

## Vascular Flora of Brayton-Horsley Prairie: A Remnant Prairie and Spring Fen Complex in Eastern Iowa

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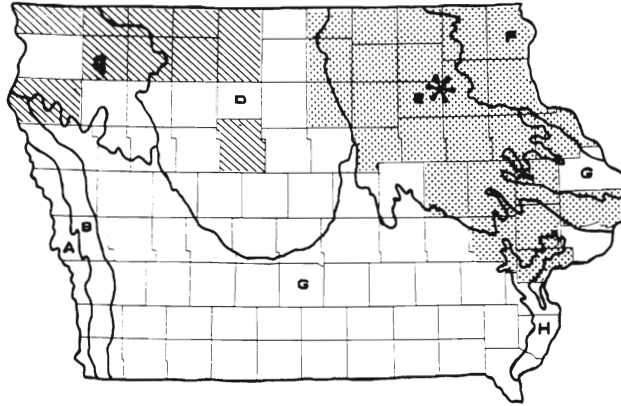
### ABSTRACT

The Brayton-Horsley Prairie is a 14-hectare prairie and spring fen complex in Bremer County, east-central Iowa. Three community types are found at this site, including mesic prairie, wet prairie, and spring fen. Of the 192 native vascular plant species found at this site, 35 are considered rare within the Iowan Erosional Surface. Nine are considered endangered or threatened in the state in the 1986 publication of Roosa et al. The spring fen community was found to harbor most of these rare taxa. Fens are one of the most important habitats in eastern Iowa for rare plant and animal populations, and should be protected to help preserve regional biodiversity.

### INTRODUCTION

At time of settlement Iowa was covered by over 30 million acres of tallgrass prairie, accounting for approximately 85% of the state's surface (Dick-Peddie 1953). Prairie not only occurred in mesic areas with productive soils and shallow relief, but also on steep morainal ridges, sand dunes, exposed limestone slopes, low areas along rivers, and poorly drained glacial regions. A continuum of prairie plant communities, controlled primarily by topographic position and soil permeability, exists in this landscape (White and Glenn-Lewin 1984), with xeric prairie occupying the driest areas, wet prairies occupying the most saturated, and mesic prairies existing in between. The continuum of tallgrass prairie habitats was well developed in the swell and swale topography (*sensu* Betz 1972) of the Iowan Erosional Surface (Prior 1976), which extends over 30 counties of northeastern Iowa (Figure 1). The gently rolling land surface, with scattered loess, sand, or gravel-topped paha ridges, allowed development of xeric, mesic, and wet prairies. Some plant communities within this landscape with unusual soil or microclimate characteristics are quite different from those along the main continuum. White and Glenn-Lewin (1984) documented this for sand prairie communities. However, other unusual habitats also occur. The exposure of groundwater-bearing, upland gravels during late-Pleistocene and Holocene erosion allowed for formation of peat in scattered, spring-fed habitats in northeastern Iowa. These plant communities differ greatly from those of the main prairie continuum. Sites such as these are considered spring fens.

Spring fens are peatland areas created by the local release of slightly to strongly minerotrophic groundwater, typically possessing a pH between 5.5 and 8.0 (Moore and Bellamy 1974, Succow and Lange 1984). In the central



Major landform regions of Iowa which affect the distribution of plants. (After Prior 1976.)

- A = Missouri River Alluvial Plain
- B = Loess Hills
- C = Northwest Iowa Drift Plain
- D = Des Moines Lobe
- E = Iowan Erosional Surface
- F = Paleozoic Plateau  
("Driftless Area")
- G = Southern Iowa Drift Plan
- H = Mississippi River Alluvial Plain

Counties containing fen habitats (from Nekola 1988b), Nekola (personal observation), and Lammers (personal observation).)




-  = within historically documented Iowa range
-  = outside historically documented Iowa range
-  = location of Brayton-Horsley Prairie

Figure 1. Major landform regions of Iowa with distribution of fen habitats.

United States, spring fens harbor plant communities dominated by graminoids (particularly Cyperaceae), forbs (especially Asteraceae), and scattered shrubs (predominantly *Salix* spp.). They also contain a significant number of species which, in the Upper Midwest, are confined to these communities.

In Iowa, spring fens were long considered restricted to the northwestern counties, where several highly minerotrophic examples are known (Cratty 1903, Wolden 1926, Carter 1939, Anderson 1943, Hayden 1943, Conard 1952a, Thorne 1952, Holte and Thorne 1962, Holte 1966, van der Valk 1975, Lammers and van der Valk 1979, and Moats 1981). Early geologic surveys (White 1870, Calvin 1897, Calvin 1902) also noted the presence of similar habitats on the Iowan Erosional Surface. Some of these sites were known to botanists, and often referred to as "marshes," "seeps," "wet prairies," "sedge meadows," "sloughs," "bogs," "hillside bogs," "boggy prairie" or other similar terms

(e.g. Rickey 1964, Roosa and Eilers 1978, and Roosa et al 1986). Field observations since 1984 by J.C. Nekola have identified spring fen communities from the Iowan Erosional Surface, Southern Iowa Drift Plain, and Paleozoic Plateau (Prior 1976) in 25 counties of northern and northeastern Iowa, outside of their typically-documented western Iowa distribution (Figure 1).

In Iowa, spring fens occur as small pockets of saturated soils within otherwise dry to mesic tallgrass prairie. Prior to settlement in the 1850s, spring fens covered less than 0.5% of the Iowa landscape (unpublished data compiled by J.C. Nekola from County Soil Maps of the USDA Soil Conservation Service). Spring fens, and the organisms restricted to them, were thus very rare even before European settlement destroyed 99.98% of Iowa's tallgrass prairie (Smith 1981). A century and a half later, preliminary estimates based on complete inventories in four counties (with a sample size of over 400 potential sites) suggest that more than 95% of original Iowan Erosional Surface spring fens have lost most, if not all, of their inherent biological diversity from draining, grazing, and other human disturbances (Nekola unpub. data). Despite the small contribution of fens to the past and present landscape of eastern Iowa, approximately 17% of the species listed as endangered, threatened, or of special concern in Iowa by Roosa et al (1986) have been observed growing in these habitats (Nekola, pers. observ.). Spring fens thus contribute more to biological diversity in Iowa than would be expected simply from their amount of habitat alone.

A number of the species found in these fen habitats are quite rare in the state. Some, including *Carex prairea* (Fen Sedge), *Gentianopsis procera* (Small-fringed Gentian), *Lobelia kalmii* (Kalm's Lobelia), *Menyanthes trifoliata* (Buckbean), *Parnassia glauca* (Grass-of-Parnassis), *Platanthera hyperborea* (Northern Green Orchid) and *Salix pedicellaris* (Bog Willow) had not been documented from eastern Iowa in over 50 years (Eilers 1971, Niemann 1975). Others, like *Rhynchospora capillacea* (Beaked Rush), *Scleria verticillata* (Nut Sedge), and *Triglochin maritima* (Bog Arrow Grass) were considered restricted to western Iowa (Roosa and Eilers 1978, Roosa et al 1986). Some, like *Salix candida* (Sage Willow) and *Angelica atropurpurea* (Great Angelica) were feared extirpated (Spence 1959, Roosa and Eilers 1978), while others, like *Carex sterilis* and *Cypripedium calceolus* var. *parviflorum* (Small Yellow Lady's Slipper) were previously unreported from the state. In addition to rare vascular plants, 6 rare terrestrial gastropod species with boreal, European, and glacial relict affinities (Nekola 1988a; Terrence Frest, pers. commun.), and 11 species of rare lepidoptera with northern and Coastal Plain affinities (Nekola and Schlicht 1987, Nekola 1988a) have been identified from eastern Iowa fens. Preliminary observations also indicate the presence of a large number of regionally rare bryophyte taxa from these sites (Conard 1952a, 1952b; Diana Horton, pers. commun.; Nekola, unpubl. data). Even though nearly 100 spring fens are now known from eastern Iowa (Nekola 1988b), very little information has been published about this habitat, which may be as important a refuge for rare organisms in the prairies of the Iowan Erosional Surface as algalic talus

slopes (Frest 1981, 1986a, 1986b; Lammers 1983) are to the woodlands of the Paleozoic Plateau. Documentation of the biological diversity of these few remaining sites is thus of critical importance.

#### METHODS

One of the most diverse spring fen sites in eastern Iowa is found within a tract known as the Brayton-Horsley Prairie. This site offers a unique combination of mesic prairie, wet prairie, and spring fen communities, and is the only location known in the state at which these three communities still coexist. The interest of John and Gretchen Brayton, the site's principal owners, in the flora of the site prompted initiation of a floristic inventory by T.G. Lammers (TGL) in 1981, which was continued by J.C. Nekola (JCN) in 1984 and 1985. In these studies, an effort was made to locate and record habitats for all vascular plant species occurring within the Brayton-Horsley Prairie. The site was visited by TGL on 2-3 week intervals between the first week of April and the last week of September in 1981. Monthly visits were made by JCN from August to October 1984, and May to July 1985. All uncultivated land within the Brayton-Horsley prairie was included in these visits. Each native or naturalized species observed during these surveys was noted, as well as its distribution on the site. Voucher specimens for all observed species were collected. Visual estimations of population size of all threatened or endangered taxa were also made. From the floristic list and distribution maps, the primary community types present at the site were categorized.

#### SITE DESCRIPTION

The Brayton-Horsley Prairie is located in extreme northeastern Bremer County, 3.2 km south of the town of Sumner in Section 2, Dayton Township (Township 92 North, Range 11 West). John and Gretchen Brayton, charter members of the Iowa Chapter of The Nature Conservancy (TNC), own most of this unique area and have conscientiously protected it for many years. The Iowa Chapter, TNC, was recently granted a conservation easement on the property by the Braytons and Louis Horsley, who owns the remainder of the site. The site is divided into three units occupying adjacent upland drainageways which flow into the Little Wapsipinicon River. These drainageways are separated by uplands planted in row crops. The northernmost unit contains approximately 0.8 ha of prairie, the central unit 1.2 ha, and the southernmost unit 12.0 ha. Approximately 10 ha of the southern unit is a spring fen (Figure 2). The site was intermittently grazed up until 20 years ago and has been left undisturbed since (John Brayton, pers. commun.). The central portion of the spring fen appears pristine, however, judging from the undisturbed soil surface (lack of large hummocks) and diversity of the plant community. The cattle apparently did not penetrate deeply into the site due to unsound footing.

The geomorphology of the region is characteristic of northern and central sections of the Iowan Erosional Surface. The landscape represents a stepped pediment surface with exposed upland gravels of pre-Illinoian age ("Buchanan gravels" of Calvin 1897) and little or no loess cover (Hallberg et al 1978). The three units at Brayton-Horsley are confined to the backslopes and footslopes of a pediment edge. Soils are of the Kenyon-Clyde-Floyd association, which are

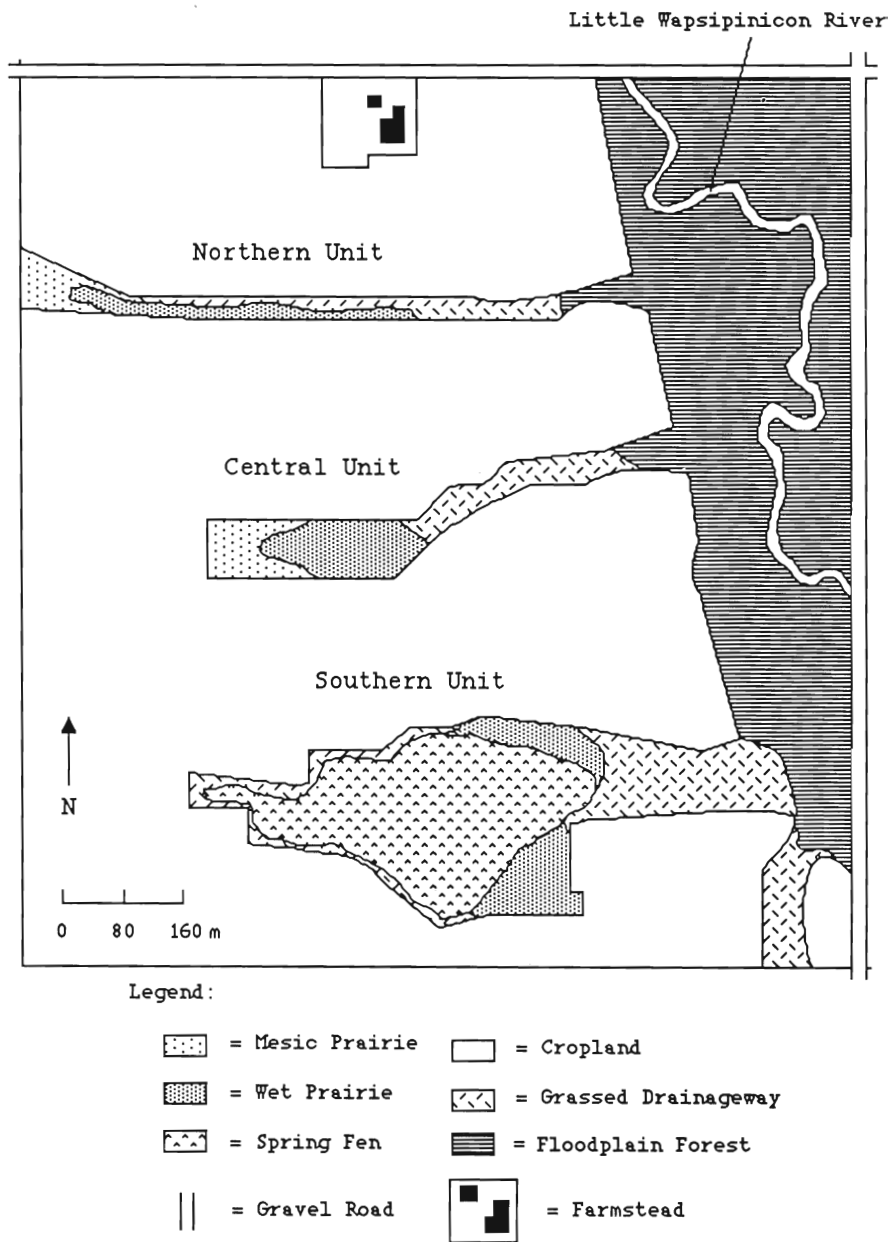


Figure 2. Plant communities of the Brayton-Horsley Prairie NE 1/4 Sec. 2, T. 92 N., R. 11 W.

moderately-well to very poorly drained (Buckner 1967). The soil of the spring fen in the southern unit has up to 4 m accumulation of undecomposed sedge peat (Nekola, unpubl. data). Soil survey workers in eastern Iowa have characterized these soils as the Palms Muck (Herb Wilson, SCS Soil Scientist, pers. commun.). The remaining soils are moderately-well to poorly drained Clyde and Tripoli clay loams, which formed in moderately fine textured loamy material overlying the pre-Illinoian glacial till (Buckner 1967).

The climate of the region is humid-continental with warm summers, cold winters, and a relatively uniform precipitation distribution (Buckner 1967). The weather station at Waverly/Tripoli reports a mean January temperature of  $-8^{\circ}\text{C}$  and a mean July temperature of  $23^{\circ}\text{C}$ . Extremes of  $-37^{\circ}\text{C}$  (January 1912) and  $43^{\circ}\text{C}$  (July 1936) have been recorded. The mean growing season is 149 days (May 7 to October 3), and mean precipitation is 81 cm.

#### DESCRIPTION OF PLANT COMMUNITIES

Water availability controls the distribution of the three plant communities at Brayton-Horsley. Higher areas which dry quickly are covered by mesic prairie. Areas subject to spring inundation and summer drying contain wet prairie species. The area fed by permanent ground-water constitutes the spring fen. This last habitat is characterized by saturated (but never inundated) soil, which is buffered from precipitation fluctuations by the constant ground-water supply. Soil temperature is also buffered from extremes due to the constant temperature of the upwelling ground-water. This area of buffered water supply and temperature contains many rare taxa that are not found elsewhere at the site.

##### *Mesic prairie*

The mesic prairie community is found on backslopes of the pediment edge, where drainage is good and water levels are kept lower than surrounding areas. Specifically, it occurs at the heads of the drainageways on the western ends of the northern and central units (Figure 2). *Andropogon gerardii*, *Sporobolus heterolepis*, and *Sorghastrum nutans* are the dominant grasses. Also found here are many typical prairie forbs, including *Artemisia ludoviciana*, *Aster azureus*, *Cacalia tuberosa*, *Coreopsis palmata*, *Desmodium canadense*, *Dicanthelium scribnerianum*, *Dodecatheon meadia*, *Eryngium yuccifolium*, *Geum triflorum*, *Helianthemum bicknellii*, *Hypoxis hirsuta*, *Lithospermum canescens*, *Phlox pilosa*, *Potentilla arguta*, *Silphium laciniatum*, *Sisyrinchium campestre*, *Solidago nemoralis*, *Viola pedatifida*, and *Zizia aurea*. No species considered threatened or endangered by Roosa et al (1986) occur within this community at the Brayton-Horsley Prairie.

##### *Wet prairie*

The wet prairie community is confined to footslopes and toeslopes along the drainageways, and to the border of the spring fen (Figure 2), where moisture levels are periodically high but fall during dry periods. Often the drainageways are covered with standing water during the spring. *Andropogon gerardii*, *Panicum virgatum*, and *Spartina pectinata* are the most common grasses, while *Carex lanuginosa* and *C. meadii* are also important. Other

characteristic species of this community include *Dodecatheon meadia*, *Galium boreale*, *Gentianella quinquefolia* subsp. *occidentalis*, *Gentianopsis crinita*, *Iris virginica* var. *shrevei*, *Lathyrus palustris*, *Liatris pycnostachya*, *Lilium michiganense*, *Lilium philadelphicum* var. *andinum*, *Ophioglossum vulgatum*, *Phlox maculata*, *Polytaenia nuttallii*, *Populus tremuloides*, *Pycnanthemum virginianum*, *Saxifraga pennsylvanica*, *Senecio aureus*, *Spiranthes cernua*, *Spiraea alba*, and *Valeriana edulis* subsp. *ciliata*.

Five species listed as threatened or endangered by Roosa et al (1986) are found in this habitat. *Ophioglossum vulgatum*, *Platanthera praeclara*, *P. psycodes*, and *Valeriana edulis* subsp. *ciliata* occur at Brayton-Horsley only in wet prairie. *Gentianopsis crinita* is found in both the wet prairie and spring fen, though it is more abundant in the wet prairie habitat.

#### Spring fen

The spring fen emanates from a footslope at the head of the drainageway at the southern unit (Figure 2). Toward the periphery the soil surface is dotted with sedge hummocks. However, in the center of the fen these are much less pronounced. Standing water is found only in hollows between hummocks; over most of the fen surface, the water table is at or just below the soil surface.

A unique plant assemblage is found in the spring fen. *Carex stricta*, *Carex prairea*, and other *Carex* species dominate along with *Aster umbellatus*, *Eupatorium maculatum* and *Onoclea sensibilis*. The Poaceae constitute a lower proportion of the fen flora as compared to the adjacent wet and mesic prairie habitats. The only frequent grass in this habitat is *Muhlenbergia glomerata*, which in Iowa most commonly occurs in fens. Shrubs comprise a smaller but significant percentage of cover and include *Betula pumila* var. *glandulifera*, plus various species of *Salix* and *Cornus*.

Many of the species found in the spring fen at Brayton-Horsley are most commonly encountered on the Iowan Erosional Surface in fen habitats. These include *Betula pumila* var. *glandulifera*, *Bidens coronata*, *Chelone glabra*, *Cornus stolonifera*, *Dryopteris cristata*, *Epilobium leptophyllum*, *Eriophorum angustifolium*, *Gentianopsis crinita*, *Liparis loeselii*, *Pilea fontana*, *Potentilla palustris*, *Rubus pubescens*, *Rumex orbiculatus*, *Salix candida*, *Salix pedicellaris*, *Scutellaria galericulata*, *Solidago riddellii*, *Triadenum fraseri*, and *Viola macloskeyi* subsp. *pallens*. Many of these are northern or northeastern taxa which reach the southern or southwestern limit of their ranges in Iowa spring fens. Twenty-five of these species are believed to be rare on the Iowan Erosional Surface (Eilers 1971). Five are considered threatened or endangered by Roosa et al (1986).

Species characteristic of wet prairies and woodland habitats in eastern Iowa also occur within the spring fen. At Brayton-Horsley, woodland taxa such as *Athyrium filix-femina*, *Polemonium repens*, and *Rubus pubescens* were observed in this habitat in full sun.

#### RARE, THREATENED AND ENDANGERED SPECIES

The large number of rare species found at the Brayton-Horsley Prairie makes this site of special importance to natural heritage conservation in Iowa. Thirty-five native taxa regarded as rare on the Iowan Erosional Surface by

Eilers (1971) are found on this site. All but 10 of these are restricted to the spring fen community. Nine of these 35 are listed as threatened or endangered by Roosa et al (1986); they are discussed below. Information regarding their current distribution in Iowa has been assembled from the unpublished field notes and herbarium collections of JCN and TGL.

*Betula pumila* var. *glandulifera* is threatened in Iowa (Roosa et al 1986). Over 250 clumps were observed in 5 colonies within the spring fen in cold, peaty soil. Though reported from only one site in Iowa by Roosa and Eilers (1978), it has been observed subsequently by JCN at 12 spring fens in six northeastern Iowa counties.

*Eriophorum angustifolium* is endangered in Iowa (Roosa et al 1986). At the Brayton-Horsley Prairie it is restricted to cold, peaty soils of the spring fen, where in 1985, 40 individuals were noted in four colonies. Several hundred individuals were observed in 1981, however. Such yearly variability in number of flowering individuals has been noted from other Iowa populations (Nekola, pers. observ.). Roosa and Eilers (1978) reported that *E. angustifolium* had only been collected twice in the previous two decades. It has subsequently been observed by the authors at 40 sites in 16 northeastern Iowa counties. Additional populations are also known from the fens of northwestern Iowa (Wolden 1956; Bob Moats, pers. commun.). Although it has been observed in wet prairie remnants (e.g. Randalia Prairie in Fayette County and Hoffman Prairie in Cerro Gordo County), the most frequently utilized habitat for *Eriophorum angustifolium* in northeastern Iowa is fens.

*Gentianopsis crinita* is threatened in Iowa (Roosa et al 1986). It occurs in both the wet prairie and spring fen communities in eastern Iowa. At Brayton-Horsley, approximately 300 flowering individuals were seen in 1981, with 400 observed in 1985. Such population fluctuations are common, as this taxon has an annual or biennial life history. Roosa and Eilers (1978) reported only four populations from four eastern counties. Additional populations have been located by JCN from 16 sites in nine northeastern Iowa counties. In Iowa, spring fens appear to be the favored habitat, as almost 80 percent of the new sites are from this community type.

*Platanthera praeclara*, endangered in Iowa (Roosa et al 1986), has been only recently segregated from *P. leucophaea* by Sheviak and Bowles (1986). This species is restricted to tallgrass prairies from Iowa westward and is under consideration for listing as an endangered species by the U.S. Fish and Wildlife Service (U.S.D.I. Fish and Wildlife Service 1985). At the Brayton-Horsley Prairie, this orchid is restricted to the wet prairie border of the spring fen in the south unit, where in seven years no more than six individuals have been observed in a given year. During four of these years, no individuals were noted. Apparently, *P. praeclara* does not flower every season and can undergo extended periods of dormancy. Similar fluctuations in population size have been noted for this taxon and *P. leucophaea* in Illinois (Kibbe 1952, Sheviak 1974). Additional individuals may be present in the wet prairie border along the south side of the fen (John Brayton, pers. commun.).

*Platanthera psycodes* is endangered in Iowa (Roosa et al 1986). Niemann (1975) could not locate extant populations of this species during his survey of



Iowa orchids. However, a small population was discovered in 1982 at Brayton-Horsley Prairie by John Brayton in the wet prairie border of the spring fen. Only five individuals were observed from 1983-1985. A larger population was discovered in 1983 by Brayton three km north of the Brayton-Horsley Prairie along the Little Wapsipinicon River. Three additional populations have subsequently been located by JCN in Buchanan and Mitchell Counties in wet prairies, fens, and swampy woodlands.

*Ophioglossum vulgatum* is endangered in Iowa (Roosa et al 1986). At the Brayton-Horsley Prairie it is present in sedge-dominated wet prairie of the central and southern units. The population was estimated at over 1000 individuals. Roosa and Eilers (1978) considered this one of the rarest Iowa peridophytes, with only three populations known in three northeastern Iowa counties. *Ophioglossum vulgatum* has since been found by JCN in wet prairies, moist sand prairie, wet sandy woods, and fens at 13 new sites in 9 northeastern Iowa counties. The Brayton-Horsley Prairie harbors the largest of these new populations.

*Salix candida*, endangered in Iowa (Roosa et al 1986), was previously considered extirpated from the state (Roosa and Eilers 1978, Spence 1959). Extant populations were discovered by TGL in 1980 and 1981 at the Brayton-Horsley Prairie and two additional sites. Approximately 90 individuals occur at Brayton-Horsley in the cold, peaty soil at the center of the spring fen. Since 1984, 26 new sites have been located by JCN in 11 northeastern Iowa counties. All of these populations are restricted to fen habitats.

*Salix pedicellaris*, endangered in Iowa (Roosa et al 1986), was recently thought restricted in the state to Pilot Knob State Park (Roosa and Eilers 1978). In 1985, two clumps were discovered in the central section of the spring fen at Brayton-Horsley Prairie. Approximately 130 stems were observed. Since 1985, this taxon has been observed by JCN at six other fens in five northeastern Iowa counties.

*Valeriana edulis* subsp. *ciliata*, threatened in Iowa (Roosa et al 1986), is the only threatened or endangered species found at Brayton-Horsley Prairie which does not occur in the southern unit. Approximately 350 individuals were observed in the wet prairie of the central unit, where it consistently occurred with *Ophioglossum vulgatum* and *Gentianopsis crinita*. Reported from only seven eastern Iowa counties by Roosa and Eilers (1978), it has subsequently been observed by JCN at 15 new sites in seven northeastern Iowa counties, where it has been found in limestone glades, wet prairies, and spring fens.

Another 26 taxa species at Brayton-Horsley Prairie are considered rare on the Iowan Surface by Eilers (1971). Among these are some considered rare throughout the state, including *Carex prairea*, *Dryopteris cristata*, *Epilobium leptophyllum*, *Liparis loeselii*, *Muhlenbergia glomerata*, *Pilea fontana*, *Polytaenia nuttallii*, *Potentilla palustris*, *Rubus pubescens*, *Rumex orbiculatus*, *Solidago riddellii*, *Triadenum fraseri*, and *Viola macloskeyi* subsp. *pallens* (Crawford 1970; Peck 1976; Lammers and van der Valk 1977, 1979; Dean Roosa, pers. commun.). In eastern Iowa, many of these species most frequently occur in fens. *Rubus pubescens*, however, is typically found in Iowa on alfic talus slopes of the Paleozoic Plateau (Frest 1986a, 1986b). At Brayton-

Horsley, *Rubus pubescens* is locally dominant on the southern side of the fen. This population exceeds 5000 individuals and may be the largest in the state. It has been found to occur on six fens in five counties on the Iowan Erosional Surface. These populations are among the most southerly known between the mountains of West Virginia and Colorado.

Another species found in the wet prairie of the central unit at Brayton-Horsley, *Tomanthera auriculata*, is currently considered critically endangered throughout its range (Nature Conservancy 1986), and has been suggested by Orzell and Summers (1983) as a candidate for protective listing by the U.S. Fish and Wildlife Service.

Over 70 percent of the endangered, threatened or rare plants, and approximately 40 percent of the site's total flora, is restricted to the spring fen. The existence of the spring fen at the Brayton-Horsley Prairie thus not only increases the site's habitat diversity, but also its species diversity. Because of the mosaic of three prairie habitats and the number of rare taxa present, the Brayton-Horsley Prairie can be considered one of the most significant natural areas in the state. Through use of this site as a microcosm for the landscape as a whole, it can be argued that protection of spring fen habitats in eastern Iowa will be an essential prerequisite to adequate conservation of the state's natural diversity, for such habitats help maintain both species and habitat diversity within the region.

#### ANNOTATED CATALOGUE

The annotated catalogue of vascular plants of the Brayton-Horsley Prairie is based upon collections and observations made by TGL during the 1981 growing season, and by JCN during the 1984 and 1985 growing seasons. Voucher specimens for the former are deposited in the Martin L. Grant Herbarium at the University of Northern Iowa (ISTC), while those for the latter are deposited in the R.V. Drexler Herbarium of Coe College in Cedar Rapids, Iowa. The nomenclature of the catalogue follows that of Kartesz and Rappasz (1980). Proceeding each binomial is a common name, a subjective approximation of the relative abundance of the species at Brayton-Horsley (in ascending order: rare, infrequent, frequent, and common) and an indication of the habitat association (M = mesic prairie, W = wet prairie, F = spring fen) at the Brayton-Horsley Prairie. Those species considered rare from the Iowan Erosional Surface (Eilers 1971) are noted by a bold-face "R." If the taxon is considered endangered or threatened by Roosa et al (1986), it is denoted by a bold-face "E" or "T," respectively.

##### DIVISION EQUISETOPHYTA

##### EQUISETACEAE

*Equisetum arvense* L. (Field Horsetail)—Infrequent; W.

*Equisetum laevigatum* A. Br. (Prairie Scouring-rush)—Infrequent; W.

##### DIVISION POLYPODIOPHYTA

##### ASPLENIACEAE

*Athyrium filix-femina* (L.) Roth (Lady Fern)—Rare; F. This typical woodland fern has been observed frequently in eastern Iowa

fen communities. The fronds are more coriaceous than those of woodland plants and bear denser sori, possibly due to the higher light levels in fen sites.

*Dryopteris cristata* (L.) A. Gray (Crested Fern)—Rare; F; R. Although considered rare in Iowa (Cooperrider 1959, Peck 1976), this fern occurs frequently in the fens of eastern Iowa.

*Onoclea sensibilis* L. (Sensitive Fern)—Common; F.

OPHIOGLOSSACEAE  
*Ophioglossum vulgatum* L. (Adder's-Tongue Fern)—Infrequent; W; R; E.

THELYPTERIDACEAE  
*Thelypteris palustris* Schott (Marsh Fern)—Common; F.

DIVISION MAGNOLIOPHYTA  
CLASS MAGNOLIOPSIDA

ACERACEAE  
*Acer negundo* L. (Box Elder)—Rare; F.  
APIACEAE

*Cicuta maculata* L. (Water Hemlock)—Frequent; F.

*Eryngium yuccifolium* Michx. (Rattlesnake Master)—Infrequent; M,W.

*Oxypolis rigidior* (L.) Raf. (Cowbane)—Frequent; F.

*Polytaenia nuttallii* DC (Prairie Parsley)—Infrequent; W; R. Also considered rare in Iowa by Crawford (1970).

*Zizia aurea* (L.) W.D.J. Koch (Golden Alexanders)—Frequent; M,W.

APOCYNACEAE  
*Apocynum cannabinum* L. var. *hypericifolium* A. Gray (Indian Hemp)—Infrequent; W.

ASCLEPIADACEAE  
*Asclepias incarnata* L. (Swamp Milkweed)—Frequent; W,F.

*Asclepias syriaca* L. (Field Milkweed)—Infrequent; M.

ASTERACEAE  
*Achillea millefolium* L. (Yarrow)—Frequent; M,W,F.

*Ambrosia artemisiifolia* L. (Common Ragweed)—Infrequent; W.

*Ambrosia trifida* L. (Giant Ragweed)—Locally common; F.

*Antennaria neglecta* Greene (Field Pussytoes)—Frequent; M,W.

*Artemisia ludoviciana* Nutt. (White Sage)—Infrequent; M,W.

*Aster azureus* Lindl. (Sky-blue Aster)—Frequent; M,W.

*Aster ericoides* L. (Heath Aster)—Frequent; W.

*Aster laevis* L. (Smooth Blue Aster)—Infrequent; W.

*Aster novae-angliae* L. (New England Aster)—Frequent; W.

*Aster pilosus* Willd. (Hairy Aster)—Infrequent; M.

*Aster puniceus* L. (Swamp Aster)—Common; F.

*Aster simplex* Willd. (Panicled Aster)—Infrequent; W.

*Aster umbellatus* P. Mill. (Flat-top Aster)—Common; F.

*Bidens coronata* (L.) Britt. (Swamp Beggartick)—Common; F; R.

*Cacalia plantaginea* (Raf.) Shinnars (Indian Plantain)—Infrequent; M.

*Cirsium flodmanii* (Rydb.) Arthur (Prairie Thistle)—Infrequent; W; R.

*Coreopsis palmata* Nutt. (Tickseed)—Frequent; M.

*Eupatorium maculatum* L. (Spotted Joe Pye Weed)—Common; F.

*Eupatorium perfoliatum* L. (Common Boneset)—Common; F.

*Helenium autumnale* L. (Sneezeweed)—Frequent; W,F.

*Helianthus grosseserratus* Martens. (Bigtooth Sunflower)—Common; W,F.

*Krigia biflora* (Walt.) Blake (Two-flowered Cynthia)—Infrequent; M,W.

*Liatris pycnostachya* Michx. (Prairie Blazing Star)—Frequent; W.

*Parthenium integrifolium* Michx. (Wild Quinine)—Infrequent; M,W.

*Prenanthes racemosa* Michx. (Rattlesnake Root)—Infrequent; W.

*Ratibida pinnata* (Vent.) Barnh. (Yellow Coneflower)—Frequent; M,W.

*Rudbeckia hirta* L. (Black-eyed Susan)—Infrequent; M,W.

*Rudbeckia subtomentosa* Pursh (Sweet Coneflower)—Infrequent; W.

*Senecio aureus* L. (Golden Ragwort)—Infrequent; W,F; R.

*Silphium laciniatum* L. (Compass Plant)—Infrequent; M.

*Silphium perfoliatum* L. (Cup Plant)—Infrequent; W.

*Solidago canadensis* L. (Tall Goldenrod)—Frequent; W.

*Solidago gigantea* Ait. (Late Goldenrod)—Common; W,F.

*Solidago graminifolia* (L.) Salisb. (Grassleaved Goldenrod)—Frequent; W,F.

*Solidago nemoralis* Ait. (Gray Goldenrod)—Infrequent; M.

*Solidago riddellii* Frank (Riddell's Goldenrod)—Infrequent; W,F; R. Rare in Iowa (Lammers and van der Valk 1977), this taxon is primarily restricted to fens and occurs in Iowa as far south as Linn County (Nekola, herbarium specimen at the R.V. Drexler Herbarium, Coe College).

*Solidago rigida* L. (Stiff Goldenrod)—Frequent; M.

*Sonchus asper* (L.) Hill (Sow Thistle)—Rare; F.

*Vernonia fasciculata* Michx. (Ironweed)—Infrequent; W,F.

BALSAMINACEAE  
*Impatiens capensis* Meerb. (Orange Jewelweed)—Common; F.

BETULACEAE  
*Betula pumila* L. var. *glandulifera* Regel (Bog Birch)—Infrequent; F; R; T. In Iowa

this species most frequently occurs in fen communities.

BORAGINACEAE

*Lithospermum canescens* (Michx.) Lehm. (Hoary Puccoon)—Frequent; M,W.

BRASSICACEAE

*Cardamine bulbosa* (Schreb.) BSP (Spring Cress)—Frequent; F.

CAMPANULACEAE

*Campanula aparinoides* Pursh (Marsh Bellflower)—Common; F.

*Lobelia inflata* L. (Indian Tobacco)—Infrequent; M,W.

*Lobelia spicata* Lam. (Spiked Lobelia)—Frequent; M.

*Lobelia siphilitica* L. (Great Blue Lobelia)—Common; F.

CAPRIFOLIACEAE

*Sambucus canadensis* L. (Elderberry)—Rare; F.

CARYOPHYLLACEAE

*Stellaria longifolia* Muhl. ex. Willd. (Marsh Chickweed)—Common; W,F.

CISTACEAE

*Helianthemum bicknellii* Fern. (Frostweed)—Infrequent; M.

CLUSIACEAE

*Hypericum perforatum* L. (Klamath Weed)—Infrequent; W.

*Triadenum fraseri* (Spach) Gl. (Marsh St. John's-wort)—Frequent; F; R.

CONVOLVULACEAE

*Calystegia sepium* (L.) R. Br. (Hedge Bindweed)—Infrequent; M,W.

CORNACEAE

*Cornus amomum* P. Mill. subsp. *obliqua* (Raf.) J.S. Wilson (Pale Dogwood)—Infrequent W,F.

*Cornus stolonifera* Michx. (Red Osier Dogwood)—Frequent; W,F; R. In Iowa known primarily from algific talus slope (Frest 1986a, 1986b) and fen communities (Nekola, unpubl. data).

CUSCUTACEAE

*Cuscuta cephalanthi* Engelm. (Dodder)—Infrequent; F; R. Parasitic on *Aster puniceus*, *Impatiens capensis*, *Rumex orbiculatus* and other herbaceous species.

EUPHORBIACEAE

*Euphorbia corollata* L. (Flowering Spurge)—Infrequent; M,W.

FABACEAE

*Dalea purpurea* Vent. (Purple Prairie Clover)—Infrequent; M.

*Desmodium canadense* (L.) DC (Showy Tick-trefoil)—Frequent; M,W.

*Lathyrus palustris* L. (Marsh Vetchling)—Infrequent; W,F.

*Melilotus officinalis* (L.) Lam. (Yellow Sweet Clover)—Infrequent; M.

*Trifolium hybridum* L. (Alsike Clover)—Infrequent; W.

*Vicia americana* Muhl. (Wild Vetch)—Infrequent; M.

GENTIANACEAE

*Gentiana andrewsii* Griseb. (Bottle Gentian)—Frequent; W,F.

*Gentianella quinquefolia* (L.) Sm. subsp. *occidentalis* (A. Gray) J. Gillett (Stiff Gentian)—Infrequent; W.

*Gentianopsis crinita* (Froel.) Ma. (Fringed Gentian)—Frequent; W,F; R; T.

LAMIACEAE

*Lycopus americanus* Muhl. ex Bart. (Water Horehound)—Frequent; F.

*Lycopus virginicus* L. (Bugle Weed)—Infrequent; F; R.

*Mentha arvensis* L. (Field Mint)—Infrequent; F.

*Monarda fistulosa* L. (Wild Bergamot)—Infrequent; M,W.

*Physostegia virginiana* (L.) Benth. subsp. *virginiana* (Obedient Plant)—Rare; W.

*Prunella vulgaris* L. (Self-heal)—Infrequent; W.

*Pycnanthemum virginianum* (L.) Dur. & Jacks. (Mountain Mint)—Frequent; W,F.

*Scutellaria galericulata* L. (Marsh Skullcap)—Frequent; F; R.

*Stachys palustris* L. subsp. *pilosa* (Nutt.) Epling (Hedge-nettle)—Frequent; W,F.

LYTHRACEAE

*Lythrum dacotanum* Nieuwl. (Winged Loosestrife)—Frequent; W,F.

OLEACEAE

*Fraxinus nigra* Marsh. (Black Ash)—Rare; F.

ONAGRACEAE

*Oenothera biennis* L. (Evening Primrose)—Rare; W.

*Epilobium coloratum* Biehler (Willow Herb)—Infrequent; F.

*Epilobium leptophyllum* Raf. (Fen Willow Herb)—Infrequent; F; R.

OXALIDACEAE

*Oxalis stricta* L. (Yellow Wood Sorrel)—Infrequent; W.

PLANTAGINACEAE

*Plantago major* L. (Common Plantain)—Rare; W.

POLEMONIACEAE

*Phlox maculata* L. (Marsh Phlox)—Frequent; W,F.

*Phlox pilosa* L. (Prairie Phlox)—Infrequent; M,W.

*Polemonium reptans* L. (Jacob's Ladder)—Infrequent; W,F. Typical of mesic forests in eastern Iowa, this species is also encountered in fens and wet prairies.

#### POLYGONACEAE

*Polygonum amphibium* L. var. *emersum* Michx. (Water Smartweed)—Infrequent; F; R. Only the terrestrial form occurs here.

*Polygonum amphibium* L. var. *stipulaceum* (Coleman) Fern. (Devil's Shoestring)—Infrequent; F.

*Polygonum pensylvanicum* L. (Pinkweed)—Infrequent; W,F.

*Polygonum sagittatum* L. (Tear-thumb)—Frequent; F.

*Rumex orbiculatus* A. Gray (Swamp Dock)—Infrequent; F; R. In Iowa, most commonly encountered in fens.

#### PRIMULACEAE

*Dodecatheon meadia* L. (Shooting Star)—Frequent; M,W.

*Lysimachia ciliata* L. (Fringed Loosestrife)—Rare; F.

*Lysimachia quadriflora* Sims (Yellow Loosestrife)—Frequent; W,F.

#### RANUNCULACEAE

*Anemone canadensis* L. (Canada Anemone)—Infrequent; W.

*Anemone cylindrica* A. Gray (Thimbleweed)—Frequent; M.

*Caltha palustris* L. (Marsh Marigold)—Common; F.

*Ranunculus pensylvanicus* L. f. (Bristly Buttercup)—Infrequent; F.

*Thalictrum dasycarpum* Fisch. & Lall. (Meadow-rue)—Frequent; W.

#### ROSACEAE

*Fragaria virginiana* Duchesne (Wild Strawberry)—Frequent; M,W.

*Geum laciniatum* Murr. (White Avens)—Infrequent; W,F.

*Geum triflorum* Pursh (Prairie Smoke)—Infrequent; M.

*Malus ioensis* (Wood) Britt. (Iowa Crabapple)—Infrequent; M.

*Potentilla arguta* Pursh (Prairie Cinquefoil)—Infrequent; W.

*Potentilla palustris* (L.) Scop. (Marsh Cinquefoil)—Frequent; F; R. Considered rare in Iowa (Lammers and van der Valk 1977), in eastern Iowa this species is restricted to fens.

*Potentilla recta* L. (Sulfur Cinquefoil)—Infrequent; M.

*Potentilla simplex* Michx. (Common Cinquefoil)—Infrequent; M,W.

*Prunus virginiana* L. (Choke Cherry)—Rare; F.

*Rosa carolina* L. (Wild Rose)—Frequent; M,W.

*Rubus occidentalis* L. (Black Raspberry)—Infrequent; F.

*Rubus pubescens* Michx. (Hairy Raspberry)—Frequent; F; R. This species was historically known only from algalic talus slope sites (Frest 1986a, 1986b) and a fen north of Cresco in Howard County (Tolstead 1938).

*Spiraea alba* DuRoi (Meadowsweet)—Frequent; W,F.

#### RUBIACEAE

*Galium boreale* L. (Northern Bedstraw)—Frequent; W.

#### SALICACEAE

*Populus tremuloides* Michx. (Quaking Aspen)—Infrequent; W,F. Forms small, dense groves.

*Salix bebbiana* Sarg. (Beaked Willow)—Frequent; F. Also found on algalic talus slopes (Frest 1986a, 1986b).

*Salix candida* Fluegge ex Willd. (Sage Willow)—Infrequent; F; R; E. Restricted in Iowa to fens.

*Salix discolor* Muhl. (Pussy Willow)—Frequent; F.

*Salix humilis* Marsh. (Prairie Willow)—Infrequent; M,W.

*Salix pedicellaris* Pursh (Bog Willow)—Rare; F; R; E. Restricted in Iowa to fens.

*Salix petiolaris* Sm. (Slender Willow)—Infrequent; F.

*Salix rigida* Muhl. (Stiff Willow)—Infrequent; F.

#### SANTALACEAE

*Comandra umbellata* (L.) Nutt. (Bastard Toadflax)—Infrequent; M,W.

#### SAXIFRAGACEAE

*Ribes americanum* P. Mill. (Black Currant)—Infrequent; W,F.

*Saxifraga pensylvanica* L. (Swamp Saxifrage)—Common; W,F.

#### SCROPHULARIACEAE

*Agalinis tenuifolia* (Vahl) Raf. (Slender Gerardia)—Infrequent; W.

*Chelone glabra* L. var. *linifolia* Coleman (Turtlehead)—Frequent; F; R.

*Pedicularis lanceolata* Michx. (Swamp Lousewort)—Frequent; F.

*Tomanthera auriculata* (Michx.) Raf. (Prairie Gerardia)—Infrequent; W; R.

*Veronicastrum virginicum* (L.) Farw. (Culver's Root)—Frequent; W.

ULMACEAE

*Ulmus pumila* L. (Siberian Elm)—Rare; F.

URTICACEAE

*Pilea fontana* (Lunnell) Rydb. (Spring Clearweed)—Infrequent; F; R. Rare in Iowa (Lammers and van der Valk 1977), this species occurs in almost all Iowa spring fens.

VALERIANACEAE

*Valeriana edulis* Nutt. ex Torr. & A. Gray subsp. *ciliata* (Torr. & A. Gray) F.G. Mey. (Valerian)—Infrequent; W; R; T.

VERBENACEAE

*Verbena hastata* L. (Blue Vervain)—Common; W,F. A few individuals with rose-pink flowers (forma *rosea* Cheney) were collected.

VIOLACEAE

*Viola nephrophylla* Greene (Northern Bog Violet)—Infrequent; F.

*Viola pedatifida* G. Don. (Prairie Violet)—Infrequent; M.

*Viola X bernardii* Greene (*V. sororia* X *V. pedatifida*)—Infrequent; M.

*Viola macloskeyi* Lloyd subsp. *pallens* (Banks ex DC.) M.S. Baker (Smooth White Violet)—Rare; F; R.

VITACEAE

*Parthenocissus inserta* (Kern.) Fritsch (Woodbine)—Rare; F.

DIVISION MAGNOLIOPHYTA

CLASS LILIOPSIDA

CYPERACEAE

*Carex annectens* (Bickn.) Bickn. (Yellow-fruited sedge)—Infrequent; F.

*Carex buxbaumii* Wahlenb. (Buxbaum's Sedge)—Infrequent; F.

*Carex hystricina* Muhl. ex Willd. (Porcupine Sedge)—Infrequent; F.

*Carex interior* Bailey (Inland Sedge)—Frequent; F.

*Carex lanuginosa* Michx. (Wooly Sedge)—Frequent; W,F.

*Carex meadii* Dewey (Mead's Sedge)—Infrequent; W; R.

*Carex prairea* Dewey (Fen Sedge)—Infrequent; F; R.

*Carex scoparia* Schkuhr ex Willd. (Pointed Broom Sedge)—Frequent; W,F.

*Carex stricta* Lam. (Tussock Sedge)—Common; F.

*Carex vulpinoidea* Michx. (Fox Sedge)—Common; W,F.

*Eleocharis elliptica* Kunth (Flat-stemmed Spike-rush)—Infrequent; W,F; R.

*Eriophorum angustifolium* (L.) Honckeny (Cotton Sedge)—Infrequent; F; R; E. Re-

stricted in Iowa to fens and wet prairies.

*Scirpus cyperinus* (L.) Kunth (Woolgrass)—Frequent; F.

*Scirpus tabernaemontanii* J.G. Gmel. (Bulrush)—Infrequent; F.

IRIDACEAE

*Iris virginica* L. var. *shrevei* (Small) E. Anderson (Wild Iris)—Infrequent; F.

*Sisyrinchium campestre* Bickn. (Blue-eyed Grass)—Frequent; M,W.

JUNCACEAE

*Juncus tenuis* Willd. var. *uniflorus* (Farw.) Farw. (Dudley's Rush)—Frequent; F.

LILIACEAE

*Hypoxis hirsuta* (L.) Cov. (Yellow-eyed Grass)—Infrequent; M,W.

*Lilium michiganense* Farw. (Michigan Lily)—Rare; W.

*Lilium philadelphicum* L. var. *andinum* (Nutt.) Ker.-Gawl. (Wood Lily)—Rare; M,W.

ORCHIDACEAE

*Liparis loeselii* (L.) L.C. Rich. (Bog Twayblade)—Rare; F; R. Considered rare in Iowa (Lammers and van der Valk 1979).

*Platanthera praeclara* Sheviak & Bowles (Western Prairie Fringed Orchid)—Rare; W; R; E. Recently segregated from *P. leucophaea* (Nutt.) Lindl., this species reaches the eastern terminus of its range in the prairies of eastern Iowa. *P. praeclara* has larger, more divergent, and more angular columns than *P. leucophaea*, and is pollinated by different species of sphingid moths (Sheviak and Bowles 1986).

*Platanthera psycodes* (L.) Lindl. (Purple Fringed Orchid)—Rare; W; R; E.

*Spiranthes cernua* (L.) L.C. Rich. (Nodding Lady's Tresses)—Rare; W.

POACEAE

*Agrostis stolonifera* L. var. *major* (Gaud.) Farw. (Redtop)—Common; W,F.

*Andropogon gerardii* Vitman (Big Bluestem)—Common; M,W,F.

*Dicanthelium oligosanthos* (Schultes) Gould var. *scribnerianum* (Nash) Gould (Scribner's Panic-grass)—Infrequent; M.

*Elymus canadensis* L. (Canadian Wild Rye)—Infrequent; M.

*Glyceria striata* (Lam) A.S. Hitchc. (Manna Grass)—Common; F.

*Leersia oryzoides* (L.) Sw. (Rice Cut-grass)—Frequent; F.

*Muhlenbergia glomerata* (Willd.) Trin. (Marsh Muhly)—Common; F; R. Rare in Iowa (Pohl 1966, Lammers and van der Valk

- 1979) and most commonly encountered in fen habitats.
- Panicum virgatum* L. (Switchgrass)—Common; W.
- Phleum pratense* L. (Timothy)—Infrequent; W.
- Poa pratensis* L. (Kentucky Bluegrass)—Infrequent; M,W.
- Schizachyrium scoparium* (Michx.) Nash (Little Bluestem)—Infrequent; M.
- Sorghastrum nutans* (L.) Nash (Indian Grass)—Common; M,W.
- Spartina pectinata* Link (Slough Grass)—Common; W,F.
- Sphenopholis obtusata* (Michx.) Scrib. (Wedge Grass)—Infrequent; W,F; R.
- Sporobolus heterolepis* (A. Gray) A. Gray (Prairie Dropseed)—Common; M,W.

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