

# THE SEDGE (*CAREX*) FLORA OF OHIO FENS

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*Abstract.* Sedges (*Carex*) represent one of the most important and yet overlooked elements of the flora of fens. Herbarium specimens were examined at various institutions throughout Ohio, and field surveys were conducted at the majority of known fens in the state in 1990-1993. Based on these surveys, twenty-two species of sedges were deemed characteristic of Ohio fens. The occurrence of these twenty-two species was documented at twenty-seven of the most intact fens in Ohio. Maps were prepared recording known occurrences of these species in Ohio. The floristic affinities of the twenty-two Ohio fen sedges was determined based on state-wide and North American distribution as well as on occurrence in wetlands other than fens in Ohio. Ohio fens contain sedges of boreal as well as prairie affinity. Some species are obligate calciphiles which only occur in calcareous fens or on exposed limestone or dolomite bedrock.

## INTRODUCTION

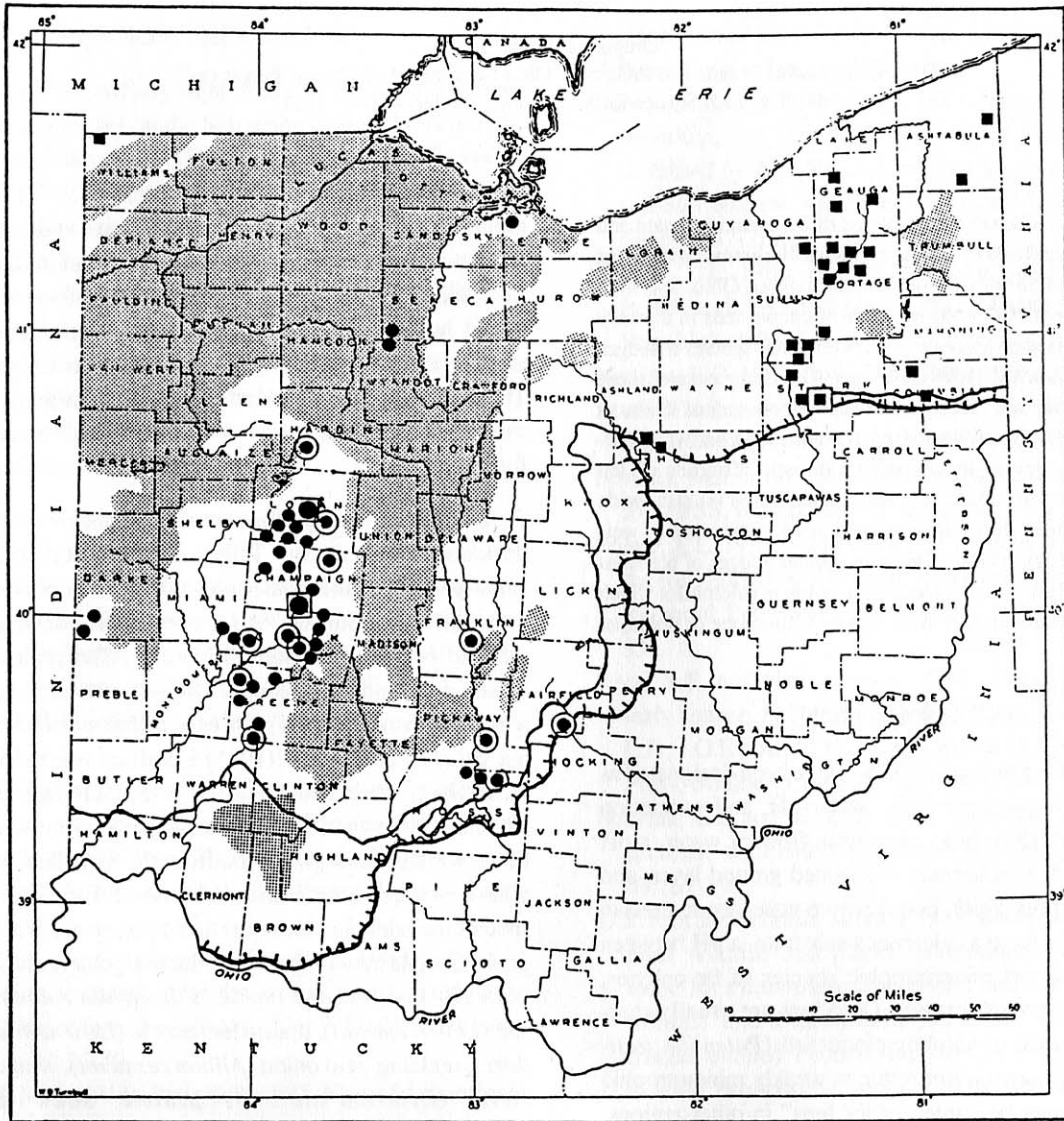
Peat-accumulating wetlands in Ohio have been designated as bog or fen based on hydrology, water pH, and vegetation (Andreas 1985). Ohio bogs have little flow of water, a pH between 3.5-5.5, a *Sphagnum* dominated ground layer, and an ericaceous shrub layer. Fens receive water from artesian springs or seeps, have a calcareous substrate, a pH between 5.5-8.0, and support minerotrophic species of bryophytes, sedges, composites and grasses. Ohio fens are usually characterized by a zone of shrubby cinquefoil (*Potentilla fruticosa*). Ohio bogs are ombrotrophic to weakly minerotrophic peatlands and may be named "poor fens" in other regions. Ohio fens are strongly minerotrophic wetlands, and may be designated "rich fens" in other regions. Of the 114 peatlands listed by Andreas (1985), 58 were considered fens and 56 were bogs. Of these peatlands, 39 fens and 27 bogs are still in existence.

Throughout North America, rich fens can be placed into two major groups based on floristic affinities and geography (Schneider 1992). Prairie fens occur mostly in the midwestern United States, generally north of the southern limit of Pleistocene glaciation and south of the boreal tension zone which passes through Minnesota, Wisconsin, southern Michigan, and southern Ontario. Most of these fens occur in Ohio, southern Michigan, southern Ontario, northern Illinois and Indiana, southeastern Wisconsin, northern Iowa, as well as in south-central and northwestern Minnesota. Prairie fens are also in the unglaciated Ozark Mountains of Missouri. Much of the area where these fens occur corresponds to the

tallgrass prairie region of North America and prairie fens share many plant species with seasonally wet, tallgrass prairies. Boreal fens occur to the north of the tension zone in the boreal forest regions of northern Minnesota and Michigan, as well as in Canada and the northeastern United States. These fens have many plant species with northern distributions and share species with northern coniferous, swamp forests.

Ohio lies to the south of the boreal tension zone in the eastern deciduous forest region. Tallgrass prairie occurred only in small pockets in the western half of Ohio in pre-settlement times. In Ohio, Stuckey and Denny (1981) designated and mapped two types of fens (Figure 1). The prairie fens of west-central and south-central Ohio share a number of plant species with the tallgrass prairies of midwestern North America. Stuckey and Denny (1981) identified twenty plant species which were designated as the southeastern prairie element. These species also occur in wet prairies south of the limit of Pleistocene glaciation from the Appalachian Mountains westward to the Ozarks in Missouri. Examples of these species include: big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), Riddell's goldenrod (*Solidago riddellii*), queen-of-the-prairie (*Filipendula rubra*), blazing star (*Liatris spicata*), prairie loosestrife (*Lysimachia quadriflora*), nodding wild onion (*Allium cernuum*), winged loosestrife (*Lythrum alatum*), prairie dock (*Silphium terebinthinaceum*), whorled rosinweed (*Silphium trifoliatum*) and low nut-rush (*Scleria verticillata*).

The fens of northeastern Ohio, which Stuckey and Denny (1981) called "bog fens," share species with Ohio bogs and with the fens north of the boreal tension zone. Many of these species have northern distributions, but also occur in the Appalachian Mountains and on the Atlantic Coastal Plain. Some characteristic northeastern Ohio fen species are: swamp birch (*Betula pumila*), pitcher plant (*Sarracenia purpurea*), speckled alder (*Alnus rugosa*), tamarack (*Larix laricina*), poison sumac (*Toxicodendron vernix*), cranberry (*Vaccinium macrocarpon*), alder-leaved buckthorn (*Rhamnus alnifolia*), hoary willow (*Salix candida*), green cottongrass (*Eriophorum viridi-carinatum*) and white beak-rush (*Rhynchospora alba*). These fens also contain some species more typical of prairies and are floristically transitional be-



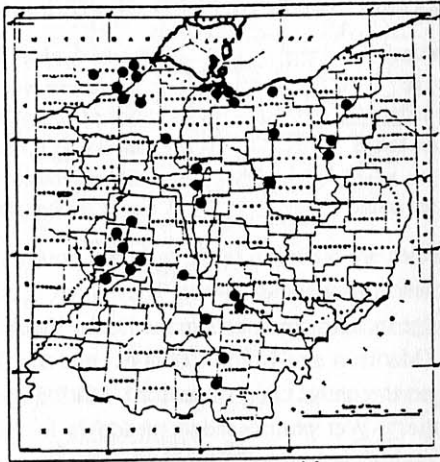
**Figure 1. Distribution of fens in Ohio, modified with additional locations from Stuckey and Denny (1981). Dots, extant prairie fens; dots with circles, destroyed prairie fens; squares, extant bog fens; squares with circles, destroyed bog fens; solid line, maximum extent of Wisconsin glaci- ation; hashured line, maximum extent of continental Pleistocene glaci- ation; shaded area, maximum relief less than 100 feet.**

tween the prairie fens of the midwest and the boreal fens of the north.

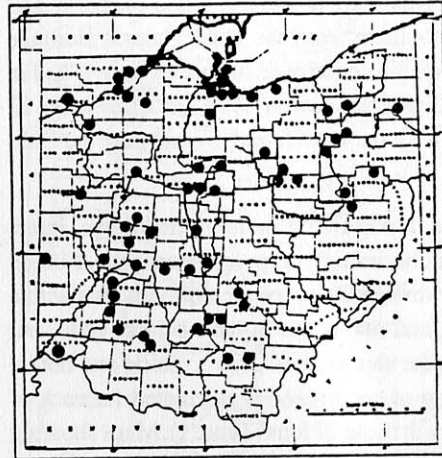
Many species which occur in fens in Ohio are also present in sedge meadows in the Oak Openings of Fulton, Henry, Lucas and Wood Counties of northwestern Ohio. The Oak Openings is an area characterized by sand deposits from preglacial Lake Warren underlain by limestone bedrock. Sedge meadows occur in areas where the water table is close to the surface creating a permanently saturated, calcareous substrate.

Despite the fact that sedges (*Carex*) are among the dominant plant species in fens, little has appeared in print to characterize this aspect of Ohio's flora. Since Stuckey and Denny

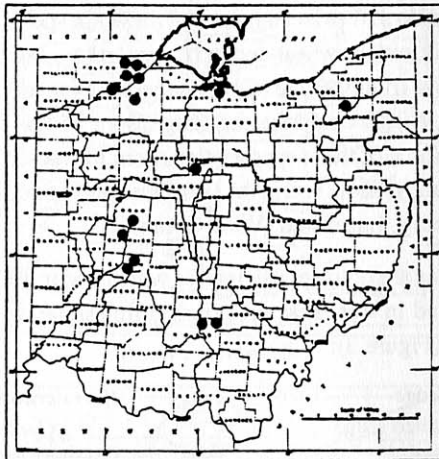
(1981) did their field work in late summer and did not include the early-flowering sedges (*Carex*) in their floristic study, no comprehensive survey of the Ohio fen sedge flora had ever been compiled. Most sedges which typically occur in Ohio fens were underreported in Braun's *Monocotyledoneae* [of Ohio] 1967, reflecting the lack of sedge collections from Ohio fens. Many species which occur in these alkaline peatlands, including sedges, have narrow ecological tolerances and are restricted to fens or other highly alkaline habitats in the midwestern part of their ranges. These species may be rare or endangered in many regions as a result of widespread habitat destruction.



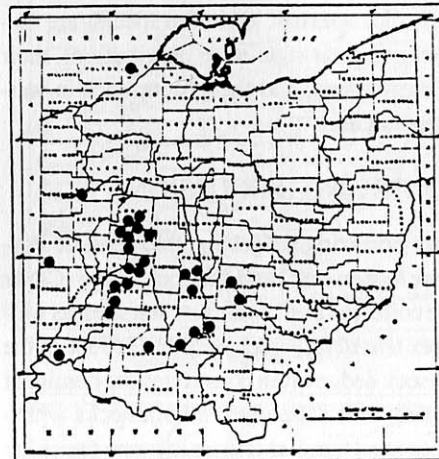
*Carex buxbaumii*



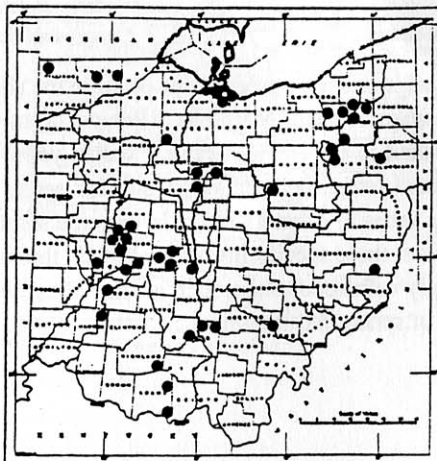
*Carex pellita*



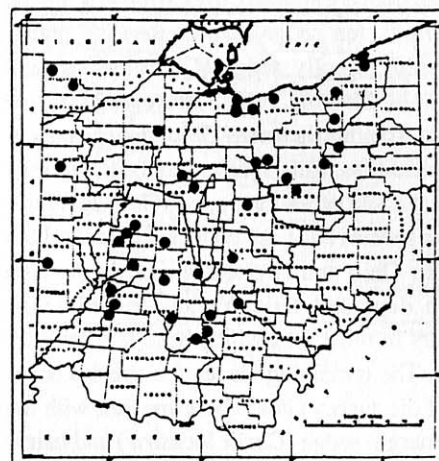
*Carex sartwellii*



*Carex suberecta*



*Carex tetanica*



*Carex trichocarpa*

Figure 2. Species of prairie affinity.



## OBJECTIVES AND METHODS

This study determines which species of sedges are characteristic of Ohio fens. Surveys were conducted during the 1990-93 field seasons at the majority of known fen sites. Specimens were examined at several Ohio herbaria and information was obtained from the Ohio Natural Heritage Data Base. Based on the occurrence of species in fens and in other highly calcareous habitats in Ohio and elsewhere, 22 species of the genus *Carex* were found to constitute the Ohio fen sedge flora.

Twenty-seven fens, representing most of the known, intact fens in Ohio, were chosen for comparative analysis. Fifteen are prairie fens in western Ohio, ten are northern fens with a more boreal flora, and two occur in west-central Ohio, but appear to combine the elements of Ohio's prairie and boreal fens. The frequency of occurrence is calculated for each of the 22 sedge species in these 27 fens (Table 1). Maps showing the distribution of each species in Ohio were prepared to aid in the analysis of geographic distributions and affinities (Figures 2-5). These characteristic Ohio fen species are discussed in relationship to their state-wide distributions, their North American distributions, and their occurrence in wetlands other than fens in Ohio.

## RESULTS AND DISCUSSION

The most frequently occurring sedges in Ohio fens are Porcupine sedge (*Carex hystericina*) and Tussock sedge (*Carex stricta*) which were collected at all twenty-seven sites, as well as rigid sedge (*Carex tetanica*), which occurred at 93% of the sites (Table 1). Tussock sedge often constitutes the dominant ground cover of many fens. The uneven hummocks which this species produces are a familiar feature in many fen sedge meadows. Other species which occur in the majority of Ohio's fens include: delicate sedge (*Carex leptalea*), inland sedge (*Carex interior*), fen sedge (*Carex sterilis*), prairie sedge (*Carex prairea*), woolly sedge (*Carex pellita*) and brown sedge (*Carex buxbaumii*). Prairie straw sedge (*Carex suberecta*) is absent from northeastern Ohio, but does occur in 13 of the 17 prairie fens. This species has been reported only once in Ohio at a site other than a fen (Oak Openings, Lucas County). The species has been collected in several fen remnants in western Ohio and is often one of the last fen species present in degraded fens. Yellow-fruited sedge (*Carex flava*) occurs in most fens which have fast moving, spring-fed streams. The remaining eleven fen species occur in less than 40% of the survey sites. These species, with the exception of lake-margin sedge (*Carex lacustris*) and hairy-fruited sedge (*Carex trichocarpa*), are rare in Ohio.

Curtis (1959) considered fens to be a "hybrid community" which combines northern, atlantic coastal plain and prairie

floristic elements. The twenty-two sedge species were placed into categories based on their occurrence in wetlands other than fens in Ohio and throughout North America in order to determine their floristic affinities.

Six species have a distinctive prairie affinity (Figure 2):

Brown's sedge	<i>Carex buxbaumii</i> Wahlenb.
Woolly sedge	<i>Carex pellita</i> Muhl.
Sartwell's sedge	<i>Carex sartwellii</i> Dewey
Prairie straw sedge	<i>Carex suberecta</i> (Olney) Britt.
Rigid sedge	<i>Carex tetanica</i> Schkuhr
Hairy-fruited sedge	<i>Carex trichocarpa</i> Muhl.

These species are common in the tallgrass prairie region of North America (Schneider 1992). They often occur in wet prairie sedge meadow remnants in the Darby Plains of western Ohio (Madison and Union Counties) and the Sandusky Plains of north-central Ohio (Crawford, Marion and Wyandot Counties). Wet prairie sedge meadows in the former tallgrass prairie regions of Ohio have almost completely disappeared. However, recent surveys of the few, small remnants that do still exist suggest that these six species, as well as tussock sedge, wheat sedge (*Carex atherodes* Sprengel) and yellow-fruited sedge (*Carex annectens* var. *xanthocarpa* (Bickn.) Wieg.) comprise the sedge flora of this imperiled habitat. Some of these species also occur in wet sedge meadows on sandy, peaty soil in the Oak Openings of northwestern Ohio (Henry, Lucas and Wood Counties).

Six species are obligate calciphiles which occur in Ohio only in fens and in wet areas on exposed limestone or dolomite bedrock (Figure 3):

Crawe's sedge	<i>Carex crawei</i> Dewey
Yellow-fruited sedge	<i>Carex flava</i> L.
Inland sedge	<i>Carex interior</i> Bailey
Delicate sedge	<i>Carex leptalea</i> Wahlenb.
Fen sedge	<i>Carex sterilis</i> Willd.
Little green sedge	<i>Carex viridula</i> Michx.

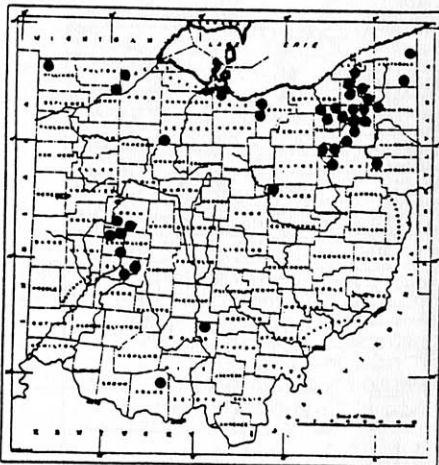
Crawe's sedge and little green sedge occur in the abandoned limestone quarries on the Marblehead Peninsula and adjacent Kelleys Island in Lake Erie. Crawe's sedge, yellow-fruited sedge, inland sedge, delicate sedge and fen sedge grow in calcareous seeps in Adams County of extreme south-central Ohio. In fens, these species invariably inhabit the most open and strongly calcareous sites, such as marl flats, seeps, and the edges of spring-fed streams.



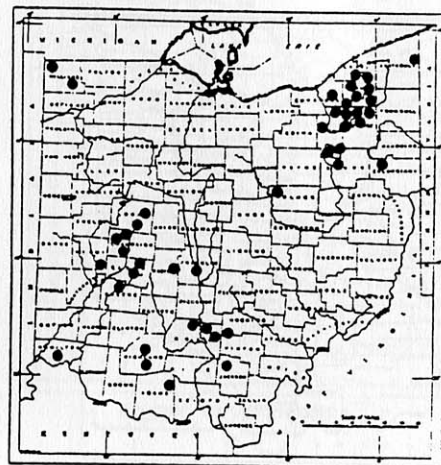
*Carex crawei*



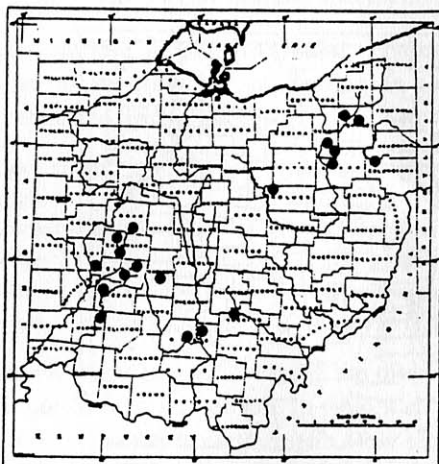
*Carex flava*



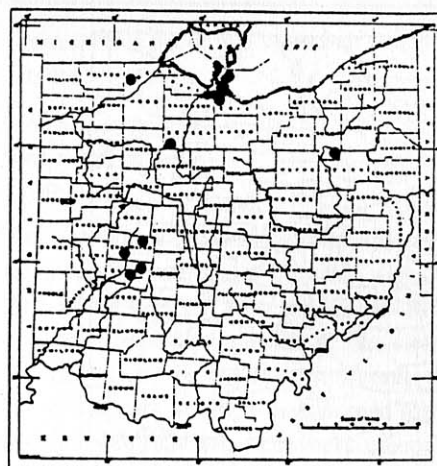
*Carex interior*



*Carex leptalea*



*Carex sterilis*



*Carex viridula*

Figure 3. Species of fens and calcareous bedrock.



*Carex aquatilis*



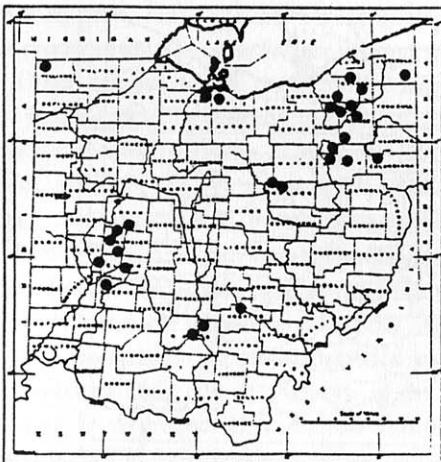
*Carex bebbii*



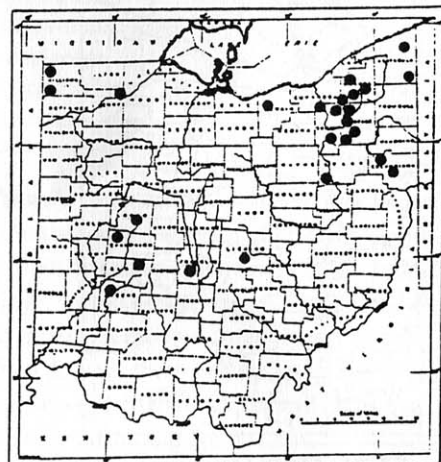
*Carex diandra*



*Carex lasiocarpa*



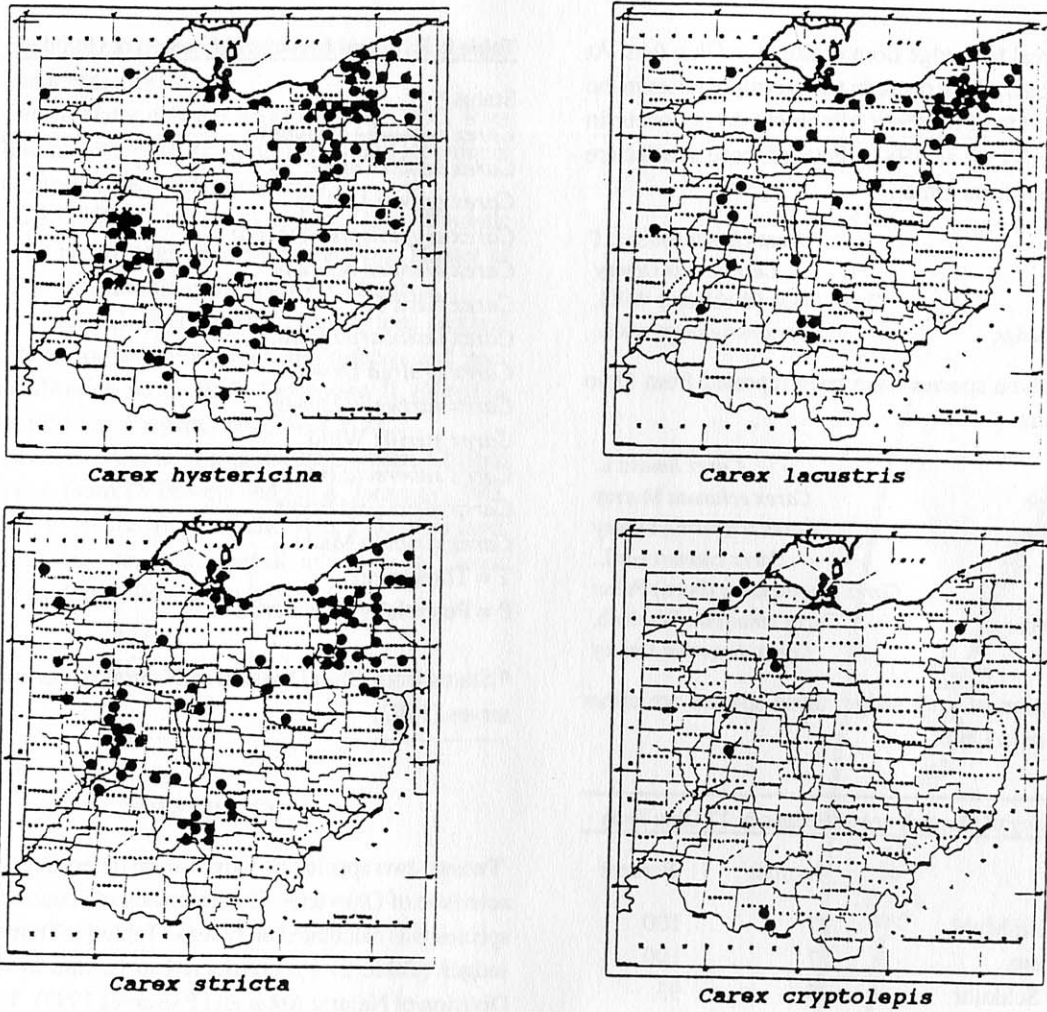
*Carex prairea*



*Carex utriculata*

Figure 4. Fen species abundant in a variety of wetlands north of Ohio.





**Figure 5. Three widespread wetland species and *Carex cryptolepis*.**

Six species are rare in Ohio and mostly confined to the northern part of the state, but are abundant in a variety of wetland habitats to the north (Figure 4):

Leafy tussock sedge	<i>Carex aquatilis</i> Wahlenb.
Bebb's sedge	<i>Carex bebbii</i> Olney
Lesser panicled sedge	<i>Carex diandra</i> Schrank
Slender sedge	<i>Carex lasiocarpa</i> Ehrh.
Prairie sedge	<i>Carex prairea</i> Dewey
Beaked sedge	<i>Carex utriculata</i> Boott

Leafy tussock sedge and slender sedge are often dominant species in boreal fens, but are rare in Ohio. Leafy tussock sedge occurs in one fen in northwestern Ohio and in a few Lake Erie coastal marshes. Slender sedge occurs in some fens and bogs, but is never a dominant species. It also occurs in sedge meadows in the Oak Openings of northwestern Ohio. Bebb's sedge, lesser panicled sedge, prairie sedge and beaked sedge sometimes inhabit Ohio bogs, as well as fens. These six species represent the boreal element which is more characteristic of northern Ohio fens.

Three species occur in a variety of wetland habitats in Ohio (Figure 5):

Porcupine sedge	<i>Carex hystericina</i> Muhl.
Lake-margin sedge	<i>Carex lacustris</i> Willd.
Tussock sedge	<i>Carex stricta</i> Lam.

These species are extremely abundant in Ohio, but mostly in the glaciated portions of the state. One additional species, little yellow sedge (*Carex cryptolepis* Mackenz.), regularly occurs on sandy, somewhat acidic sites (Crins and Ball 1989). The species is known from only three fens in Ohio, but also occurs in sedge meadows in the Oak Openings. It has also been collected in calcareous seeps in Adams County.

Much of the boreal fen sedge flora is absent in Ohio fens. At least eleven species which occur in minerotrophic sites in the Red Lake Peatlands of northern Minnesota do not occur in Ohio fens (Wheeler et. al. 1983). Four of these species are completely absent from Ohio:

Creeping sedge	<i>Carex chordorrhiza</i> L.f
Meager sedge	<i>Carex exilis</i> Dewey
Pale sedge	<i>Carex livida</i> (Wahlenb.) Willd.
Smaller bearded sedge	<i>Carex pseudocyperus</i> L.

An additional seven species have been reported from Ohio bogs, but not fens:

Mud sedge	<i>Carex limosa</i> L.
Little prickly sedge	<i>Carex echinata</i> Murray
Three-seeded sedge	<i>Carex trisperma</i> Dewey
Grey sedge	<i>Carex canescens</i> L.
Brownish sedge	<i>Carex brunnescens</i> (Pers.) Poiret
Thin-flowered sedge	<i>Carex tenuifolia</i> Wahlenb.
Two-seeded sedge	<i>Carex disperma</i> Dewey

With the exception of grey sedge, these species are either extirpated or rare in Ohio.

**Table 1. Frequency of Occurrence of Sedges in 27 Ohio Fens**

Species	Number	Percent
<i>Carex hystericina</i> Muhl.	27	100
<i>Carex stricta</i> Lam.	27	100
<i>Carex tetanica</i> Schkuhr.	25	93
<i>Carex leptalea</i> Wahlenb.	21	78
<i>Carex interior</i> Bailey	20	74
<i>Carex sterilis</i> Willd.	18	67
<i>Carex prairea</i> Dewey	17	63
<i>Carex pellita</i> Muhl.	17	63
<i>Carex buxbaumii</i> Wahlenb.	15	56
<i>Carex flava</i> L.	13	48
<i>Carex suberecta</i> (Olney) Britt.	13	48
<i>Carex lacustris</i> Willd.	10	37
<i>Carex sartwellii</i> Dewey	9	33
<i>Carex utriculata</i> Boott	8	30
<i>Carex viridula</i> Michx.	7	26
<i>Carex trichocarpa</i> Muhl.	6	22
<i>Carex lasiocarpa</i> Ehrh.	5	19
<i>Carex diandra</i> Schrank	5	19
<i>Carex crawei</i> Dewey	4	15
<i>Carex cryptolepis</i> Mackenz.	4	15
<i>Carex bebbii</i> Olney	4	15
<i>Carex aquatilis</i> Wahlenb.	1	4

**Table 2. Rare and Endangered Sedges of Ohio Fens**

Status *		
	<i>Carex aquatilis</i> Wahlenb.	T
	<i>Carex bebbii</i> Olney.	T
	<i>Carex crawei</i> Dewey	P
	<i>Carex cryptolepis</i> Mackenz.	P
	<i>Carex diandra</i> Schrank	P
	<i>Carex flava</i> L.	P
	<i>Carex lasiocarpa</i> Ehrh.	T
	<i>Carex prairea</i> Dewey	P
	<i>Carex sartwellii</i> Dewey	T
	<i>Carex sterilis</i> Willd.	P
	<i>Carex suberecta</i> (Olney) Britt.	P
	<i>Carex utriculata</i> Boott	P
	<i>Carex viridula</i> Michx.	P
	T = Threatened	
	P = Potentially Threatened	

\* Status from Ohio Division of Natural Areas and Preserves (1992)

## SUMMARY

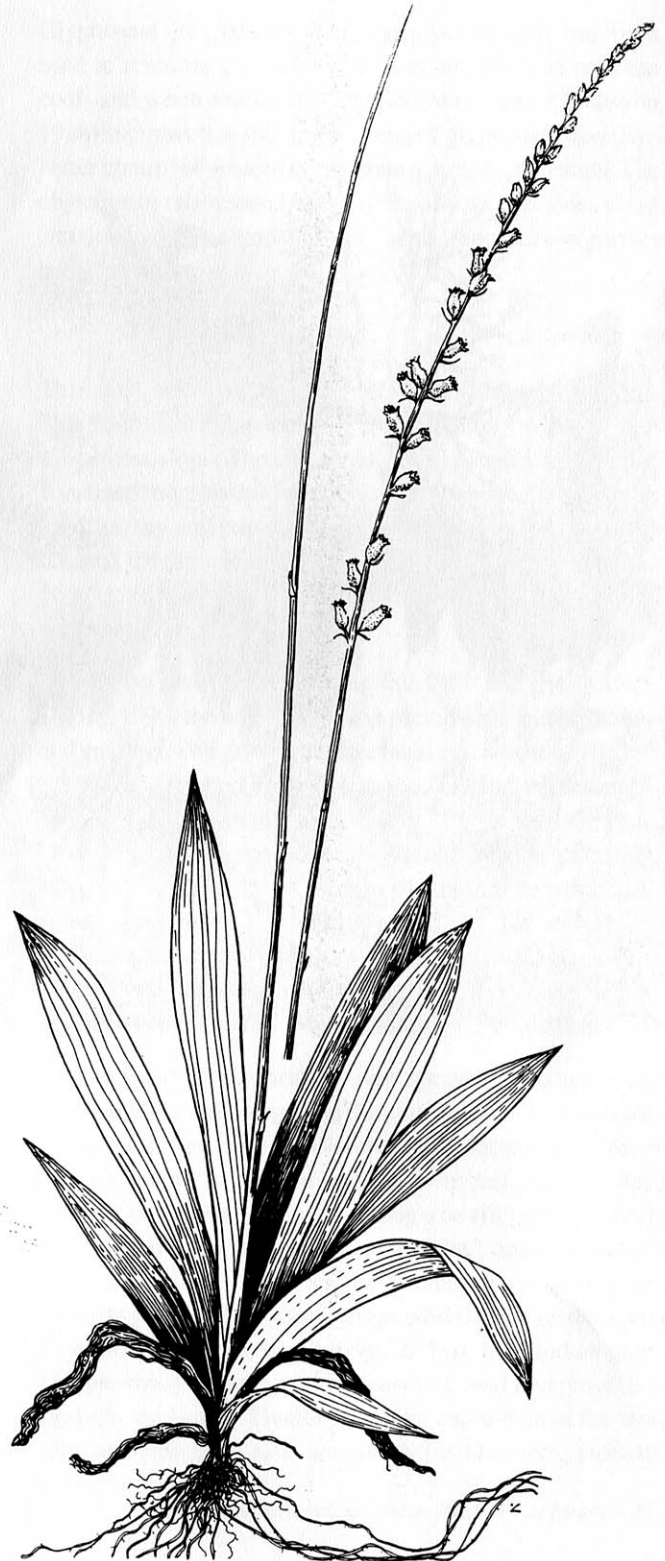
Twenty-two species of sedges were determined to be characteristic of Ohio fens. The frequency of occurrence of these species was calculated at 27 fens (Table 1). Thirteen of these sedges (Table 2) are considered to be rare in Ohio (Ohio Division of Natural Areas and Preserves 1992). The Ohio fen sedge flora has a distinctive prairie element which is more pronounced in fens in the western part of the state. These species of prairie affinity typically grow in the sedge meadow portion of fens. Six species are obligate calciphiles which typically grow in open, marly sites in fens, such as seeps, marl flats and streamlets. Ohio fens also have a boreal sedge flora which is best represented in the northeastern part of the state. However, much of the boreal sedge flora of North America is absent from Ohio fens.

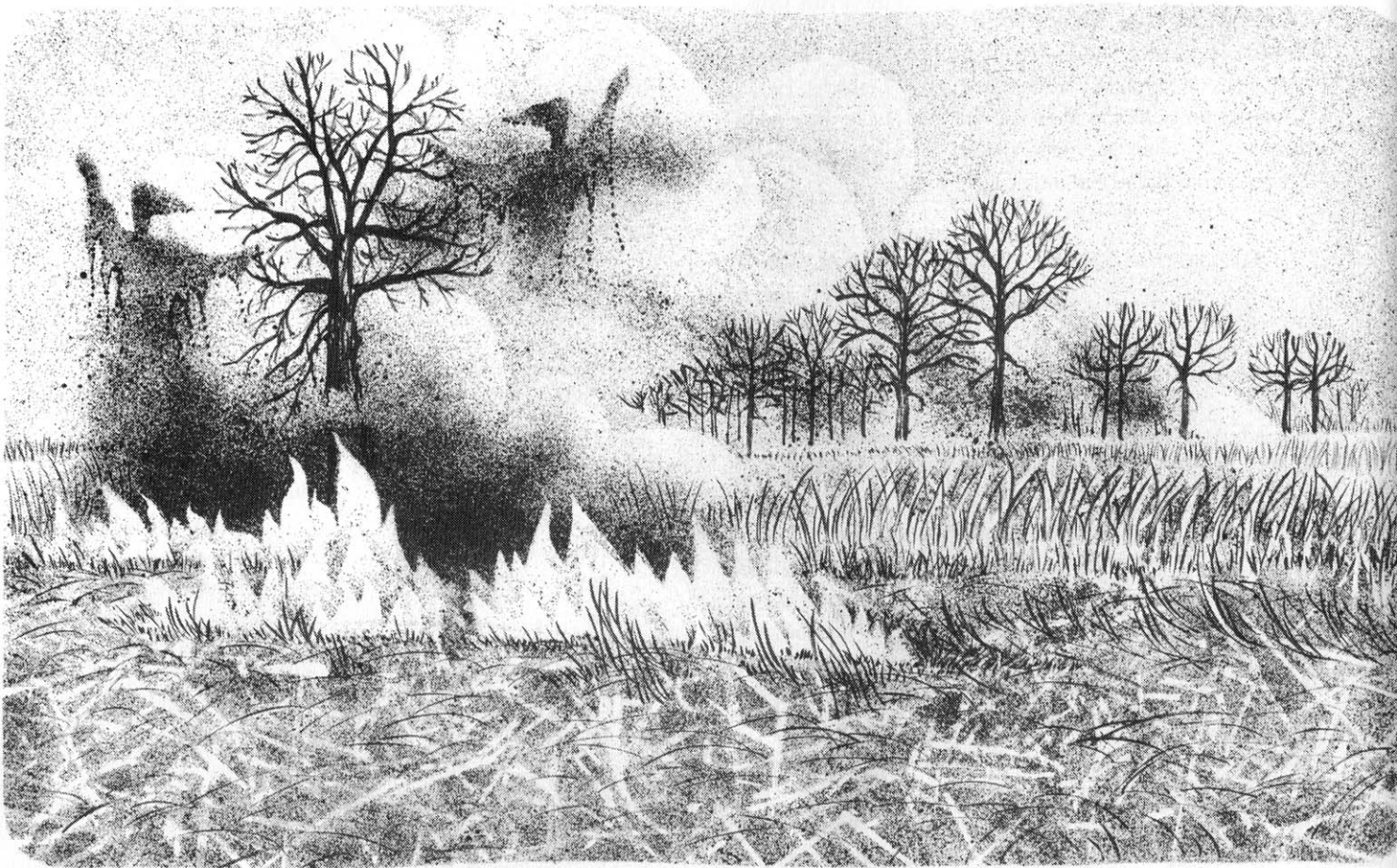
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Thomas H. Stettin '94