubs, clearing of shoreline areas as a result of tree cutting, establishment of aquatic and emergent marsh plants, dam abandonment and breaching, and colonization of pond basins by graminoids on peat or muck substrates or by shrubs and trees on mineral soils (Hammerson 1994). Drawn-down pond basins, as well as beaver ponds themselves, may include habitat suitable for *Carex wiegandii*. Beaver ponds support a shifting mosaic of environmental conditions that relate to pond age and size, successional status, substrate, hydrological characteristics, and nutrient inputs (Naiman et al. 1988). In some ponds, the wetland community may be predominantly fen, while other ponds may be dominated by emergent marsh (Naiman et al. 1988).

Beaver activity can eliminate occurrences and destroy habitat suitable for *Carex wiegandii*. Flooding associated with beaver activity appears to be the cause of the disappearance of a subpopulation of NH .008 (Livermore). Other occurrences along dammable brooks (e.g., ME .006 [Pittsburgh], ME .020 [Mount Desert], ME .021 [Mount Desert], ME .022 [Bar Harbor], and NH .007 [Lincoln]) may be under a similar threat.

Other occurrences (e.g., NH .008 [Livermore]) occur on floating mats. Beavers can dig through floating mats and form areas of open water (Rebertus 1986). Rising water levels associated with beaver damming can lift a floating mat, rip it from shoreline vegetation, and increase moat area (Rebertus 1986). In some fens, small ponds can form as a result of increasing the area of natural moats. The persistence of a fen following beaver-induced flooding may depend on whether the mat was floating or grounded prior to flooding. Floating mats rise with increased water levels associated with beaver impoundments (Rebertus 1986, Naiman et al. 1988), although a change in water level can significantly alter vegetation composition on the mat (Jeglum 1975). Beaver reestablishment in a *Sphagnum*-dominated fen in West Virginia led to the flooding of 15% of the fen, species abundance shifts, a change in the course of the stream channel, and the loss of one plant community (Lang and Wieder 1984). Naiman et al. (1988)

stated that fens with floating mats in flooded basins change little over time. Other beaver-related ecosystem alteration, management, and monitoring issues are summarized in Hammerson (1994).

## Herbivory

Little is known about what impact herbivory, including seed predation, may have on *Carex wiegandii* populations, although the current extent of the threat seems negligible. Small populations may be vulnerable to extirpation by deer and moose browsing. One population (i.e., ME .037 [T08 R16 WELS]), appeared to have been browsed by snowshoe hare.

## Woody-plant encroachment

Dynamic ecosystem processes are necessary for the long-term survival of several *Carex wiegandii* populations. Populations under successional threats, occurring in anthropogenically and naturally disturbed wetlands, include ME .013 (T09 R18 WELS), ME .018 (Sanford), ME .033 (Osborn), and ME .038 (Cherryfield). Dynamic processes may set back succession and create habitat suitable for the sedge in areas that would otherwise move toward increased woody cover. Woody plant cover should be prevented from shading-out *C. wiegandii* populations, particularly in anthropogenic habitats such as power line corridors, log landings, roadsides, pastures, and borrow pits (e.g., ME .018 [Sanford] and ME .038 [Cherryfield]).

## Phytogeographical considerations

*Carex wiegandii* is a rare boreal sedge reaching the southern limit of its range in Michigan, Pennsylvania, and central New England. In general terms, species with a northern distribution with respect to New England have been displaced since deglaciation to the north and to higher elevations by species with a more southern distribution. Many of these more northern species, such as *C. wiegandii*, now persist as disjunct occurrences in relatively cooler microhabitats along the southern margin of their range. These phytogeographic considerations suggest that, when a northern species is locally extirpated, it is unlikely a nearby population can contribute propagules for recolonization and that available suitable habitat is limited in extent relative to that of rare southern species. In addition, Reznicek (1989) suggests that, compared to southern species in New England, fewer new occurrences and range extensions will be found for northern species. Compared to most southern species, therefore, *C. wiegandii* and other northern species are under a greater threat of extirpation (Reznicek 1989), especially with accelerating climatic change.

## DISTRIBUTION AND STATUS

### *General Distribution and Status*

*Carex wiegandii* is a mostly maritime species of northeastern North America, with the center of its range along the Gulf of St. Lawrence (Reznicek and Ball 1980). Its range extends inland to Ontario, seaward through the eastern maritime provinces, and south to the Upper Peninsula of Michigan, northern New York, and central New England, with a disjunct occurrence in northwestern Pennsylvania (Gleason and Cronquist 1991; A. A. Reznicek, personal communication with W. Nichols, 2001). A questionable occurrence has been documented in New Jersey. *C. wiegandii* occurs in eight states in the United States and seven provinces in Canada (Table 1, Figure 1).

Information on *Carex wiegandii's* distribution can be found in several literature sources. Penskar et al. (1996) discuss its occurrence in Michigan. Rothrock (1978) mentions that *C. wiegandii*'s southern range was appreciably extended after correct identification of several collections from northern Pennsylvania. Fernald (1933a, 1933b) documents it at Bonne Bay, Newfoundland, the northernmost occurrence then known.

Several articles document *Carex wiegandii's* distribution in New England. A study of the ecology of sedges in Maine peatlands (Anderson et al. 1996) locates *C. wiegandii* at two of the sites studied. Greene (1990) describes the location of several *C. wiegandii* populations in Acadia National Park and Mount Desert Island. Sorenson (1984, 1986) and Davis et al. (1983) also mention the occurrence of the sedge in Maine. Hodgdon and Allen (1973) discuss a station for the sedge in New Hampshire. A report describing the results of rare plant and exemplary natural community inventories in New Hampshire's White Mountain National Forest documents *C. wiegandii* at several sites in the national forest (Sperduto and Engstrom 1995). A U.S. Forest Service report (Royte et al. 1996) also documents the sedge at one site on the national forest in New Hampshire. Sorrie (1987) describes it at a site in South Ashburnham, Massachusetts.

*Carex wiegandii* is globally rare (G3) (see Appendix 5 for an explanation of global, national, and state rank codes). Caricologist A. A. Reznicek feels it may be more common than collection records indicate, although he believes the sedge is truly globally rare (Maine Department of Conservation 1999). *C. wiegandii* has a national rank of N3 in the United States and N2N3 in Canada (NatureServe 2000).

In New England (Figure 2), the state rank of *Carex wiegandii* is S1, S1S2, or S2. Of the 57 New England occurrences, 34 are extant and 23 are historical (last seen before 1982). The location of one additional historical population is uncertain, occurring in either Massachusetts or Nova Scotia. Along the southern margin of its range, *C. wiegandii* is disjunct in relatively cooler microhabitats (Reznicek 1989). *Flora Conservanda* (Brumback and

Mehrhoff et al. 1996) lists the sedge in Division 1, a category for globally rare taxa occurring in New England (see Appendix 4).

Outside of New England, the status of *Carex wiegandii* is SR (Labrador, New Brunswick, and Newfoundland Island), S1 (New York, Pennsylvania, Nova Scotia, Ontario, and Prince Edward Island), S2 (Michigan), S2S3 (Quebec), and S? (New Jersey) (NatureServe 2000; A. A. Reznicek, personal communication with W. Nichols, 2001). The largest populations known exceed 1000 plants and occur at two sites in Pennsylvania. This area is characterized by high-plateau white pine–hemlock–mixed hardwood swamps inundated as a result of beaver activity.

**Table 1. Occurrence and status of *Carex wiegandii* in the United States and Canada based on information from Natural Heritage Programs (see Appendices 2 and 6 for explanation of rank codes).**

| OCCURS & LISTED (AS S1, S2, OR T & E) | OCCURS & NOT LISTED (AS S1, S2, OR T & E) | OCCURRENCE REPORTED OR UNVERIFIED | HISTORIC (LIKELY EXTIRPATED) |
|---|---|---|---|
| Maine: S2 (26 extant occurrences) | Quebec: S2S3 | Labrador: SR | Ontario: S1 (A. A. Reznicek, personal communication with W. Nichols, 2001) |
| Massachusetts: S1; E (1 extant occurrence) | New Jersey: S? | New Brunswick: SR | |
| Michigan: S2 | | Newfoundland: SR | |
| New Hampshire: S1S2; T (4 extant occurrences) | | | |
| New York: S1 | | | |
| Nova Scotia: S1 | | | |
| Pennsylvania: S1 | | | |
| Prince Edward Island: S1 | | | |
| Vermont: S1; (1 new population; five historic populations, but three are of questionable identification; R. Popp, personal communication with W. Nichols, 2000) | | | |

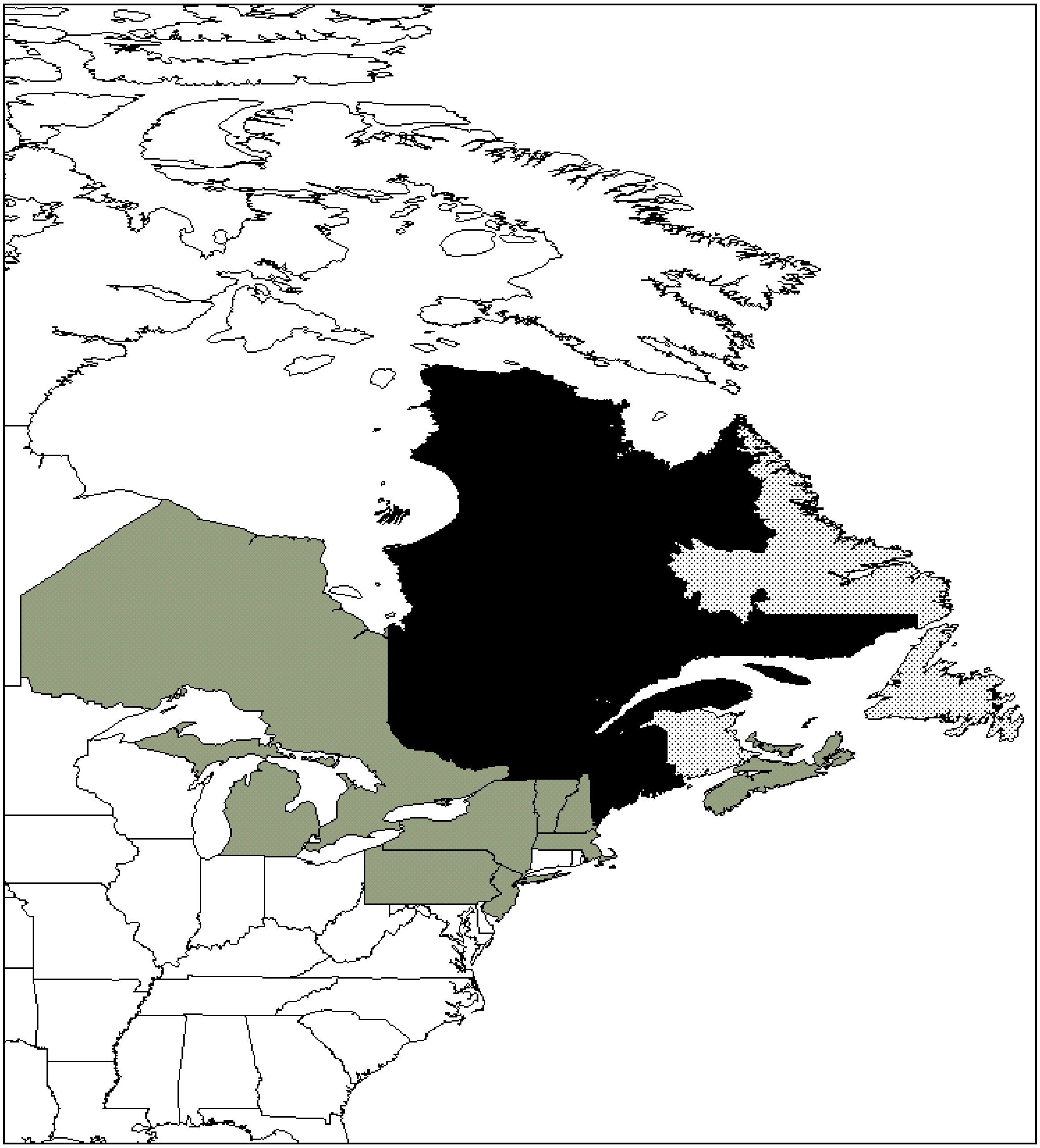

**Figure 1. Occurrences of *Carex wiegandii* in North America.** States and provinces shaded in gray have one to five current occurrences of the taxon. States shaded in black have more than five confirmed occurrences. States with stippling are ranked "SR" (status "reported" but not necessarily verified). See Appendix 5 for explanation of state ranks.

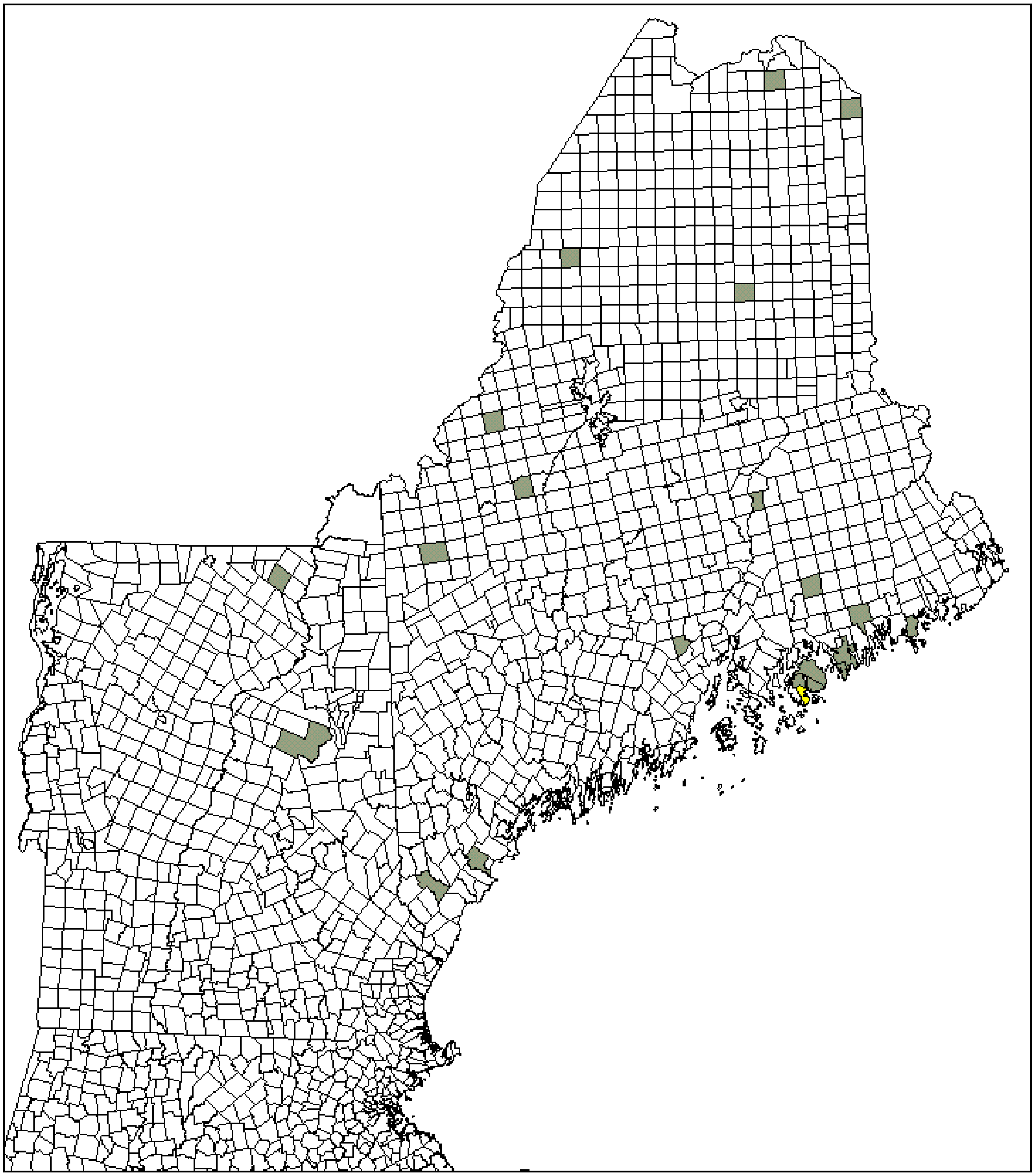

**Figure 2. Extant occurrences of *Carex wiegandii* in New England.** Town boundaries for New England states are shown. Towns shaded in gray have one to five extant occurrences of the taxon.

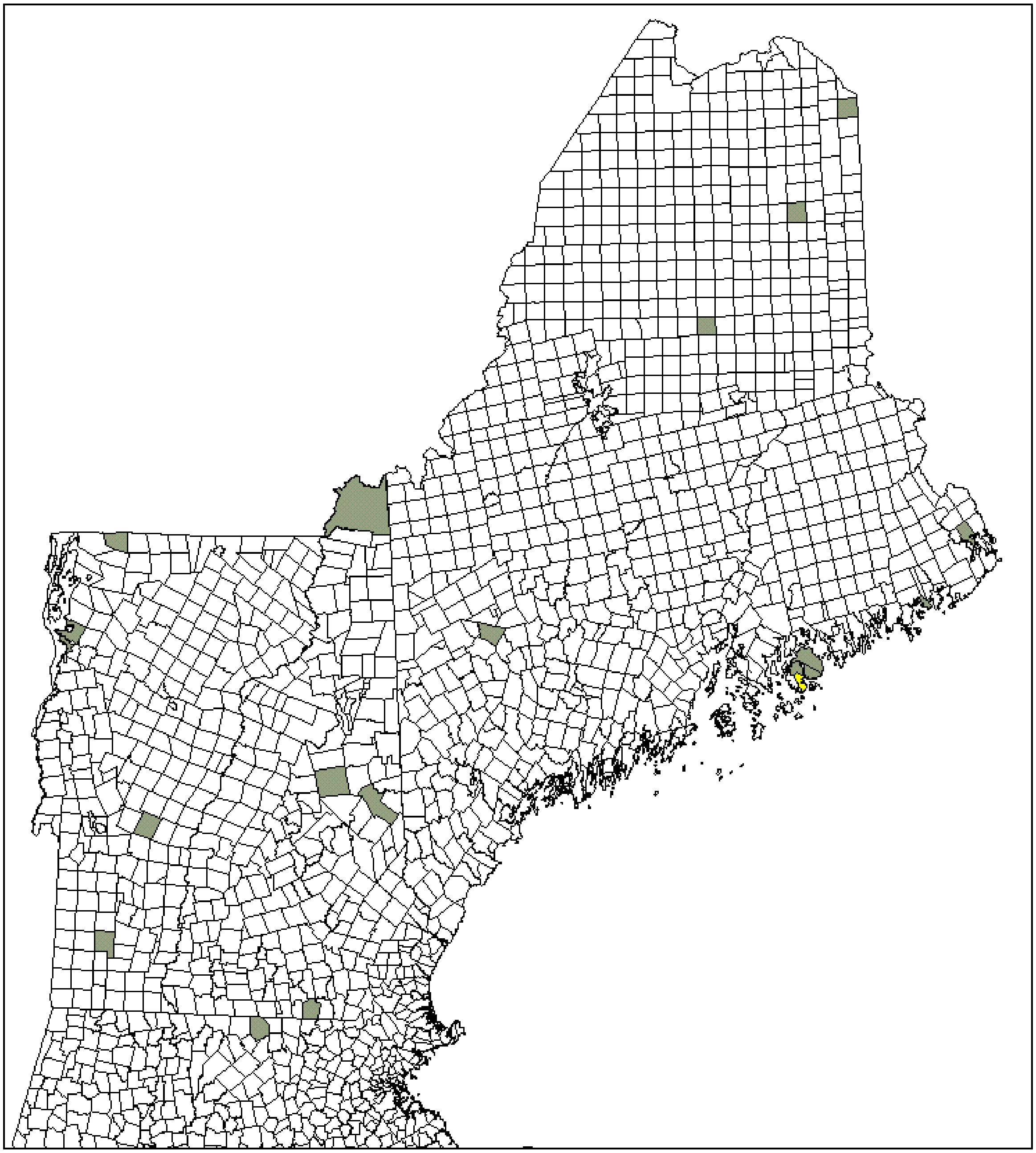

**Figure 3. Historic occurrences of *Carex wiegandii* in New England.** Towns shaded in gray have one to five historic records of the taxon.

| **Table 2. New England Occurrence Records for *Carex wiegandii*. Shaded occurrences are considered extant.** | | | |
|---|---|---|---|
| **State** | **EO #** | **County** | **Town** |
| **ME** | **.001** | **Penobscot** | **T06 R07 WELS** |
| **ME** | **.002** | **Aroostook** | **T17 R05 WELS** |
| ME | .003 | Aroostook | Caswell |
| ME | .004 | Penobscot | Indian Island Penobs |
| **ME** | **.005** | **Franklin** | **Rangeley** |
| ME | .006 | Piscataquis | T04 R09 WELS |
| ME | .007 | Oxford | Dixfield |
| **ME** | **.008** | **Somerset** | **Pierce Pond TWP** |
| ME | .009 | Washington | Pembroke |
| ME | .010 | Washington | Roque Bluffs |
| ME | .011 | Hancock | Bar Harbor |
| ME | .012 | Hancock | Mount Desert |
| **ME** | **.013** | **Somerset** | **T09 R18 WELS** |
| ME | .014 | Hancock | Mount Desert |
| ME | .015 | Hancock | Swans Island |
| **ME** | **.016** | **Aroostook** | **Caswell** |
| ME | .017 | Aroostook | Squapan TWP |
| **ME** | **.018** | **York** | **Sanford** |
| **ME** | **.019** | **Hancock** | **Bar Harbor** |
| **ME** | **.020** | **Hancock** | **Mount Desert** |
| **ME** | **.021** | **Hancock** | **Mount Desert** |
| **ME** | **.022** | **Hancock** | **Bar Harbor** |
| **ME** | **.023** | **Hancock** | **Southwest Harbor** |
| **ME** | **.024** | **Hancock** | **Southwest Harbor** |
| ME | .025 | Hancock | Bar Harbor |
| ME | .026 | Hancock | Bar Harbor |
| **ME** | **.027** | **Hancock** | **Cranberry Isles** |
| **ME** | **.028** | **Hancock** | **Southwest Harbor** |
| **ME** | **.029** | **York** | **Saco** |
| **ME** | **.030** | **York** | **Saco** |
| **ME** | **.031** | **Hancock** | **Gouldsboro** |
| **ME** | **.032** | **Waldo** | **Brooks** |
| **ME** | **.033** | **Hancock** | **Osborn** |
| **ME** | **.034** | **Penobscot** | **Passadum-keag** |
| **ME** | **.035** | **Knox** | **Isle au Haut** |
| **ME** | **.036** | **Somerset** | **Attean TWP** |
| **ME** | **.037** | **Somerset** | **T08 R16 WELS** |

| Table 2. New England Occurrence Records for *Carex wiegandii*. Shaded occurrences are considered extant. | | | |
|---|---|---|---|
| **State** | **EO #** | **County** | **Town** |
| **ME** | **.038** | **Washington** | **Cherryfield** |
| **ME** | **.039** | **Franklin** | **Eustis** |
| **ME** | **.0??** | **Washington** | **Jonesport** |
| **ME** | **.0??** | | **Northeast Carry TWP** |
| **ME** | **.0??** | | **Northeast Carry TWP** |
| **ME** | **.0??** | **Hancock** | **Winter Harbor** |
| NH | .001 | Hillsboro | Hollis |
| NH | .004 | Carroll | Sandwich |
| NH | .005 | Carroll | Ossipee |
| NH | .006 | Coos | Pittsburg |
| **NH** | **.007** | **Grafton** | **Lincoln** |
| **NH** | **.008** | **Grafton** | **Livermore** |
| **NH** | **.009** | **Grafton** | **Lincoln** |
| VT | .001 | Windham | Stratton |
| VT | .002 | Chittenden | Burlington |
| VT | .003 | Franklin | Franklin |
| VT | .004 | Windsor | Bridgewater |
| VT | .005 | Windsor | Chester |
| **VT** | **.006** | **Essex** | **Lewis** |
| MA | .001 | Worcester | Ashburnham |
| *MA* | *.002* | *Worcester* | *Holden* |
| MA | .??? | Unknown | Unknown |

## CURRENT CONSERVATION MEASURES IN NEW ENGLAND

*Carex wiegandii* receives a moderate level of conservation action as a result of its global rank (G3; vulnerable to extinction) and listing on rare plant lists in four New England states. Its listing in Maine and New Hampshire, however, does not prevent it from being taken by a private landowner or others with the permission of the landowner. In Massachusetts, plants occurring on the current regulatory list of endangered, threatened, and special concern species are protected under the Massachusetts Endangered Species Act (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00). Species occurring on this list require a permit to collect, including seeds and other parts of the plant. In Vermont, plants listed as endangered or threatened cannot be taken without a permit from the secretary of the Vermont Agency of Natural Resources. However, the Vermont statute protects just the rare plants themselves and not the habitat where they grow.

Conservation action for *Carex wiegandii* has resulted from general land protection in the White Mountain National Forest in New Hampshire and Acadia National Park in Maine and by targeted protection of peatland habitats, some of which support the sedge. Of the 57 New England occurrences, at least 28 are on public land. Although most or all of the organizations and land managers of these public lands have been made aware of the sedge, most lack the resources to adequately research, monitor, and manage these populations.

The Maine Department of Conservation (1999) has written a fact sheet for the sedge, and the New Hampshire Natural Heritage Program and The Nature Conservancy (Nichols 1997) recently updated *Carex wiegandii's* Element Global Ranking Form. An Element Stewardship Abstract for *C. wiegandii* has been prepared (Ostlie 1990) with the support of The Nature Conservancy. The fact sheet, Element Global Ranking Form, and Element Stewardship Abstract for *C. wiegandii* help guide conservation action and provide stewards and land managers with management-related information.

NEPCoP is involved in seed banking, germination research, and propagation for *Carex wiegandii*. In 1993, 459 seeds from 17 plants thought to be *C. wiegandii* were collected at a site in Worcester County, MA. Only one seedling germinated (November 1993) from seeds sown from this collection. The seedling died in September 1996. It has since been learned that this population has been misidentified and is actually all odd *C. atlantica*, perhaps affected by fungus smut, which alters normal perigynia growth. In 1995, 494 seeds were collected from a site near Ossipee Lake, NH by Patrick McCarthy. Sedge identification was never confirmed, and no germination was observed. In July 1999, seed was collected from a Saco, ME site by Betsy Newcomer. Eleven seedlings emerged from 100 sown seeds in June 2000. Species identification needs to be confirmed. Two thousand seeds were collected at a site in Acadia National Park, ME. Seeds from this collection were sown in October 2000.

NEPCoP volunteers and state Natural Heritage Programs monitor extant populations, search for new populations, and provide the data that will help inform future conservation, management, and protection decisions. The present level of conservation action for *Carex wiegandii* by land managers and various conservation organizations, however, does not ensure its long-term viability in New England. A proactive approach, beyond the current levels of conservation action, is likely required. The implementation of this conservation and management plan for *C. wiegandii* may be critical to ensure the sedge's regional and global survival.

# II. CONSERVATION

## CONSERVATION OBJECTIVES FOR TAXON IN NEW ENGLAND

*Carex wiegandii* is rare in New England (Brumback and Mehrhoff et al. 1996) and vulnerable to extinction globally (NatureServe 2000). The primary conservation objective for the taxon in New England is maintaining or increasing the sedge's long-term viability. Over the next 20 years, this objective can be accomplished by maintaining or increasing the long-term viability and number of known occurrences (currently 34 populations) including representatives from across its geographic range, through the application of the following prioritized conservation actions.

- Primary conservation actions for the taxon in New England are land acquisition or protection of occurrences, surveying extant populations, relocating historical occurrences, *de novo* searches, research, habitat or site management, and information management.
- Secondary objectives include *ex-situ* activities and increasing public awareness.
- If few new populations are discovered after extensive *de novo* searches, then augmentation, introduction, and reintroduction should be considered a primary objective at suitable sites.

A discussion of these conservation objectives, including objective rationale and other relevant information, follows in "General Conservation Actions for the Taxon."

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# IV. APPENDICES

1. **Rank Specifications for *Carex wiegandii* (Nichols 1997)**

2. **Key to *Stellulatae* of North America (Reznicek and Ball 1980)**

3. **Historical Ranks**

4. **Divisions of the list "*Flora Conservanda*: New England"**

5. **Explanation of Global, National, and State Rank Codes**

## Appendix 1. Rank specifications for *Carex wiegandii* (Nichols 1997).
**EO SPECS AS OF 15 MARCH 1997**

**EOSPECS**
An Element Occurrence for *Carex wiegandii* is any natural population of one or more plants and the habitat on which the plant(s) is/are present. The species is probably a dynamic opportunist of disturbances that retard or set back succession in peatlands and other habitats (Reznicek pers. comm. 1997).

EOs are separated by either:

* a distance of at least 1 km of unsuitable habitat; or

* a distance of at least 2 km of apparently suitable habitat that is not known to be occupied.

Justification: The rationale for the large separation distance across unoccupied but suitable habitat is because of the growth response of propagules in the seed bank following flooding or other disturbances (e. g. , inundated areas in high-plateau white pine–hemlock–mixed hardwood swamps).

Reznicek, A. A. 1997. Pers. comm. with W. F. Nichols.

Nichols, W. F. (NHNHP) 1997–03–15

**ARANKSPECS**
Populations greater than 300 plants with sufficient sexual and/or asexual recruitment to maintain numbers at current estimates deserve this rank. Populations occur in excellent habitats of large-size (> 4 ha [> 10 ac]) and high natural integrity (margins of acidic sphagnum bogs, poor fens, graminoid swales, openings in high-plateau white pine–hemlock–mixed hardwood swamps or damp acidic peat-sand flats) with dynamic ecosystem processes. The integrity of biotic and abiotic factors, community structure, and processes within (condition) and surrounding (landscape context) the occurrence and the degree to which they affect the continued existence of the EO should be excellent to receive an "A" rank.

Justification: Populations have exceeded 1000 plants at two sites in Pennsylvania along the margins of high-plateau white pine–hemlock–mixed hardwood swamps inundated as a result of beaver activity. However, habitat size and diversity and continuation of dynamic ecosystem processes may be more important than the actual number of plants present at one instant in time. In larger habitats, the plant is more likely to survive periods without the appropriate perturbations, either in the seed bank or as scattered individuals in small disturbance patches like trails, blowdowns, or small beaver floodings (Reznicek pers. comm. 1997). Occurrences not meeting landscape and habitat conditions and other criteria described for a defined population size may fall to a lower rank, at the discretion of the surveyor. In general, population size and availability of suitable habitat are the primary factors influencing the rank of this Element.

**BRANKSPECS**
Populations of 101–300 plants with sufficient sexual and/or asexual recruitment to sustain numbers at current estimates or populations larger than 1000 plants that show continued population decline (> 25% over a 5 year period) deserve this rank. Populations occur in good to excellent, moderate-sized (2–4 ha [5–10 ac]) to large-sized (> 4 ha [> 10 ac]) habitats with dynamic ecosystem processes (as described above that may show low levels of anthropogenic disturbance, but are largely natural). The integrity of biotic and abiotic factors, community structure, and processes within (condition) and surrounding (landscape context) the occurrence and the degree to which they affect the continued existence of the EO can be good to excellent to receive a "B" rank. Occurrences exceeding minimum landscape and habitat conditions and other criteria described for a defined population size remain at the rank specified by the population size unless the population size is close to that required by the next higher rank.

**CRANKSPECS**
Populations of 11–100 plants with sufficient sexual and/or asexual recruitment to sustain numbers at current estimates or populations larger than 100 plants that show continued population decline (> 25% over a 5 year period) deserve this rank. Populations occur in fair to excellent, small-sized (< 2 ha [< 5 ac]) to large-sized (> 4 ha [> 10 ac]) habitats (as described above that may show signs of moderate levels of anthropogenic disturbance, although apparently not permanently detrimental to most populations). The integrity of biotic and abiotic factors, community structure, and processes within (condition) and surrounding (landscape context) the occurrence and the degree to which they affect the continued existence of the EO can be fair to excellent to receive a "C" rank. Occurrences exceeding minimum landscape and habitat conditions and other criteria described for a defined population size remain at the rank specified by the population size unless the population size is close to that required by the next higher rank.

Justification: EOs not reaching CRANKSPECS often occur in degraded habitats and are not likely to survive for extended periods due to low viability and susceptibility to extirpation from stochastic events.

**DRANKSPECS**
Populations of 10 or fewer plants or populations of 11–100 plants that exhibit continued population decline (> 25% over a 5 year period) deserve this rank. Populations occur in any size poor habitat as described above with impaired ecosystem processes and moderate to high levels of anthropogenic disturbance including water table perturbations or other destructive actions or in man-made habitats (e.g., borrow pits). The integrity of biotic and abiotic factors, community structure, and processes within (condition) and surrounding (landscape context) the occurrence and the degree to which they affect the continued existence of the EO can be poor to excellent to receive a "D" rank. Occurrences exceeding minimum landscape and habitat conditions and other criteria described for a defined population size remain at the rank specified by the population size unless the population size is close to that required by the next higher rank.

Reznicek, A. A. 1997. Pers. comm. with W. F. Nichols.

**OTHER BASIC EO RANKS USED IN THIS DOCUMENT FOR *CAREX WIEGANDII***

<blank> = Unranked

E = Verified extant

H = Historical

SR = Reported: Element reported in the state but without persuasive documentation which would provide a basis for either accepting or rejecting (e.g., misidentified specimen) the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports that are hard to dismiss because the habitat is now destroyed.

## Appendix 2. Key to *Stellulatae* of North America (Reznicek and Ball 1980: 178-179)

| | |
|---|---|
| 1. Spikes usually solitary; leaves involute; anthers 2.0–3.6 mm. | 1. *C. exilis* |
| 1. Spikes 2–8; leaves flat or plicate; anthers 0.6–2.2 (2.35) mm. | 2. |
| 2. Perigynium beak smooth-margined. | 8. *C. seorsa* |
| 2. Perigynium beak at least sparsely serrulate on margins. | 3. |
| 3. Widest leaves 2.8–5.0 mm wide. | 4. |
| 3. Widest leaves 0.8–2.7 mm wide. | 7. |
| 4. Lower perigynia of spikes mostly 1.1–1.6 times as long as wide, mostly 2.1–3.0 mm wide. | 6a. *C. atlantica* subsp. *atlantica* |
| 4. Lower perigynia of spikes (1.5) 1.7–3.0 times as long as wide, mostly 1.2–2.0 mm wide. | 5. |
| 5. Longer pistillate scales 2.1–3.1 mm long; west coast of North America. | 7b. *C. echinata* subsp. *phyllomanica* |
| 5. Longer pistillate scales 1.4–2.2 mm long; eastern North America. | 6. |
| 6. Infructescences mostly 15–30 mm long, lowest 2 spikes 1.3–9.5 mm distant. | 4. *C. wiegandii* |
| 6. Infructescences mostly 30–85 mm long, lowest 2 spikes 10–40 mm distant. | 5. *C. ruthii* |
| 7. Terminal spikes entirely staminate; anthers (1.0) 1.2–2.2 (2.35) mm long. | 2. *C. sterilis* |
| 7. Terminal spikes partly or wholly pistillate; anthers 0.6–2.2 (2.35) mm long. | 8. |
| 8. Terminal spikes without a distinct clavate base of staminate scales, staminate portion less than 1 mm in length; anthers (1.0) 1.2–2.2 (2.35) mm long. | 2. *C. sterilis* |
| 8. Terminal spikes with a distinct clavate base 1.0–16.5 mm long of staminate scales; anthers 0.6–1.6 (2.0) mm long. | 9. |
| 9. Lower perigynia 2.0–3.0 mm wide. | 6a. *C. atlantica* subsp. *atlantica* |
| 9. Lower perigynia 0.9–1.95 mm wide. | 10. |

10. Lower perigynia mostly 1.9–3.0 mm long, 1.0–2.0 (2.2) times as long as wide; beaks mostly 0.4–0.95 mm long, mostly 0.2–0.5 times as long as body. 11.

10. Lower perigynia mostly 2.85–4.75 mm long, (1.7) 1.8–3.6 times as long as wide; beaks mostly 0.95–2.0 mm long, mostly 0.45–0.85 times as long as body. 13.

11. Perigynia mostly nerveless over achene on adaxial surface; beak of perigynium conspicuously setulose-serrulate; perigynia often more or less convexly tapered from widest point to beak, forming a “shoulder.” 3. *C. interior*

11. Perigynia mostly 1–10 nerved over achene on adaxial surface; beak of perigynium more sparsely serrulate with definite spaces between the often single teeth; perigynia mostly more or less cuneate or even concavely tapered from widest point to beak. 12.

12. Widest leaves 1.6–2.7 mm wide, infructescence mostly 18–45 mm long. 6a. *C. atlantica* subsp. *atlantica*

12. Widest leaves (0.65) 0.8–1.6 mm wide, infructescence mostly 8–20 mm long. 6b. *C. atlantica* subsp. *capillacea*

13. Heads very dense, 12–25 (40) mm long; distance between lower 2 spikes usually less than length of lowest spike. 14.

13. Heads more lax, usually 25–80 mm long; distance between lower 2 spikes usually more than length of lowest spike. 7a. *C. echinata* subsp. *echinata*

14. Perigynia 2.85–3.6 (4.0) mm long, often nerveless over achene on adaxial surface; widest leaves 1.0–2.4 (2.7) mm wide; widespread. 7a. *C. echinata* subsp. *echinata*

14. Perigynia (3.1) 3.5–4.75 mm long, usually 2–12 nerved over achene on adaxial surface; widest leaves (1.7) 2.3–2.7 mm wide; west coast of North America. 7b. *C. echinata* subsp. *phyllomanica*

## Appendix 3. Historical Ranks

The justification for a 20-year historical threshold for *Carex wiegandii* is based on the sedge's frequent occurrence in dynamic habitats and an understanding of the historical rank defined by The Nature Conservancy and Association for Biodiversity Information (1999) below.

> The "H" = HISTORICAL EO rank should be used when there is a lack of recent field information verifying the continued existence of an EO, such as
> a) when an EO is based only on historical collections data; or
> b) when an EO was ranked "A", "B", "C", "D", or "E" at one time and is later, without field survey work, considered to be possibly extirpated due to general habitat loss or degradation of the environment in the area.
>
> This definition of the "H" rank is dependent on an interpretation of what constitutes "recent" field information. In general, if there is no known survey of an animal EO within the last 20 years, it should be assigned an "H" rank. Similarly, if there is no known survey of a plant or community EO within the last 20 to 40 years, it should be assigned an "H" rank. While these time frames represent suggested maximum limits, the actual time period for historical EOs may vary according to the biology of the Element and the specific landscape context of each occurrence (including anthropogenic alteration of the environment). Thus, an "H" rank may be assigned to an EO before the maximum time frames have lapsed. Occurrences that have not been surveyed for periods exceeding these time frames should not be ranked "A", "B", "C", or "D."
>
> The higher maximum limit for plants and communities (i.e., ranging from 20 to 40 years) is based upon the assumption that occurrences of these Elements generally have the potential to persist at a given location for longer periods of time. This greater potential is a reflection of plant biology and community dynamics. However, landscape factors must also be considered. Thus, areas with more anthropogenic impacts on the environment (e.g., development) will be at the lower end of the range, and less-impacted areas will be at the higher end.

## Appendix 4. Divisions of the List "*Flora Conservanda*: New England"

The NEPCoP list *Flora Conservanda* (Brumback and Mehrhoff *et al*. 1996) is divided into the following divisions:

Division 1 = Globally rare taxa occurring in New England.

Division 2 = Regionally rare taxa (< 20 populations observed since 1970 within New England).

Division 2(a) = Regionally rare taxa (> 20 current populations within New England but a substantial number are small and vulnerable to extirpation).

Division 3 = Locally rare taxa (common within New England but one or more populations are disjunct or ecologically anomalous or demonstrably declining).

Division 4 = Historic taxa (not seen since 1970).

Division Indeterminate (IND.) = Indeterminate (under review, but taxonomy, nomenclature, or status in the wild not clearly understood).

## Appendix 5. Explanation of Global, National, and State Rank Codes.

Ranks describe rarity throughout a species' range (globally, or "G" rank), within a nation (national, or “N” rank), and within New Hampshire (statewide, or "S" rank). The rarity of sub-species and varieties is indicated with a taxon ("T") rank. For example, a G5T1 rank shows that the species is globally secure (G5) but the sub-species is critically imperiled (T1).

| *Code* | *Examples* | *Description* |
|---|---|---|
| **1** | G1 N1 S1 | Critically imperiled because extreme rarity (generally one to five occurrences) or some factor of its biology makes it particularly vulnerable to extinction. |
| **2** | G2 N2 S2 | Imperiled because rarity (generally six to 20 occurrences) or other factors demonstrably make it very vulnerable to extinction. |
| **3** | G3 N3 S3 | Either very rare and local throughout its range (generally 21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction because of other factors. |
| **4** | G4 N4 S4 | Widespread and apparently secure, although the species may be quite rare in parts of its range, especially at the periphery. |
| **5** | G5 N5 S5 | Demonstrably widespread and secure, although the species may be quite rare in parts of its range, particularly at the periphery. |
| **U** | GU NU SU | Status uncertain, but possibly in peril. More information needed. |
| **H** | GH NH SH | Known only from historical records, but may be rediscovered. A G5 SH species is widespread throughout its range (G5), but considered historical in New Hampshire (SH). |
| **X** | GX NX SX | Believed to be extinct. May be rediscovered, but evidence indicates that this is less likely than for historical species. A G5 SX species is widespread throughout its range (G5), but extirpated from New Hampshire (SX). |

Modifiers are used as follows.

| *Code* | *Examples* | | *Description* |
|---|---|---|---|
| **Q** | G5Q | GHQ | Questions or problems may exist with the species' or sub-species' taxonomy, so more information is needed. |
| **?** | G3? | 3? | The rank is uncertain due to insufficient information at the state or global level, so more inventories are needed. When no rank has been proposed the global rank may be "G?" or "G5T?" |

When ranks are somewhat uncertain or the species' status appears to fall between two ranks, the ranks may be combined. For example:

| | |
|---|---|
| G4G5 | The species may be globally secure (G5), but appears to be at some risk (G4). |
| G5T2T3 | The species is globally secure (G5), but the sub-species is somewhat imperiled (T2T3). |
| G4?Q | The species appears to be relatively secure (G4), but more information is needed to confirm this (?). Further, there are questions or problems with the species' taxonomy (Q). |

G3G4Q S1S2 The species is globally uncommon (G3G4), and there are questions about its taxonomy (Q). In New Hampshire, the species is very imperiled (S1S2).