

New England Plant Conservation Program

*Carex davisii* Schwein. & Torr.  
Davis' sedge

Conservation and Research Plan  
for New England

Prepared by:  
Elizabeth Thompson  
Consulting Ecologist

For:

New England Wild Flower Society  
180 Hemenway Road  
Framingham, MA 01701  
508/877-7630  
e-mail: [conserve@newfs.org](mailto:conserve@newfs.org) website: [www.newfs.org](http://www.newfs.org)

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## SUMMARY

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Davis' sedge (*Carex davisii* Schwein. & Torr.) is a perennial sedge (Cyperaceae) that grows in floodplain forests, alluvial meadows, and calcareous woods, usually associated with rivers and streams. The plant is widely distributed in eastern North America, and is considered common in several states at the western edge of its range. Its northeastern range limit is western New England. It is rare in New England, likely because it is at the northern edge of its range and because its habitat is highly altered. It is known from only eight extant sites in Vermont, Massachusetts, and Connecticut. Seven of these sites were visited in 2002. One site was new in 2002; in the other six cases the plant's presence was reverified. There are, in addition, ten historic sites, most of which warrant modern inventory.

The 20-year conservation objective for Davis' sedge in New England is to secure long-term protection and appropriate management for no fewer than 15 populations of 50 genets each, geographically distributed in all counties, in all watersheds, and on all watercourses where the plant has historically been found. These watercourses include 1) the Connecticut River and its tributaries the Farmington River and "Sumner's Creek" (an historic name); 2) the Housatonic River and its tributaries the Konkapot River and Still River; and 3) the Poultney River.

The 100-year conservation objective is to ensure that all 15 populations are viable and will persist for at least a century. This will require an increase in the number of genets at most sites.

## 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) 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.

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

Davis' sedge (*Carex davisii* Schwein. & Torr.) is a perennial member of the sedge family (Cyperaceae), section Hymenochleaneae (Waterway 2002). The species was apparently discovered in the second decade of the 19<sup>th</sup> century by Gottif Muhlenberg, was subsequently described and named (first as *C. aristata*, then as *C. Torreyana*) by Chester Dewey, and nearly simultaneously as *C. Davisii* by Lewis de Schweinitz and John Torrey in their 1825 *Monograph of the North American Species of Carex*. This name has persisted, and no synonyms survive in modern manuals.

Regardless of the confusion, Davis' sedge is a distinctive and handsome plant. It has relatively large perigynia that become orange or brown with age, and light, long-awned scales that contrast with the brown perigynia late in the season. It is a tall plant, with flowering culms reaching nearly a meter in height. The culms, however, tend to lie prostrate, especially late in the season. The plants are clump-forming, with short rhizomes.

Davis' sedge grows in floodplain forests, alluvial meadows, calcareous woods (nearly always adjacent to a current or historic floodplain), shores, and occasionally along roads or in other anthropogenic habitats near rivers.

The range of Davis' sedge is western New England (and perhaps Quebec) west to Ontario, Minnesota and south to Nebraska, Kansas, Oklahoma, and Texas; and, in the east south to Maryland, Tennessee, and Arkansas. It is most abundant, but not necessarily common, in the Midwestern states. It has a global rank of G4, a US national rank of N? and a Canada national rank of N2 (see Appendix 3 for explanations of ranks).

Davis' sedge is rare in New England, likely because it is at the northern edge of its range and because its habitat is highly altered. It is listed as Endangered in Connecticut and Massachusetts. Eight extant sites are known in New England. An additional ten sites are known only from historical collections. Seven of the eight extant sites were visited in 2002, and the plant was found at each of these.

Little is known about the biology of Davis' sedge or about threats to its persistence. Field biologists who have studied the sedge in the last two decades have postulated that invasive exotic species pose a major threat, but this has not been tested. Impoundment of rivers has probably eliminated two historic sites, and urban development has likely eliminated at least one. Other potential threats include natural secondary succession, competition with native herbaceous species, and trampling.

The purpose of this Conservation and Research Plan is to summarize existing information on Davis' sedge in New England and to recommend a set of conservation actions that will ensure the persistence of the plant in New England over time.

The 20-year conservation objective for Davis' sedge in New England is to secure long-term protection and appropriate management for no fewer than 15 populations of 50 genets each, geographically distributed in all counties and on all watercourses where the plant has historically been found. These watercourses include 1) the Connecticut River and its tributaries the Farmington River and "Sumner's Creek" (an historic name); 2) the Housatonic River and its tributaries the Konkapot River and Still River; and 3) the Poultney River.

The 100-year conservation objective is to ensure that all 15 populations are viable and will persist for at least a century. This will require an increase in the number of genets at most sites.

## **DESCRIPTION**

The following description is adapted largely from Steyermark's *Flora of Missouri*, Volume 1, Revised Edition (Yatskievych 1999).

Davis' sedge is a perennial herb with short-creeping rhizomes, forming dense tufts or clumps. The sheaths of the previous season's basal leaves sometimes persist, becoming dissected into hairlike fibers. The vegetative stems are well-developed, with several leaves, but they are shorter than the flowering stems. The flowering stems are 30-90 cm long, shorter or longer than the leaves, sharply trigonous, glabrous or somewhat hairy on the angles, and strongly purplish at the base. The culms tend to lie prostrate, especially late in the season. The lowermost leaves are reduced to nearly bladeless sheaths. The leaf blades are 1-40 cm long, 3-8 mm wide, green to dark green, flat, and are glabrous or more commonly hairy, at least near the base of the undersurface. The leaf sheaths are concave at the tip and glabrous to evenly hairy on both sides. The ligules are about as long as wide or wider than long and are U-shaped to broadly V-shaped. Their ventral sides are thin and white. The lowermost leaf sheaths are strongly purplish-tinged.

The terminal spikelet is mostly staminate, with few to several pistillate flowers toward the tip. The two or three lateral spikelets are entirely pistillate. The terminal spikelet is 5-35 mm long and linear to narrowly oblanceolate in outline. The staminate scales are 3.5-7.5 mm long, lanceolate, and mostly awned at the tip. They are white with green midribs.

The pistillate spikelets are 20-40 mm long and mostly erect when young but usually nodding or drooping at maturity. The scales are 4.0-6.2 mm long and narrowly elliptic-ovate. They are tapered to a usually long awn. At least the uppermost pistillate scales have a definite awn more than half as long as the main body of the scale. The scale is white or pale green with

a green midrib. The perigynia are 4.5-6.0 mm long and 2.0-2.5 mm wide. They are oblong-ovate in outline, broadest below the middle, and are circular to very bluntly trigonous in outline. They taper to a short beak with two minute, papery teeth at the tip and are rounded to a stalk-like base. The sides of the perigynia have several nerves. They are pale green to green, turning yellowish-brown or dull orange at maturity. The achenes are 2.2-2.6 mm long and yellowish brown, with deeply concave sides and blunt angles. The short beak is straight or nearly so.

In several floras, Davis' sedge is described in comparison with *C. formosa*, perhaps its closest relative. Gray (1889), for example, describes Davis' sedge, following the description of *C. formosa*, in this way: "Always taller, spikes heavier, perigynia more inflated, strongly nerved and prominently toothed, no longer or shorter than the conspicuous awn and spreading scale." The conspicuously awned scale is the most commonly-used character for distinguishing Davis' sedge from *C. formosa* and from *C. oxylepis*, another close relative that does not occur in New England.

Late in the growing season, Davis' sedge is conspicuous and distinctive, with the mature large, brown perigynia contrasting with light, papery scales.

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

The nomenclature of Davis' sedge was very confused for the first few years following its discovery. The plant we now know as *C. davisii* was apparently first described, as *Carex* No. 46, by Gottlif Muhlenberg in an 1817 publication (Schweinitz and Torrey 1825, Dewey 1826), or perhaps as *Carex* No. 45 (Schweinitz and Torrey 1825). It was then named by Chester Dewey, as *C. aristata* (Dewey 1824, Dewey 1825). Dewey later (1826) renamed the plant *C. Torreyana* because the name *C. aristata* had been previously used for another taxon (Schweinitz and Torrey 1825). Meanwhile, Dewey named another species *C. Davisii*, in honor of Emerson Davis, an amateur caricologist from Westfield, Massachusetts.

Borrowing from Dewey's work and that of other caricologists of the time, Lewis Schweinitz and John Torrey described the species in their *Monograph of the North American Species of Carex* (1825) and, I believe erroneously, named it *C. Davisii*. They list Dewey's *C. aristata* as a synonym, but describe the habitat and locality as that of Dewey's *C. Davisii* (Williamstown, Massachusetts) rather than that of *C. aristata* (alluvial meadows of the Housatonic in Sheffield, Massachusetts). Nevertheless, their description of the plant we now know as *Carex davisii*, and their naming of it, predated Dewey's appellation of *C. Torreyana*, so the former name has priority.

In spite of the apparent error, the name *C. davisii* applied to the plant we treat here has apparently persisted since the confusion of the 1820s, and is attributed to Schweinitz and Torrey. In no modern regional floras, in none of the New England state floras for states in which Davis' sedge occurs, nor in Kartesz (1994), are synonyms given for *Carex davisii*. The

only reference to other names is in the original Britton and Brown *Illustrated Flora* (Britton and Brown 1913), in which *Carex Torreyana*, Dewey's name, is listed as a synonym.

The genus *Carex* has traditionally been divided into sections, or groups of species that appear to be related based on morphological characteristics. Traditionally (as in Gleason and Cronquist 1991) Davis' sedge has been included in section Gracillimae. Other New England members of this section are *C. formosa*, *C. gracillima*, *C. aestivalis*, and *C. prasina*. Recent work using DNA sequence data (Waterway and Olmstead 1998, Waterway 1999) shows that most members of this section form a clade – a group of closely related species – with members of sections Sylvaniae and Virescentes (Porocystis of some authors). There is little variability within this clade, suggesting that these three sections would best be considered one. Interestingly, long before our section concept arose, Dewey (1824) stated that *C. davisii* was related to *C. virescens*, a member of section Virescentes.

Yatskievych (1999) mentions a glabrous form of Davis' sedge (*C. davisii* f. *glabrescens* Kük.) that occurs sporadically in Missouri. No other authors mention this form. Yatskievych (1999) also describes, but does not name, an apparent sterile hybrid between *C. davisii* and *C. hirsutella* (traditional section Virescentes), represented by a single collection. The presence of this hybrid supports the notion that the traditional sections Gracillimae and Virescentes are closely related. No other authors mention hybrids involving Davis' sedge.

In spite of the apparent relatedness of the three traditional sections, the most recent treatment of the genus *Carex* (Waterway 2002) merges sections Gracillimae and Sylvaniae within section Hymenochlaene and treats the traditional section Virescentes elsewhere. *Carex davisii*, therefore, is now regarded as a member of section Hymenochlaene.

## **SPECIES BIOLOGY**

In New England, Davis' sedge flowers from May to July (Magee and Ahles 1999). Perigynia mature and begin dropping from the plants as early as the beginning of July (Brumback 1996), but may remain on plants until mid-September or later (E. Thompson, personal observation).

There have been no studies of the reproductive biology of Davis' sedge. Like other members of the genus *Carex*, Davis' sedge is most probably wind-pollinated. Fruits are likely dispersed by gravity and by water, and perhaps by animals. Since the plant occurs in floodplains, water dispersal is a likely means of moving propagules long distances along a river course.

It is unknown how long seeds are viable or what conditions are required for germination, but M. D. Cullina (2002: 5) provides an excellent general discussion (quoted below) of the germination requirements of sedge seeds, which are small:

Most wetland members of the Cyperaceae in New England require damp, exposed soil to germinate (William Cullina, New England Wild Flower Society, personal communication), which may be related to a requirement for light or temperature fluctuation, or both...Because small seeds...have limited food reserves, it is usually critical that they germinate near the soil surface (Grime 1979), and hence light may be a requirement to break dormancy or stimulate germination...Wetland species are particularly stimulated to germinate by fluctuating temperatures (Thompson and Grime 1983).

It is unknown whether Davis' sedge seeds survive in soil seed banks, but seeds of other *Carex* species have been found in both wetland and upland seed banks, and in some cases are shown to be long-lived (Schütz and Rave 1999, Leckie et al. 2000, Schütz 2000 [as reported by Yatskievych, personal communication]).

With its short-creeping rhizomes, vegetative reproduction is locally important for Davis' sedge – each clump of several culms likely represents a single genet.

There have been no studies regarding herbivory, parasitism, or symbioses. Field data from the known New England sites do not provide any further information.

## **HABITAT/ECOLOGY**

The habitat for Davis' sedge in New England is described consistently as rich calcareous woods, meadows, shores, and banks (Fernald 1950, Magee and Ahles 1999). Floodplain forests seem to be the primary habitat for the species, especially here in the Northeast, but it occasionally grows in upland forests and even in somewhat disturbed habitats such as road and field edges.

All New England occurrences are near rivers. Most of the Connecticut occurrences, for example, are in floodplain forests or on rich wooded banks immediately adjacent to floodplains (some of which have been highly altered). The one extant occurrence in Massachusetts (the site from which the species was first described) is in a floodplain forest. The single extant Vermont occurrence was first discovered at the edge of a hayfield, under bales of hay, less than a mile from a river. In the 2002 survey, the plants were found in adjacent young calcareous woods. The other Vermont occurrence, known only from an historical record, was on a wooded bank above a river which has since been flooded.

In general, the plants seem to prefer the boundary between floodplain and adjacent upland forest, but there is a great range in how distant the plants are from a river and how far above flood level they grow. William Moorhead (Consulting botanist, personal communication) describes the most common habitat at one large population in Connecticut as “levees, levee scars, and slopes and brows of channel scars.” Light levels vary from dense shade to nearly full

sun (in the anthropogenic habitats). Soils are mostly mesic during the growing season, but may be flooded during parts of the year. Moorhead has investigated elevations and river-flooding frequencies of two sites on the Farmington River, a tributary of the Connecticut. They range from a few feet below the 10-year flood elevation to about halfway between the 10- and 50-year flood elevation, according to the projected Army Corps of Engineers flood profiles for the Farmington River after installation of upstream flood control structures in the late 1950s and 1960s.

The national list of wetland plants (U.S. Fish and Wildlife Service 1996) lists Davis' sedge as FAC- in the Northeast, meaning that it is equally likely to occur in wetlands or non-wetlands (estimated probability of occurring in wetlands toward the lower end of the range 34%-66%). During 2002 field work, I observed the plant in a few wetland situations, but more often it grew in mesic uplands adjacent to wetlands (floodplain forests).

Outside New England, the habitat descriptions are similar (e.g., Voss 1972 for Michigan and Yatskievych 1999 for Missouri), with floodplain or bottomland forests and streambanks described as the primary habitat, and fields and road edges described as occasional habitats. The Missouri Botanical Garden's Kemper Center for Home Gardening (2002) describes culture requirements for *Carex davisii* as "wet soil in full sun to partial shade."

All extant populations are found in habitats that have some level of disturbance, whether that is natural (flooding) or anthropogenic. Therefore, disturbance is probably a key component of the habitat requirements of this plant. This idea needs investigating.

Commonly associated species in low floodplain occurrences in New England are *Fraxinus pensylvanica*, *Acer saccharinum*, *Salix nigra*, *Populus deltoides*, *Laportea canadensis*, *Matteuccia struthiopteris*, *Geum canadense*, *Carex amphibola*, *Carex sprengelii*, *Toxicodendron radicans*, *Onoclea sensibilis*, *Lindera benzoin*, *Parthenocissus quinquefolius*, *Phalaris arundinacea*, *Lysimachia nummularia*, *Carex bromoides*, *Cornus amomum*, *Carex retroflexa*, *Elymus riparius*, *Ageratina altissima*, *Festuca subverticillata*, *Lonicera morrowii*, *Rhamnus cathartica*, and occasionally *Juglans cinerea*.

For the occurrences in high flood plain forest habitat, additional associates include *Acer saccharum*, *Carya cordiformis*, *Carya ovata*, *Tilia americana*, *Ostrya virginiana*, *Carpinus caroliniana*, *Ulmus americana*, *Pinus strobus*, *Quercus rubra*, *Fraxinus americana*, *Prunus serotina*, *Prunus virginiana*, *Berberis thunbergii*, *Euonymus alatus*, *Hydrophyllum virginianum*, *Claytonia virginica*, *Osmorhiza longistylis*, *Cryptotaenia canadensis*, *Glechoma hederacea*, *Viola affinis*, *Viola pubescens*, *Menispermum canadense*, and *Microstegium vimineum* (local).

## **THREATS TO TAXON**

In a general sense, we can describe the threats to Davis' sedge as habitat alteration and loss, which take a number of forms. In addition, small population size makes the plant vulnerable to region-wide decline. Each of these threats is discussed in turn below, in order of importance.

### ***Impoundment of Rivers***

Davis' sedge grows most commonly in floodplain forests, alluvial meadows, and forests adjacent to these habitats. Impoundment of rivers for power generation and flood control, mostly during the early to mid 20<sup>th</sup> century, has inundated former floodplain habitats upstream of dams and has altered natural hydrologic regimes below dams. Two historic Davis' sedge localities (VT .001 [Brattleboro] and CT .008 [Brookfield]) have been inundated, and the plant has likely been extirpated from each of those sites. Several other sites have probably suffered alteration of flow and flooding regimes (Moorhead, personal communication), but these changes and their effects on Davis' sedge have not been studied.

### ***Conversion and Fragmentation of Habitat***

Floodplains are inherently threatened because they offer excellent agricultural soils, provide logical and convenient places for roads and railroads, and are easily developed. One historic Davis' sedge locality (CT .002 [Hartford]) is now heavily developed, with major highways, flood-control dikes, industrial and residential developments, and an airport replacing former floodplain forest. It is highly unlikely that Davis' sedge has survived these changes. Other sites have seen less severe conversion, from floodplain forest to agricultural fields or golf courses. MA .001 (Sheffield), CT .014 (Simsbury) and CT s.n. (Avon) have seen partial conversions of this kind. Such conversion can eliminate populations altogether, or can fragment large populations to the point where gene flow and therefore genetic vigor are impaired.

### ***Competition from Invasive Exotic Species***

Invasive exotic species are present at all eight extant localities for Davis' sedge, in some cases in great abundance. The species noted include, roughly in order of frequency of occurrence, *Rhamnus cathartica*, *Lonicera* spp. (*L. tartarica* and *L. morrowii* are not distinguished), *Rosa multiflora*, *Frangula alnus*, *Celastrus orbiculatus*, *Berberis thunbergii*, *Ligustrum obtusifolium*, *Euonymus alatus*, and *Hesperis matronalis*. The effect of these species on Davis' sedge populations has not been studied, but several field biologists (e.g., Moorhead, personal communication) have identified invasive exotic species as a generalized threat based on the known impacts of these species on other native species and ecological

communities. How they actually impact Davis' sedge needs study. Moorhead suspects shading is an important factor.

### ***Competition from Native Species***

In one case (MA .001 [Sheffield]) competition from a native plant, *Laportea canadensis*, was identified by managers as a threat to Davis' sedge. Managers at that site are studying the effects of controlling *Laportea* on the health of the Davis' sedge population. In another case (VT .002 [West Haven]), field botanists suggested that native trees might ultimately shade out Davis' sedge, which occurs in a young, somewhat open, forest. This needs to be studied. At a third site, where Davis' sedge grows in high floodplains, competition from *Carex sprengeii* is cited as a potential threat (Moorhead, personal communication).

### ***Dumping***

In one case (one of the small subpopulations of CT .014 [Simsbury]), I observed trash on a slope just a few meters above a population of Davis' sedge. More dumping in the area could cover and eliminate the plants.

### ***Hiking and Off-Road-Vehicle Trails***

Two populations (MA .001 [Sheffield] and VT .002 [West Haven]) have hiking trails that pass within a few feet of Davis' sedge populations. The impacts of these trails should be studied. Moorhead (personal communication) suggests that trails may actually be beneficial to Davis' sedge, perhaps increasing light and reducing competition.

### ***Small Populations***

Much effort has been devoted to determining minimum viable population size (MVP) for plants – the smallest number of individuals necessary for long-term persistence of a population. Estimates vary with taxon, geography, and other factors, but range from 50-1,000,000 individuals. The New England populations of Davis' sedge are mostly near or below the lower end of this range, and their viability must therefore be questioned.

## **DISTRIBUTION AND STATUS**

### ***General Status***

Davis' sedge ranges from western New England (and perhaps Quebec) west to Minnesota and south to Maryland, Tennessee, Missouri, Oklahoma, and Texas (Fernald 1950, Argus and Pryer 1990). It is most abundant, but not necessarily common, in the Midwestern states (Voss 1972, Gleason and Cronquist 1991). It is considered rare in Ontario, Arkansas, Connecticut, Delaware, Massachusetts, New York, Tennessee, and Vermont (NatureServe 2002). It is known only historically from Maryland and Virginia.

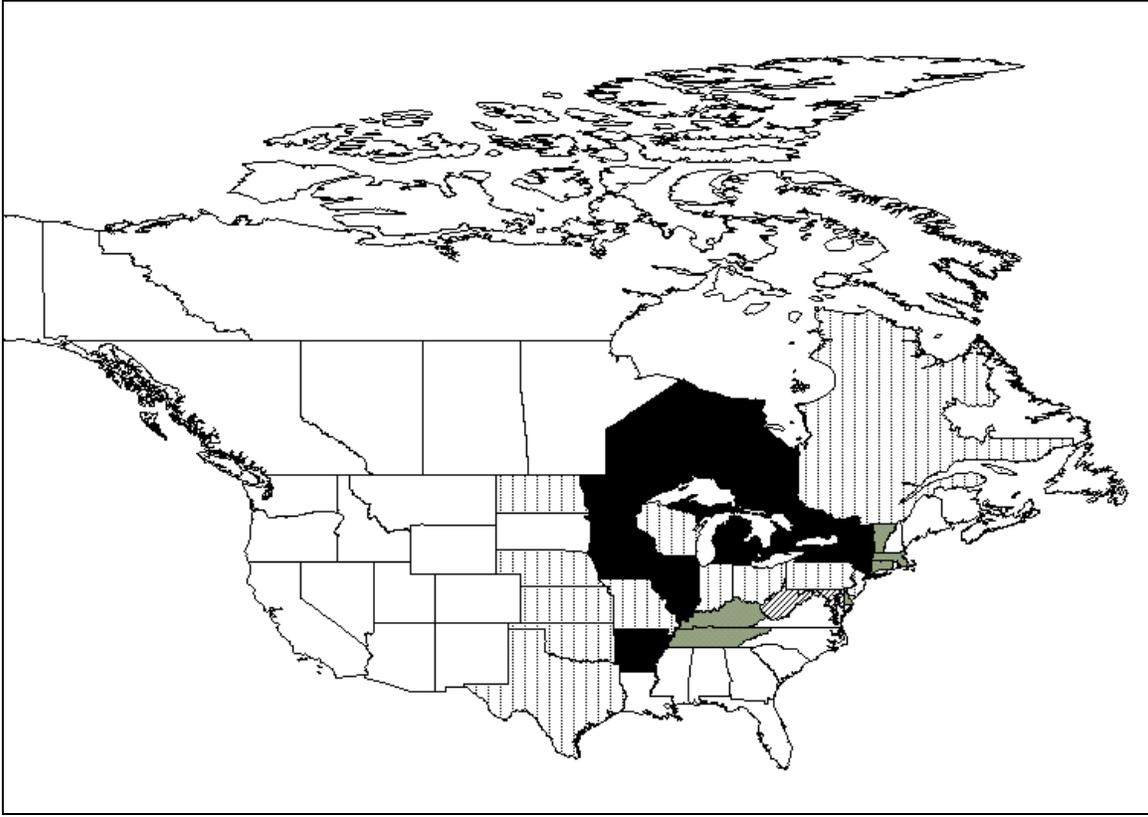
New England is at or near the northeastern limit of the plant's range. This, combined with the alteration of much of its habitat, is the likely cause of its rarity in New England. The species has been reported but not verified from Quebec. It has a global rank of G4, a US national rank of N? and a Canada national rank of N2 (see Appendix 3 for explanations of ranks). In New England, it occurs in Connecticut, where it is ranked S1 and is listed as state endangered; in Massachusetts, where it is also ranked S1 and listed as state endangered; and in Vermont, where it is ranked S1 but is not protected by state law.

### ***Status of All New England Occurrences — Current and Historical***

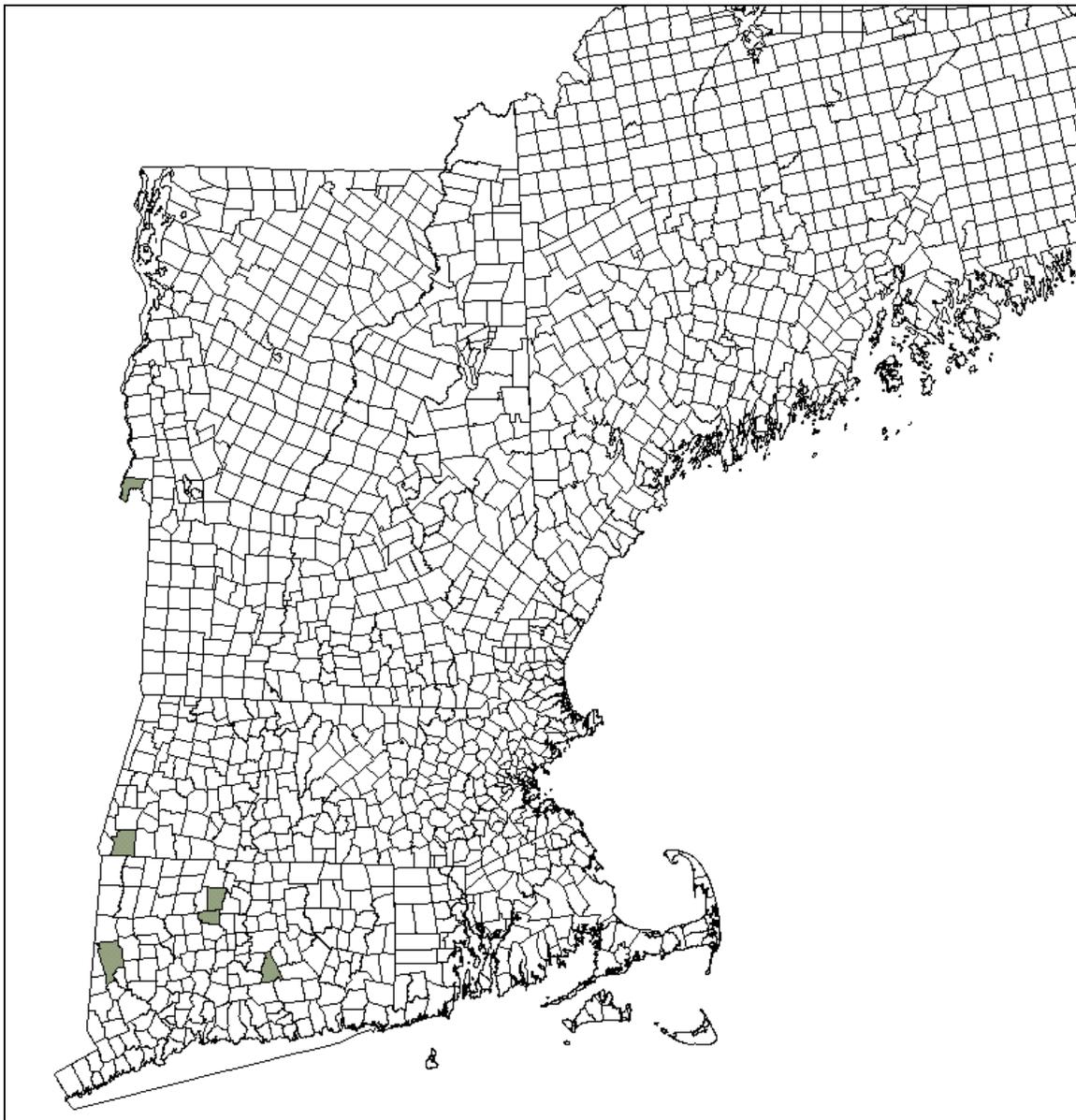
New England has a total of 18 occurrences of Davis' sedge, eight of which are known to be extant. The 18 occurrences are located in Vermont, Massachusetts, and Connecticut. The northernmost is at the southern end of Lake Champlain in Vermont; the southernmost is along the Connecticut River in south-central Connecticut. The plant has never been collected east of the floodplain of the Connecticut River.

Seven of the eight extant occurrences were visited by the author or other botanists in 2002, while the eighth was last seen in 1998. The observation dates for the historic occurrences range from 1824 to 1938. The occurrences are discussed in turn below. In most cases, more detailed information is available from the state Natural Heritage Programs.

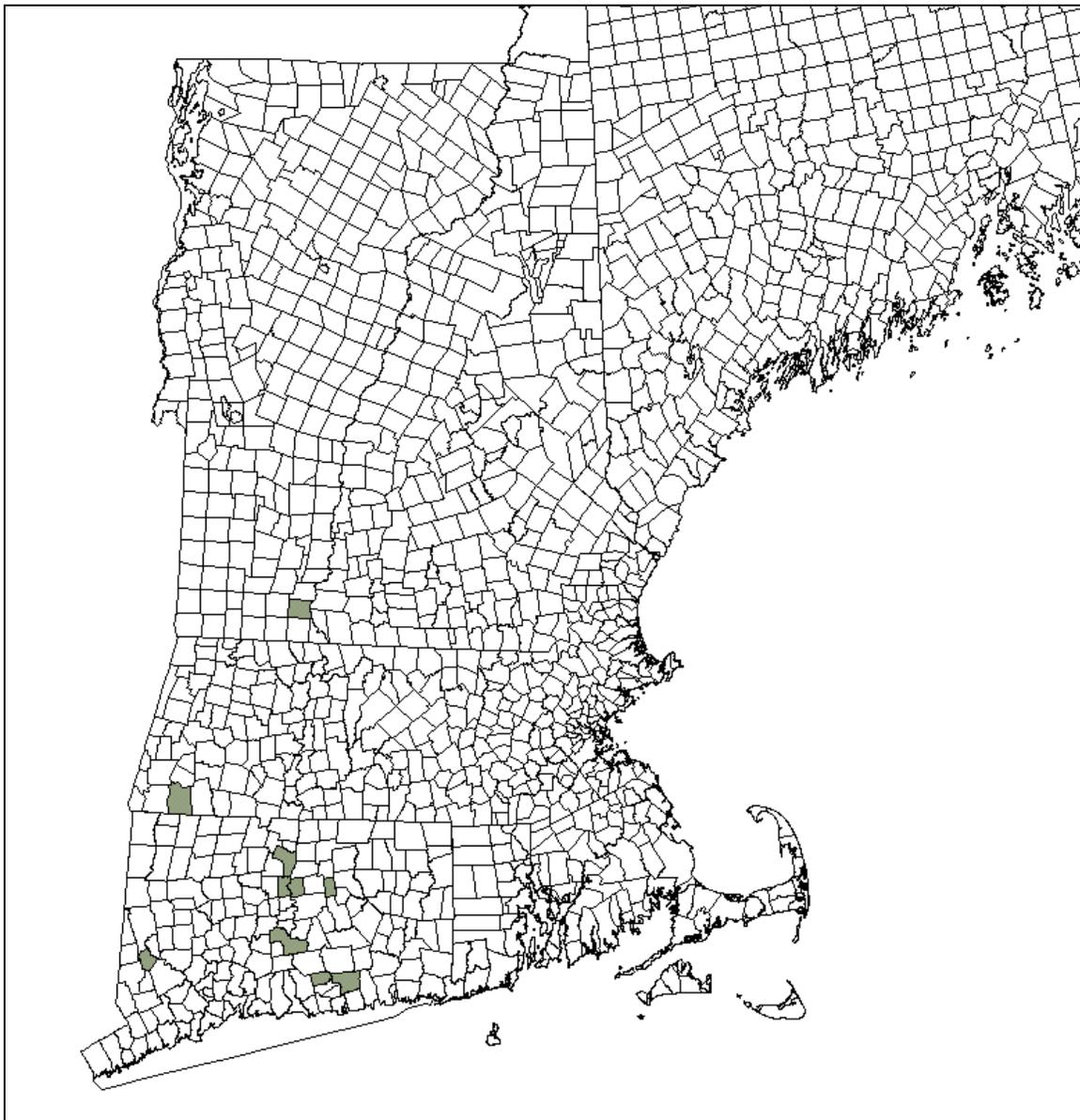
<b>Table 1. Occurrence and status of <i>Carex davisii</i> in the United States and Canada based on information from Natural Heritage Programs.</b>			
<b>OCCURS &amp; LISTED (AS S1, S2, OR T &amp; E)</b>	<b>OCCURS &amp; NOT LISTED (AS S1, S2, OR T &amp; E)</b>	<b>REPORTED BUT STATUS NOT REVIEWED</b>	<b>HISTORIC (LIKELY EXTIRPATED)</b>
Arkansas (S2)	Illinois (S4S5); described as “frequent” by Jones 1963	Indiana (SR)	Maryland (S1, X): Historical, believed to be extirpated, in spite of S1 rank
Connecticut (S1, E): Nine historic occurrences and five extant occurrences	Iowa (S4)	Kansas (SR)	West Virginia (SH)
Delaware (S1)	Kentucky (S?)	Missouri (SR)	
Massachusetts (S1, E): one extant occurrence, one historic occurrence	Michigan (S3, SC)	Nebraska (SR)	
Minnesota (S2, T)	Tennessee Valley Authority (S?)	New Jersey (SR)	
New York (S2, T)		North Dakota (SR)	
Ontario (S2)		Ohio (SR)	
Tennessee (S1, SC)		Oklahoma (SR)	
Vermont (S1): One extant and one historic occurrence		Pennsylvania (SR)	
		Quebec (SR): May not occur in Quebec, reported as “?” by Argus and Pryer 1990	
		Texas (SR)	
		Wisconsin (SR)	



**Figure 1. Occurrences of *Carex davisii* in North America.** States and provinces shaded in gray have one to five (or an unspecified number of) current occurrences of the taxon. States shaded in black have more than five confirmed occurrences. The states with diagonal hatching are designated "historic," where the taxon no longer occurs. States with stippling are ranked "SR" (status "reported" but not necessarily verified). See Appendix 2 for explanation of state ranks.



**Figure 2. Extant occurrences of *Carex davisii* 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. Historical occurrences of *Carex davisii* in New England.** Towns shaded in gray have one to five historical records of the taxon.

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

<b>State</b>	<b>EO #</b>	<b>County</b>	<b>Town</b>
VT	.001	Windham	Brattleboro
<b>VT</b>	<b>.002</b>	<b>Rutland</b>	<b>West Haven</b>
<b>MA</b>	<b>.001</b>	<b>Berkshire</b>	<b>Sheffield</b>
MA	.002	Berkshire	New Marlborough
CT	.001	Hartford	Windsor
CT	.002	Hartford	Hartford
CT	.003	Middlesex	Chester
<b>CT</b>	<b>.004</b>	<b>Middlesex</b>	<b>East Hampton</b>
<b>CT</b>	<b>.005</b>	<b>Litchfield</b>	<b>New Milford</b>
CT	.006	Hartford	East Hartford
CT	.007	Tolland	Bolton
CT	.008	Fairfield	Brookfield
CT	.009	New London	Lyme
CT	.010	Middlesex	Middletown
<b>CT</b>	<b>.012</b>	<b>Litchfield</b>	<b>New Milford</b>
<b>CT</b>	<b>.013</b>	<b>Hartford</b>	<b>Simsbury</b>
<b>CT</b>	<b>.014</b>	<b>Hartford</b>	<b>Simsbury</b>
<b>CT</b>	<b>s.n.</b>	<b>Hartford</b>	<b>Avon</b>

## II. CONSERVATION

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### CONSERVATION OBJECTIVES FOR THE TAXON IN NEW ENGLAND

The 20-year conservation objective for Davis' sedge in New England is to secure long-term protection and appropriate management for no fewer than 15 populations or metapopulations of 50 genetic individuals (as estimated by number of clumps) each, geographically distributed in all counties, in all watersheds, and on all watercourses where the plant has historically been found. These watercourses include 1) the Connecticut River and its tributaries the Farmington River and "Sumner's Creek" (an historic name); 2) the Housatonic River and its tributaries the Konkapot River and Still River; and 3) the Poultney River. It is recognized that this 20-year goal does not necessarily secure the long-term viability of *Carex davisii* in the region, partly because populations of 50 individuals are too small (see below) to be viable and partly because 15 is a modest number of populations for the region.

I therefore articulate a more long-term vision. The 100-year conservation objective is to ensure that all 15 populations or metapopulations are viable and will persist long-term. This will require an increase in the number of genets at most sites to a minimum of 500.

These goals may seem ambitious in light of the fact that only eight extant occurrences of the plant are known, but they are modest in light of the historic distribution of the plant, the vulnerability of its natural habitat, and the unknown impacts of competition, herbivory, succession, and climate change on the viability of each population.

Because of the unknowns, each population must be large enough to absorb impacts and maintain genetic variability. Much effort has been devoted to determining minimum viable population size (MVP) – the smallest number of individuals necessary for long term persistence in the face of genetic, demographic, and ecological complications. Estimates vary widely, and most authors acknowledge that the MVP will vary from species to species. Minimum viable population size estimates for plants range from 50-500 for genetic factors, 50-100 or more for demographic factors, and 1,000 to 1,000,000 or more for environmental factors (Shaffer 1987, Menges 1991, Given 1994). For the purposes of this plan, we will define a viable population or metapopulation as one that has at least 500 genetic individuals. This estimate is based in part on the size of known populations in New England that appear to be healthy. Four extant populations are in this size range.

Attaining the 20-year goal of securing protection for 15 populations will require re-verifying historic populations, finding new populations, reintroducing the plant to historical localities where it no longer occurs, and working with landowners to secure protection and appropriate management.

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## **IV. APPENDICES**

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### **1. Herbarium Abbreviations**

### **2. An Explanation of Conservation Ranks Used by The Nature Conservancy and NatureServe**

## **1. Herbarium Abbreviations**

NCBS – Connecticut Botanical Society

MO – Missouri Botanical Garden, St. Louis, Missouri

CONN – Torrey Herbarium, University of Connecticut, Storrs, Connecticut

YU – Yale University Herbarium, New Haven, Connecticut

## 2. An Explanation of Conservation Ranks Used by The Nature Conservancy and Natureserve

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.