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ABSTRACT The Kokiwanee (56 ha) and Hathaway (29 ha) preserves are located in northeastern Indiana. Both sites include gorges cut by tributaries of the Wabash River, which produce a range of microenvironments that are unusual for this part of Indiana. Floristic inventories were done from 2004 through 2011. Kokiwanee had 467 vascular plant species, while Hathaway had 316. A total of 529 species, representing 325 genera and 104 families, were found in the two sites combined, with 254 species being found in both. Many of the 213 species found only at Kokiwanee occurred in mature forest on a southwest-facing bluff or in fens; most of the 62 species found only at Hathaway were found in a crop field, old fields, or an east-facing gorge wall. Forty-three percent of the species found were county records. Nineteen percent of species were exotic, a significantly lower proportion than for the state as a whole. One state threatened-list species (*Dactylorhiza viridis*) and three state watch-list species (*Liparis loeselii*, *Panax quinquefolius*, and *Veratrum woodii*) were found. A number of species are near their northern range limits at these sites. Floristic quality is relatively high.

Key words: Deciduous forest, floristics, gorge, Indiana, vascular plants, wetlands.

INTRODUCTION In presettlement times, northeastern Indiana was largely forested (Lindsey 1961), but most of the landscape has been converted to agricultural use (Hicks and Keller 1996, NCRS 2004). Despite this, considerable plant diversity has survived in protected areas. Several recent floristic studies have been done in this region (Rothrock 1997, Ruch et al. 1998, Ruch et al. 2002, Stonehouse et al. 2003, Ruch et al. 2004, Ruch et al. 2007, Ruch et al. 2008, Ruch et al. 2009). However, only one of these studies has focused on a site within the upper Wabash River drainage (Stonehouse et al. 2003), a region noted for uncommon plant species and communities (Homoya 2006). The current study documents the vascular flora of two nature preserves located adjacent to tributaries of the Wabash River in Wabash County, Indiana.

Both of these preserves have unusual geological features. This part of Indiana has been glaciated repeatedly, and consequently has flat to rolling topography (Melhorn 1997), with bedrock mantled in tens of meters of glacial drift (Wayne and Thornbury 1951). However, the sites described in this study include gorges cut through the glacial deposits, thus possessing bedrock exposures and topographic diversity that are rarely encountered in northern Indiana (Kissel 2007). The varied microhabitats of these preserves support species that are rare or absent in the surrounding agricultural landscape.

STUDY SITES This report concerns the flora of two sites in central Wabash County, Indiana (Figure 1). The Kokiwanee and Hathaway preserves are owned by the ACRES Land Trust. The Kokiwanee Nature Preserve consists of 56 ha, located at latitude 40.815°N, longitude 85.683°W in T27N, R7E, Section 1. It is adjacent to privately owned agricultural land, privately owned forested land, and forested areas in the Salamonie Reservoir (owned by the United States Army Corps of Engineers) and Salamonie State Forest (owned by the Indiana Department of Natural Resources). The Hathaway Preserve comprises 29 ha and is located at latitude 40.811°N, longitude 85.759°W, in T27N, R7E, Section 14 (ACRES Land Trust 2008, USGS Lagro and Wabash 7 ½ minute topographic maps).

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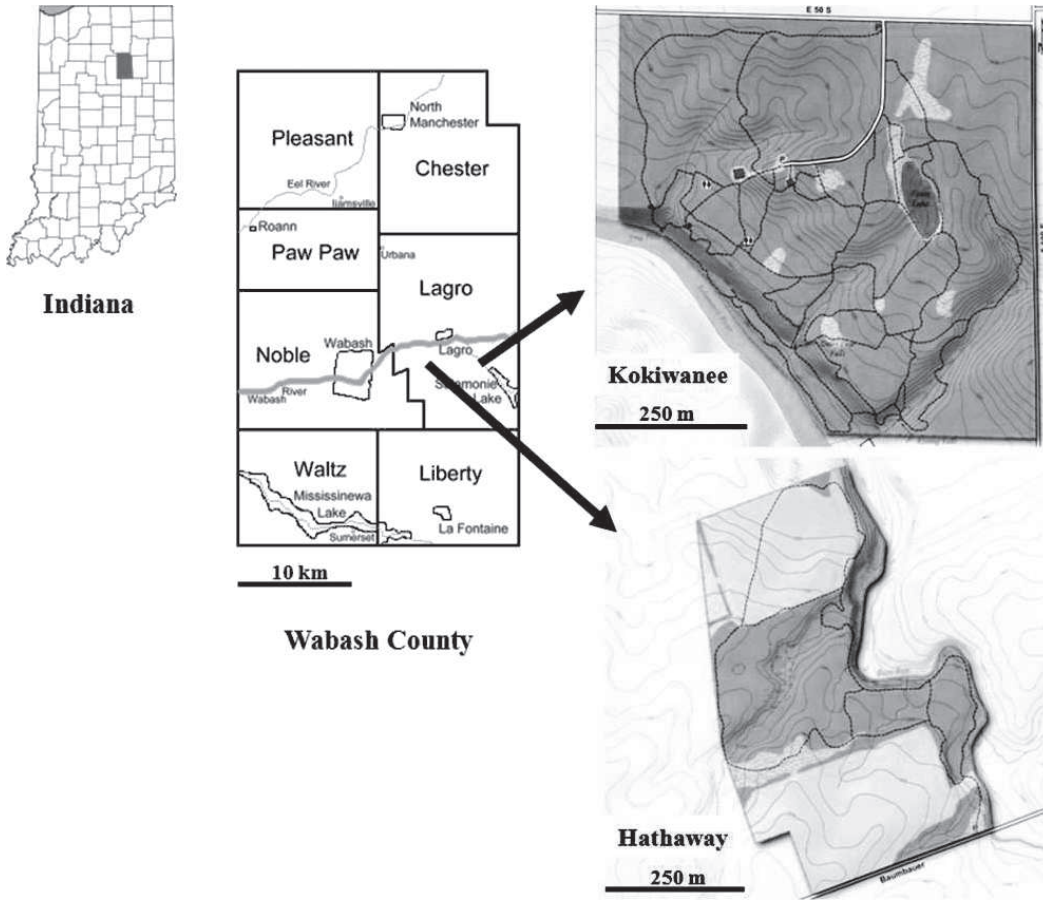

Figure 1. Location of Wabash County, Indiana and of the Kokiwanee and Hathaway preserves, Wabash County, Indiana. Contour lines (5′ or ~1.5 m intervals) and trails are shown within the preserves. Maps courtesy of Michael Sweeney (http://www.ingenweb.org) and ACRES Land Trust.

Hathaway is almost surrounded by privately owned lands, mostly used for field crops. However, it is contiguous with forests that connect to those on the Wabash River bluff and riparian forests adjacent to the river.

Bedrock at both preserves is the calcareous Wabash Formation, of Silurian age (Indiana Geological Survey 1987a, 1987b, Fleming 2005). The central and southern parts of Wabash County are included in the Bluffton Till Plain section of the Central Till Plain Natural Region of Indiana (Homoya et al. 1985). This area generally has relatively little topographic relief. However, both of the study areas include gorges excavated by tributaries of the Wabash River. The gorges are Holocene in age, and were primarily formed during a brief period of intense erosion when Glacial Lake Maumee drained through the Wabash River, creating a gorge and increasing down-cutting of tributaries (Thornbury 1958, Fleming 2005). In both study areas, bedrock has been exposed and bluffs, waterfalls, and rock faces up to c. 20 m high have been created (Figure 2).

At Kokiwanee, the terrain is rolling, with the exception of the bluff and floodplain bench that runs along the Salamonie River and the valleys of unnamed small streams that are tributary to the Salamonie. Elevation ranges from 207–247 masl (Figure 1). The bluff above the river is south- to southwest-facing and rises c. 20 m (USGS Lagro 7 ½ minute topographic map). Groundwater emerges at the base of the river bluff and a bluff above a tributary stream, producing seep and fen

Figure 2. Cliffs and rock exposures at Hathaway (top) and Kokiwanee preserves, Wabash County, Indiana.

habitats. An unusual habitat at this site is a continually wet, calcareous cliff above the river.

At Hathaway, Ross Run has excavated a north-south canyon up to c. 20 m below the c. 230 masl surroundings (Figure 1). This creek drains into the Wabash River c. 0.7 km north of the preserve boundary (USGS Wabash 7 ½ minute topographic map).

The most widespread soil types at both preserves are neutral to slightly acidic alfisols that were formed in glacial deposits, with alluvial inceptisols along the streams. Common upland soil types are Glynwood, Morley, Milton, and Blount, with small areas of Hennepin and Genesee. Rocky, better-drained soils and bare rock exposures occur on the bluffs at each site (Ruesch 1983, Soil Survey Staff NRCS 2008, Soil Survey Staff NRCS 2011).

Data from Wabash, Indiana, <10 km from the sites, indicate that the climate is cool-temperate, with mean annual temperature of 9.4°C and mean annual precipitation of 978 mm. Mean monthly temperatures for June, July, and August are >20°, while

December, January, and February average below freezing. May through August are the wettest months, with precipitation averaging c. 100 mm per month, while December, January, February, and March average <75 mm per month (Indiana State Climate Data Archive 2010).

Original land survey data for Wabash County show that mesic forests were dominated by *Fagus grandifolia*, *Acer saccharum*, *Aesculus glabra*, and *Prunus serotina*. Xeric forests were dominated by *Quercus alba*, and hydric forests by *Ulmus americana* and *Fraxinus* spp. (Lindsey 1961, Hicks and Keller 1996; nomenclature follows USDA, Soil Survey Staff NRCS, 2011; authorities are given in the annotated list at the end of this report). Lagro Township was heavily forested in the late 1800s. *Quercus alba*, *Quercus macrocarpa*, *Fraxinus* spp., *Ulmus* sp., *Carya* spp., *F. grandifolia*, *A. saccharum*, *Tilia americana*, *Juglans nigra*, and *Liriodendron tulipifera* were among the dominant trees at that time (Anonymous 1884). Although the presettlement vegetation of this part of Indiana has been mapped as *Fagus-Acer* forest (Lindsey 1961), *Quercus*-dominated forest was associated with river corridors (Hicks and Michaelis 2009).

Wabash County has a long history of human occupation, both by Native American and European-American cultures. It is unknown when large-scale agricultural activity began on what are now the Kokiwanee and Hathaway properties. However, a mill was constructed in the area in the 1830s, indicating significant grain production (Anonymous 1884).

Most of the Kokiwanee property was in agricultural use until the 1940s. Aerial photographs from 1941 and 1951 indicate that about 37% of the property was forested then. In 1945, the Kokomo Kiwanis purchased the land for the Girl Scouts, hence the name Kokiwanee. The Tribal Trails Girl Scout Council operated a camp on the property from 1945 to 1996. The camp used parts of the property intensively, with the remainder left relatively undisturbed. Pine (*Pinus strobus* and *Pinus sylvestris*) plantations were created by the Girl Scouts shortly after they took ownership. In 2003, ACRES Land Trust Inc. purchased Kokiwanee. Currently, forests cover c. 91% of the area. Most of the forests have grown up in abandoned agricultural land and were approximately 60 yrs old and dominated by *A. saccharum* at the time of this study. However, disturbed remnant forest occurred in former woodlots, and a small area of forest with significant old-growth features occurred on the river bluff and in some tributary stream valleys (Hicks and Michaelis 2009). Nonforested habitats include revegetating old fields, wetlands, some parts of the riverbank, roadsides and a pond that was constructed in the 1960s.

The majority of the Hathaway property also was used as farmland. About 49% of the area is now forested. Much of the forest appears to be comparatively young and, as at Kokiwanee, is dominated by *A. saccharum*. An area of more mature, second-growth forest contains significant amounts of *F. grandifolia*. A few scattered large trees were probably components of hedgerows when the area was farmed (e.g., *Q. alba* and *Quercus velutina* with trunk diameter >1 m). Most of the open habitats are in a field that was used for crops until 2010 (25% of the area) and in an old field that has been planted with *P. strobus* and *L. tulipifera* seedlings (21% of the area). Small areas of forested and disturbed, nonforested wetland also occur, although the seeps and fens found at Kokiwanee are absent. Hathaway was acquired by ACRES in 2007 and was added to the Indiana Nature Preserve system in 2008.

METHODS Plants in flower or fruit were collected by walking through the site, attempting to cover each major habitat type in all growing seasons. Human-altered habitats such as roadsides, crop fields, old fields, and remnant plantings of ornamentals were included. A total of 84 collecting trips were made to Kokiwanee between 30 May 2004 and 13 May 2011. The monthly distribution was March: 2 trips, April: 5 trips, May: 19 trips, June: 18 trips, July: 17 trips, August: 9 trips, September: 6 trips, and October: 5 trips. Sixteen 0.1 ha plots, each including 25 1 m^2 quadrats, were used in a study of forest vegetation at Kokiwanee (Hicks and Michaelis 2009). The plot study added only a few species. Because an Indiana Department of Natural Resources permit was required to collect at Hathaway, this site was visited only 17 times during the permit period. Collecting

trips were made from 18 August 2008 to 27 September 2009. The monthly distribution was April: 3 trips, May: 3 trips, June: 3 trips, July: 2 trips, August: 4 trips, and September: 2 trips.

Plants were identified using a number of sources, but primarily Deam (1940), Gleason and Cronquist (1991), Swink and Wilhelm (1994) and Mohlenbrock (1999). Specimens were processed and herbarium sheets were made following standard methods. Only one individual of *Dactylorhiza viridis* was encountered, and this species is documented by photographs. Vouchers are deposited in the herbarium collection of Manchester College, North Manchester, Indiana (no *Index Herbariorum* acronym; open to the public).

Nomenclature and classification follow USDA, Soil Survey Staff NRCS (2011). Designation of taxa as native to Indiana was taken from Rothrock (2004). Determination of county records and range limits generally follow USDA, Soil Survey Staff NRCS (2011), but were taken from Homoya (1993) for orchids, Jackson (2004) for native trees, and Rothrock (2009) for non-*Carex* Cyperaceae. Species were judged to be at their northern range limit if they are not known to occur in counties further north in Indiana or in Michigan. Species at their southern range limit are not known to occur in counties further south in central-western Indiana or in western or central Kentucky (however, some such species occur in the southern Appalachians). Species of special concern were determined from the list of the Indiana Department of Natural Resources (2010).

Abundance of each taxon was scored as: rare (very few plants, only found at one or two locations within site), occasional (larger number of plants, found at several locations), common (large numbers of plants, found in many locations), or abundant (dominant to subdominant in appropriate stratum in appropriate habitat).

Floristic quality was analyzed by the method developed by Swink and Wilhelm (1994) and modified for the state of Indiana by Rothrock and Homoya (2005). The flora of a site is evaluated by two metrics. The average conservatism value (or restriction to native vegetation) is C_{av} for all native taxa at the site. The floristic quality index (FQI) includes both conservatism and species richness, and $FQI = C_{av} \sqrt{n}$, where n is the total number of taxa at the site. C values were taken from Rothrock (2004). Both C_{av} and FQI were calculated for native species alone, and again for all species (counting nonnative C values as 0).

At Kokiwanee, two distinct wetland types occurred where groundwater came to the surface; these will be designated as seeps and fens. Although their landscape positions appeared to be similar, seeps and fens differed in their flora. To further investigate environmental differences between these habitats, soil samples (upper 10 cm of profile) were obtained from two seeps and two fens in August, 2006. Composition was analyzed by Continental Environmental Laboratories, Fort Wayne, Indiana, using their standard methods for organic matter, pH, cation exchange capacity, and the elements N, P, K, Mg, and Ca. However, data are reported only for variables that differed strongly between seeps and fens. Because of the small sample size, statistical tests are not possible. Chi-squared statistical tests follow Sokal and Rohlf (1981). Regression was performed using Excel.

RESULTS AND DISCUSSION

Completeness of Collections

A plot of collecting effort vs. species collected (Figure 3) showed that the cumulative number of species started to level out at about 70 collecting visits at Kokiwanee, and it appears that this site has been relatively well sampled. However, more collecting time at Hathaway may be needed.

Floristic Summary

A combined total of 529 species was found at Kokiwanee and Hathaway, with dicotyledenous angiosperms dominating in number of species, smaller numbers of monocot species, and a modest number of non-angiosperm spermatophytes and cryptogams (Table 1). There were 51 tree species (9.6%), 35 shrubs (6.6%), 12 vines (2.3%), and 431 herbs (81.5%).

Forty-three percent of the taxa found represent new county records; no new state records were encountered. While the number of county records seems high, this is because the primary source for distribution information for Indiana plants is Deam's *Flora of*

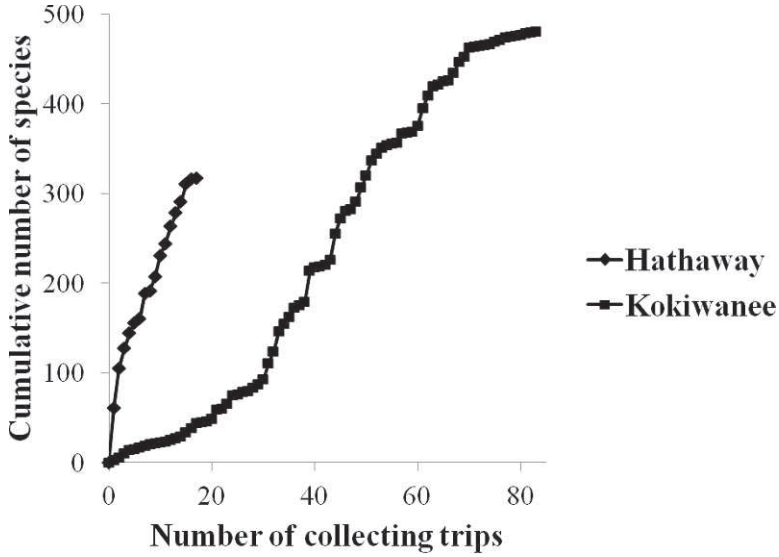

Figure 3. Cumulative number of vascular plants species recorded vs. collecting effort for Hathaway and Kokiwanee preserves, Wabash County, Indiana.

Indiana, which dates to 1940. In support of this conclusion, few county records were found for groups in which more recent state-level treatments are available (trees, orchids, non-*Carex* Cyperaceae).

I constructed a species-area curve based on floristic studies at 12 sites in northeastern Indiana. Regression showed a highly significant log-log relationship between area and number of species (Figure 4). The number of taxa found at Kokiwanee and Hathaway was consistent with the area of these preserves in relation to other protected areas in northeastern Indiana.

One hundred and four families were encountered in this study. Species representation of the families represented by the most species was similar to patterns for the state of Indiana as a whole (Table 2). Thirty-six families were represented by only a single species. Of the 325 genera found, 223 were represented by single species. The best represented genera were *Carex* (32 spp.), *Polygonum* (11), *Solidago* (7), *Symphyotrichum* (7), and *Viola* (6).

Kokiwanee had a larger number of species (467) than Hathaway (316), consistent with its larger area and wider range of habitats. There was considerable overlap in the floristic composition of the two sites, with 254 species occurring at both sites. Sorenson and Jaccard indices (Cox 1996) were 0.65 and 0.48, respectively. However, Kokiwanee had a larger proportion of unique species (213 spp., or 46% vs. 67 spp., or 20% for Hathaway). This was due mostly to the presence of fens and seeps, a south-facing bluff, and older forest at Kokiwanee. Most of the species unique to Hathaway are associated with the east-facing wall of the narrow gorge or with a crop field, habitats that do not occur at Kokiwanee.

Several state-listed species were found (Indiana Department of Natural Resources

Table 1. Number of species of higher-category taxa collected at Kokiwanee and Hathaway nature preserves, Wabash County, Indiana

Site	Pteridophytes	Gymnosperms	Angiosperms Monocots	Angiosperms Dicots	All Taxa
Kokiwanee only	7	2	60	144	213
Hathaway only	2	0	14	46	62
Both	7	1	47	199	254
Total	16	3	121	389	529

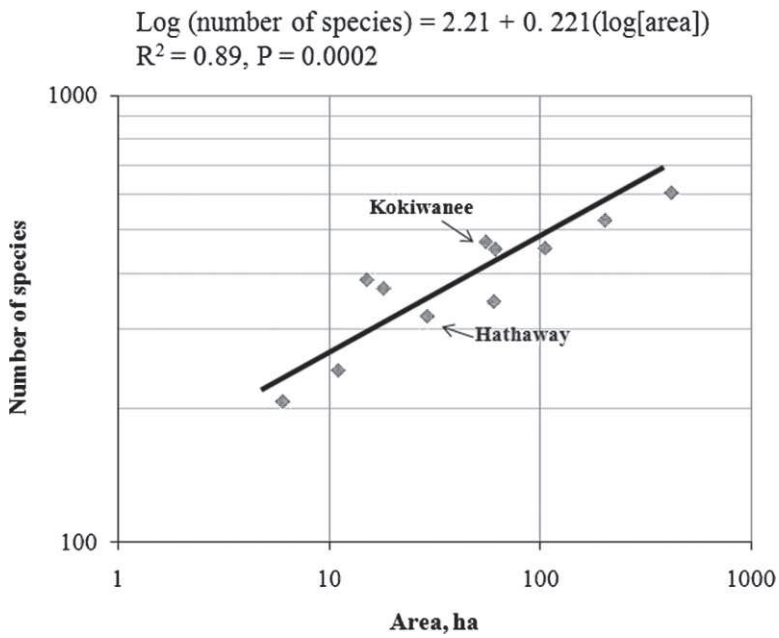

Figure 4. Species-area curve for vascular plant taxa at 12 sites in northeastern Indiana. Data from Rothrock et al. 1993, Rothrock 1997, Ruch et al. 1998, Ruch et al. 2002, Stonehouse et al. 2003, Ruch et al. 2004, Ruch et al. 2007, Ruch et al. 2008, current study and Hicks unpublished.

2010). *Dactylorhiza viridis* (*Coeloglossum viride*) is state-threatened. Watch-listed species were *Liparis loeselii*, *Panax quinquefolius*, and *Veratrum woodii*. Two state-listed species, *Matteuccia struthiopteris* and *P. strobus*, were found at Kokiwanee in situations that indicated that they had been planted.

A number of species that are near their range limits occurred at these sites. Species near the northern edge of their range included *Camassia scilloides*, *Carex shortiana*, *Delphinium tricorne*, *Hydrangea arborescens*, *Hydrophyllum macrophyllum*, *Iodanthus pinnatifidus*, *Mertensia virginica*, *Mimulus alatus*, *Scutellaria incana*, *Scutellaria ovata*, *Stachys cordata*, *Tradescantia subaspera*, *Valeriana pauciflora*, and *Veratrum woodii*. Two species were near their southern range limit, namely *D. viridis* and *Viola labradorica*. Additionally, a few species that have scattered and discontinuous distributions in Indiana were found. These were *Aureolaria virginica*, *Mitchella repens*, *Trillium grandiflorum*, *Trillium nivale*, and *Viola rostrata*.

One conspicuous case of hybridism was encountered. Although typical *A. saccharum* and *Acer nigrum* individuals were found at both sites, many individuals combining diagnostic features of these species were also encountered. Genetic studies indicate no significant differentiation between these species (Skepner and Krane 1998).

Exotic Species

Overall, 19% of the taxa found were not native (Table 3). Of the 2,812 taxa documented for the entire state of Indiana, 29% are nonnative (Rothrock 2004). Kokiwanee and Hathaway combined had a significantly lower proportion of exotic species than the state list ($\chi^2 = 26.4$, df = 1, $p < 0.001$). Each area considered separately also had a significantly smaller proportion of exotics than the state list (Kokiwanee: $\chi^2 = 33.5$, df = 1, $p < 0.001$, Hathaway $\chi^2 = 12.7$, df = 1, $p < 0.001$).

Invasive exotics were present at both sites, though not very common at either. *Lonicera maackii* and *Rosa multiflora* were fairly abundant in forest edges and young forests at both sites. *Alliaria petiolata* was frequently encountered throughout Hathaway, but was found in only a few locations at Kokiwanee. A patch of about 0.5 ha at Kokiwanee has been invaded by *Hesperis matronalis*, and *Vinca minor* occupies an area of similar extent.

Table 2. Families with the greatest number of species collected at Kokiwanee and Hathaway nature preserves, Wabash County, Indiana

Site	Asteraceae	Poaceae	Cyperaceae	Rosaceae	Lamiaceae	Liliaceae s.l.	Fabaceae	Apiaceae	Brassicaceae	Ranunculaceae
Kokiwanee only	30	19	22	5	13	8	10	3	4	5
Hathaway only	11	6	5	6	1	1	3	1	3	0
Both	30	17	13	11	8	9	5	13	10	10
Total	71	42	40	22	22	18	18	17	17	15
State rank*	1	2	3	4	7	9	5	13	6	10

*State rank indicates the relative number of species in these families in the state of Indiana, with 1 indicating the family with most species (Crovello et al. 1983).

Habitats

Second-growth mesic forests were common at both sites. Dominant trees were *A. saccharum*, *Fraxinus americana*, *Fraxinus pennsylvanica*, *L. tulipifera*, and *F. grandifolia* (the last primarily at Hathaway). Planted and escaped pines were frequent in this habitat type at Kokiwanee. These young forests had relatively high density of small trees (Hicks and Michaelis 2009), producing a dense canopy and low understory light levels. Understory vegetation was comparatively low in diversity, with typical dominants being *Osmorhiza* spp., *Parthenocissus quinquefolia*, *Sanicula* spp., *Toxicodendron radicans*, *Trillium sessile*, and *Viola sororia*, as well as seedlings of the canopy trees. A few unusual species occurred primarily or only in young forests, such as *D. viridis*, *Goodyera pubescens*, and *Ophioglossum vulgatum* at Kokiwanee.

More mature mesic forests at Kokiwanee also had significant amounts of *A. saccharum* and *F. americana*, but other species were also common in the canopy, such as *Tilia americana*, *P. serotina*, *Quercus borealis*, *Ulmus* spp., and *Celtis occidentalis*. Occasional large *Quercus muhlenbergii* and *Fraxinus quadrangulata* trees occurred on the river bluff. The understory was diverse, with high cover both in spring and summer. Common understory species included *Collinsonia canadensis*, *Euonymus obovatus*, *Geranium maculatum*, *Laportea canadensis*, *Osmorhiza* spp., *Sanicula* spp., *Solidago flexicaulis*, *Trillium sessile*, *Trillium recurvatum*, and *Viola canadensis*.

Small areas of submesic forest occurred along the bluff edges at both sites. At Kokiwanee the canopy was discontinuous, with both natural openings and openings created by the Scout camp. Ground cover included patches of *Cladonia* lichens and *Leucobryum* moss. Dominant trees included *A. saccharum*, *Q. alba*, and *Q. velutina*. *Juniperus virginiana* trees in this habitat at Kokiwanee may be native, although they have probably been planted elsewhere at the site. This habitat type had relatively high understory diversity, with many species not being found elsewhere. Species unique to this habitat included the shrubs *Physocarpus opulifolium*, *Rhus aromatica*, and *Viburnum rafinesqueanum*. Typical herbaceous species were *Agalinis tenuifolia*, *Antennaria neglecta*, *Blephilia*

Table 3. Floristic quality indicators for plants collected at Kokiwanee and Hathaway nature preserves, Wabash County, Indiana

Site	Native Species Only		All Species		
	C_{av}*	FQI	C_{av}	FQI	Exotic, %
Kokiwanee only	4.3 ± 2.3	84.3	3.6 ± 2.6	77.1	16
Hathaway only	3.8 ± 2.3	67.2	3.0 ± 2.5	54.0	20
Both	4.2 ± 2.3	86.6	3.4 ± 2.7	78.1	19
Twelve Indiana forest sites	4.2 (3.7–5.0)	69.7 (49.3–90.4)	3.4 (2.2–4.6)	60 (16.0–86.5)	16 (5–29)

*C_{av} values are mean ± standard deviation. Values for ''Twelve Indiana forest sites'' are means (range in parentheses); data from Rothrock and Homoya (2005), and Ruch et al. (2007, 2008).

ciliata, *Carex pensylvanica*, *Comandra umbellata*, *Frasera caroliniensis*, *Heuchera americana*, *Hypoxis hirsuta*, *Linum virginianum*, and *Schizachyrium scoparium*. There appear to be no studies of such vegetation in northern Indiana. However, species composition bears some affinity to forest openings of southern Illinois (Heikens and Robertson 1995).

Seeps and fens at Kokiwanee differed in soil chemistry. Fens had lower organic matter (3.5% and 11.4% vs. 15.1% and 35.4% for seeps) and nitrogen (0.23% and 0.59% vs. 0.70% and 1.52% for seeps), but higher Ca (24,250 ppm and 23,950 ppm vs. 15,100 ppm and 15,700 ppm for seeps). Seeps had relatively low diversity, and were dominated by *Symplocarpus foetidus* and *Impatiens* spp., with *Fraxinus nigra* at the periphery. Fens occurred on a bench adjacent to a small stream, and on a wet, calcareous cliff above the Salamonie River. Common species in fens were *Caltha palustris*, *Carex hystericina*, *Cirisum muticum*, *Liparis loeselii*, *Maianthemum stellatum*, *Oxypolis rigidior*, *Parnassia glauca*, *Rhynchospora capillacea* and *Solidago riddelli*. Thirty of 55 species listed by Amon et al. (2002) as typical of Midwestern fens were found at Kokiwanee. There are also many species in common with the hillside seeps of central Indiana described by Ebinger and Bacone (1981).

The riverbank at Kokiwanee had some interesting species on soil-covered banks and rock ledges, including *Calamagrostis canadensis*, *Carex emoryi*, *Gentianella quinquefolia*, *Hypericum sphaerocarpum*, *Iodanthus pinnatifidus*, and *Mertensia virginica*. A shallow pond (c. 0.7 ha) contained a few aquatic species (e.g., *Potamogeton nodosus*, *Eleocharis obtusa*, *Sparganium eurycarpum*, *Alisma subcordatum*).

Wetlands at Hathaway have had more recent disturbance than those at Kokiwanee. Species found in this area included *Carex frankii*, *Carex conjuncta*, and several *Polygonum* spp.

Finally, both sites included roadsides and old fields. The flora of these habitats was dominated by weedy native and exotic species such as *Cichorium intybus*, *Daucus carota*, *Erigeron* spp., *Euthamia graminifolia*, *Monarda fistulosa*, *Rosa multiflora*, *Rubus* spp., *Schedonorus phoenix*, and *Solidago altissima*. Hathaway also had an extensive area that was used for crops (*Glycine max* at the time of sampling).

Floristic Quality

Among the native species, 55 had C values of 0 or 1, 110 had values of 2 or 3, 155 had values of 4 or 5, 71 had values of 6 or 7, 35 had values of 8 or 9, and 5 had the top value of 10. Species rated at 10 were exclusive to one preserve or the other, with Kokiwanee having four, all found in the fens (*Lobelia kalmii*, *Muhlenbergia glomerata*, *Rhynchospora capillacea*, and *Parnassia glauca*). Hathaway had only one 10-ranked species, *Camptosorus rhizophyllus*, which occurred on rocks of the gorge wall.

According to Rothrock and Homoya (2005), for ''the best natural woodland sites in the Central Till Plain … C_{av} (native species) plateau in the low 4 range,'' and FQI values >45 indicate ''noteworthy remnants of a region's natural heritage.'' Kokiwanee and Hathaway compared favorably to these criteria (Table 3). To provide a further standard of comparison, I summarized C_{av} and FQI values for twelve other forested northern Indiana sites. Data for ten of these came from Rothrock and Homoya (2005); I also included floristic quality values for two more recently inventoried sites (Ruch et al. 2007, 2008). Again, Kokiwanee and Hathaway had comparatively high values (Table 3).

Kokiwanee had higher C_{av} and FQI values than Hathaway. This was due to more species and higher C values for the former. Higher C values at Kokiwanee reflect the presence of relatively undisturbed habitats (fens and some forest) vs. a large proportion of secondary forest, old field and crop land at Hathaway.

ANNOTATED LIST OF SPECIES Taxa are listed in alphabetical order of family, genus, and species. Information is given in the following order: scientific name with authority, common name, habitat, abundance, and collection number(s). Abundance is coded as: R = rare, O = occasional, C = common, A = abundant (see text for definitions); abundance differs significantly for the two sites only when noted. K and H denote specimens collected at Kokiwanee and Hathaway, respectively. Numbers are collection numbers of the author for voucher specimens, which are deposited at the herbarium of Manchester College, North Manchester, Indiana. *, indicates a taxon that is not native to Indiana. **, indicates a county record for Wabash County, Indiana.

PTERIDOPHYTES

ASPLENIACEAE

Asplenium platyneuron (L.) Britton, Sterns & Poggenb. Ebony spleenwort Young forest C K326 H756 **
Asplenium rhizophyllum L. Walking fern Gorge wall O H799

DRYOPTERIDACEAE

Athyrium filix-femina (L.) Roth ssp. *angustum* (Willd.) R.T. Clausen Lady fern Mesic forest R K1018 **
Cystopteris bulbifera (L.) Bernh. Bulblet fern Mesic forest, gorge wall O K577 H745
Cystopteris protrusa (Weath.) Blasdell Fragile fern Mesic forest C K459 H876 **
Diplazium pycnocarpon (Spreng.) Broun Glade fern Mesic forest R K558 **
Dryopteris carthusiana (Vill.) H.P. Fuchs Shield fern Mesic forest O K248
Polystichum acrostichoides (Michx.) Schott Christmas fern Mesic forest C K368 H746
Matteuccia struthiopteris (L.) Todaro Dryopteridaceae Ostrich fern Planted R K444 * **
Onoclea sensibilis L. Sensitive fern Forest edge O H947 **

EQUISETACEAE

Equisetum arvense L. Horsetail Streambank O K320 H764
Equisetum hyemale L. Horsetail Mesic forest O K289

OPHIOGLOSSACEAE

Botrychium dissectum Spreng. Grape fern Mesic forest O K523 H803 **
Botrychium virginianum (L.) Sw. Grape fern Mesic forest C K317 H855 **
Ophioglossum vulgatum L. Adders tongue fern Young forest O K401 **

THELYPTERIDACEAE

Phegopteris hexagonoptera (Michx.) Fée Beech fern Mesic forest R K266 **

GYMNOSPERMS

CUPRESSACEAE

Juniperus virginiana L. Red cedar Various O K399

PINACEAE

Pinus strobus L. White pine Planted O K403 H804 * **
Pinus sylvestris L. Scots pine Planted O K477 * **

ANGIOSPERMS
DICOTYLEDONS

ACANTHACEAE

Ruellia strepens L. Wild petunia Forest edge O K591 H932

ACERACEAE

Acer negundo L. Box elder Various C K380 H699
Acer nigrum Michx. f. Black maple Mesic forest A (K), R (H) K381 H790
Acer rubrum L. Red maple Mesic forest O K382
Acer saccharinum L. Silver maple Floodplain A (K), R (H) K521
Acer saccharum Marsh. Sugar maple Mesic forest A K383 H694

AMARANTHACEAE

Amaranthus hybridus L. Green amaranth Wet, open area O H983 * **

ANACARDIACEAE

Rhus aromatica Aiton Aromatic sumac Submesic forest O K518
Toxicodendron radicans (L.) Kuntze ssp. *radicans* Poison ivy Various A K1007 H1008

ANNONACEAE

Asimina triloba (L.) Dunal. Pawpaw Mesic forest A K348 H685

APIACEAE

Chaerophyllum procumbens (L.) Crantz. Wild chervil Mesic forest C K555 H849
Cicuta maculata L. Water hemlock Streambank O K486 H771
Conium maculatum L. Poison hemlock Open areas C K526 H992 *
Cryptotaenia canadensis (L.) DC Honewort Mesic forest A K329 H701
Daucus carota L. Wild carrot Roadside C K435 H733 *
Erigenia bulbosa (Michx.) Nutt. Harbinger of spring Mesic forest C K284 H828
Osmorhiza claytonii (Michx.) Clarke Sweet cicely Mesic forest A K360 H964 **
Osmorhiza longistylis (Torr.) DC Apiaceae Sweet cicely Mesic forest C K573 H949
Oxypolis rigidior (L.) Raf. Cowbane Fen R K256 **

Pastinaca sativa L. Wild parsnip Roadside O K464 H959 *
Sanicula canadensis L. Sanicle Mesic forest A K214 H680
Sanicula odorata (Raf.) K.M. Pryer & L.R. Phillippe Sanicle Mesic forest A K362 H749 **
Sanicula trifoliata E.P. Bicknell Sanicle Mesic forest O K633 H791
Taenidia integerrima (L.) Drude Yellow pimpernel Submesic forest O K593
Thaspium barbinode (Michx.) Nutt. Meadow parsnip Submesic forest O K353
Thaspium trifoliatum (L.) A. Gray Meadow parsnip Submesic forest O K668 H891 **
Zizia aurea (L.) W.D.J. Koch Golden alexanders Mesic forest R H864 **

APOCYNACEAE

Apocynum cannabinum L. Dogbane Old field C K297 H953
Vinca minor L. Periwinkle Mesic forest O K310 * **

ARALIACEAE

Aralia racemosa L. Spikenard Gorge O H784 **
Panax quinquefolius L. Ginseng Mesic forest O K650 H785 **

ARISTOLOCHIACEAE

Aristolochia serpentaria L. Virginia snakeroot Mesic forest O K267 H797
Asarum canadense L. Wild ginger Mesic forest C K325 H789

ASCLEPIADACEAE

Asclepias incarnata L. Swamp milkweed Wet, open area O K612 H966
Asclepias syriaca L. Common milkweed Disturbed areas C K456 H802
Asclepias tuberosa L. Butterflyweed Submesic forest O K457
Asclepias verticillata L. Whorled milkweed Disturbed areas O K651 **

ASTERACEAE

Achillea millefolium L. Yarrow Old field C K427 H913
Ageratina altissima (L.) King & H. Rob. White snakeroot Mesic forest A K514 H705
Ambrosia artemisiifolia L. Ragweed Roadside C K492 H728 **
Ambrosia trifida L. Giant ragweed Crop field C K522 H908
Anaphalis margaritacea (L.) Benth. Pearly everlasting Old field O H1000 **
Antennaria neglecta Greene Pussytoes Submesic forest O K314 H866
Antennaria plantaginifolia (L.) Richardson Pussytoes Submesic forest O K296 **
Anthemis cotula L. Stinking chamomile Planted R K428 * **
Arctium minus Schkuhr Burdock Disturbed areas C K652 H975 * **
Bidens cernua L. Beggarsticks Open, wet area O H1003
Bidens frondosa L. Beggar's ticks Open areas O K260
Bidens vulgata Greene Beggar's ticks Wet, open areas O H984 **
Cacalia atriplicifolia (L.) H. Rob. Indian plantain Open areas O K637
Cichorium intybus L. Chicory Roadside C K430 H730 * **
Cirsium discolor (Muhl. ex Willd.) Spreng. Field thistle Roadside O H721 **
Cirsium altissimum (L.) Hill Tall thistle Old field O K510 **
Cirsium arvense (L.) Scop. Canada thistle Disturbed areas C K432 H779 * **
Cirsium muticum Michx. Swamp thistle Fen R K251
Cirsium vulgare (Savi) Ten. Common thistle Old field O K494 * **
Conyza canadensis (L.) Cronquist Horseweed Old field C K538
Coreopsis tripteris L. Tall coreopsis Riverbank O K278
Erigeron annuus (L.) Pers. Fleabane Old field C K600 H934
Erigeron philadelphicus L. Fleabane Streambank C K331 H878
Erigeron strigosus Muhl. ex Willd. Fleabane Roadside O H723 **
Eupatoriadelphus maculatus (L.) King & H. Rob. Joe pye weed Old field O K512 **
Eupatorium perfoliatum L. Boneset Wet, open area O K513 H795 **
Eupatorium purpureum L. Joe pye weed Forest edge O K1012 H981 **
Euthamia graminifolia (L.) Nutt. Grass-leaved goldenrod Old field C K272 H805 **
Galinsoga quadriradiata Cav. Galinsoga Roadside O K496 * **
Helenium autumnale L. Sneezeweed Riverbank R K280
Helianthus decapetalus L. Thinleaf sunflower Forest edge O K222 **
Helianthus divaricatus L. Woodland sunflower Submesic forest O K631 **
Helianthus tuberosus L. Jerusalem artichoke Riverbank R K632 **
Heliopsis helianthoides (L.) Sweet False sunflower Disturbed areas O H777 **
Hieracium ×flagellare Willd. Hawkweed Submesic forest O K582 *
Hieracium caespitosum Dumort. Hawkweed Submesic forest O K581 * **
Hieracium gronovii L. Hawkweed Old field O K439 **
Lactuca biennis (Moench) Fernald Blue lettuce Mesic forest O H711
Lactuca canadensis L. Wild lettuce Old field O K500 H985
Lactuca floridana (L.) Gaertn. Woodland lettuce Forest edge O K656 **
Leucanthemum vulgare Lam. Oxeye daisy Old field C K390 H914 *
Packera glabella (Poir.) C. Jeffrey Butterweed Young forest O K565 H873 **
Packera obovata (Muhl. ex Willd.) W.A. Weber & A. Löve Roundleaf ragwort Mesic forest C K344 H838
Polymnia canadensis L. Pale leafcup Mesic forest C K467 **
Prenanthes alba L. White lettuce Submesic forest O K262 **
Prenanthes altissima L. Rattlesnake-root Submesic forest O K273 H1004 **
Ratibida pinnata (Vent.) Barnhart Prairie coneflower Old field C K451
Rudbeckia hirta L. Black-eyed susan Roadside C K506
Rudbeckia laciniata L. Cutleaf coneflower Streambank C K520 H700
Silphium perfoliatum L. Leafcup Riverbank O K489
Solidago altissima L. Tall goldenrod Old field A H817
Solidago caesia L. Wreath goldenrod Mesic forest A K548 H818
Solidago flexicaulis L. Zigzag goldenrod Mesic forest C K549 H786
Solidago gigantea Aiton Giant goldenrod Disturbed areas A K258 H800
Solidago nemoralis Aiton Gray goldenrod Submesic forest O K264 **
Solidago riddelli (Frank ex Riddell) Rydb. Riddell's goldenrod Fen R K550

Solidago rugosa Mill. Rough goldenrod Submesic forest O K265 **
Sonchus asper (L.) Hill Spiny sow thistle Crop field O H931 * **
Sonchus oleraceus L. Sow thistle Roadside O H657 * **
Symphyotrichum cordifolium (L.) G.L. Nesom Arrow-leaved aster Mesic forest A K261 H806 **
Symphyotrichum lanceolatum (Willd.) G.L. Nesom Panicled aster Swamp forest C K268 H811
Symphyotrichum lateriflorum (L.) A. Löve & D. Löve var. *lateriflorum* Aster Submesic forest O K269 **
Symphyotrichum novae-angliae (L.) G.L. Nesom New England aster Old field O K1014 H815
Symphyotrichum pilosum (Willd.) G.L. Nesom Oldfield aster Old field C K546 H816 **
Symphyotrichum puniceum (L.) A. Löve & D. Löve Aster Fen O K270 **
Symphyotrichum shortii (Lindl.) G.L. Nesom Short's aster Submesic forest O K277 **
Taraxacum officinale F.H. Wigg. Dandelion Roadside O K609 H738 * **
Tragopogon lamottei Rouy Goat's beard Roadside R H902 *
Verbesina alternifolia (L.) Britton ex Kearney Wingstem Streambank, young forest C K507 H714 **
Vernonia gigantea (Walter) Trel. Ironweed Roadside C K275 H732
Xanthium strumarium L. Cocklebur Disturbed areas O K658 H990

BALSAMINACEAE

Impatiens capensis Meerb. Jewelweed Streambank A K498 H783
Impatiens pallida Nutt. Jewelweed Streambank C K499 H782

BERBERIDACEAE

Berberis thunbergii DC Japanese barberry Mesic forest O H978 * **
Caulophyllum thalictroides (L.) Michx. Blue cohosh Mesic forest O K281
Jeffersonia diphylla (L.) Pers. Twinleaf Mesic forest O K321 H793 **
Podophyllum peltatum L. Mayapple Mesic forest C K342 H839 **

BETULACEAE

Carpinus caroliniana Walter Hop hornbeam Mesic forest O K524 H762
Corylus americana Walter Hazelnut Forest edge O K434
Ostrya virginiana (Mill.) K. Koch Musclewood Mesic forest O K639 H686

BIGNONIACEAE

Catalpa speciosa (Warder) Warder ex Engelm. Catalpa Forest edge R H813 *

BORAGINACEAE

Hackelia virginiana (L.) I.M. Johnst. Stickseed Disturbed areas C K630 H691
Mertensia virginica (L.) Pers. ex Link Virginia blue bell Riverbank O K292 **

BRASSICACEAE

Alliaria petiolata (M. Bieb.) Cavara & Grande Garlic mustard Mesic forest O (K), C(H) K294 H925 * **
Arabis laevigata (Muhl. ex Willd.) Poir. Smooth rockcress Mesic forest O K315 H860
Arabis shortii (Fernald) Gleason Short's rock cress Submesic forest O K557 H877
Barbarea vulgaris W.T. Aiton Winter cress Disturbed areas O K559 H844 *
Brassica nigra (L.) Koch Black mustard Roadside O K493 H962 * **
Capsella bursa-pastoris (L.) Medik. Shepherd's purse Crop field C H904 *
Cardamine bulbosa (Schreb. ex Muhl.) Britton, Sterns & Poggenb. Bittercress Mesic forest O K225
Cardamine concatenata (Michx.) Sw. Toothwort Mesic forest O K299 H830
Cardamine douglassii Britton Cress Mesic forest O K288 H825 **
Cardamine hirsuta L. Hairy bittercress Disturbed areas R K318 * **
Cardamine pensylvanica Muhl. ex Willd. Bittercress Disturbed areas O K365 H963 **
Hesperis matronalis L. Dame's rocket Roadside C K366 H894 *
Iodanthus pinnatifidus (Michx.) Steud. Rocket Riverbank O K584
Lepidium campestre (L.) W.T. Aiton Field cress Crop field C H899 *
Lepidium virginicum L. Peppergrass Crop field O K563 H897
Rorippa palustris (L.) Besser ssp. *fernaldiana* (Butters & Abbe) Jonsell Marsh cress Wet, open area O H971
Rorippa sylvestris (L.) Besser Yellowcress Riverbank O K621 * **

CAMPANULACEAE

Campanula rapunculoides L. European bluebell Planted R K429 * **
Campanulastrum americana (L.) Small Bluebell Mesic forest C K484 H713
Lobelia inflata L. Indian tobacco Old field O K482 **
Lobelia kalmii L. Kalm's lobelia Fen R K246
Lobelia siphilitica L. Great lobelia Various C K528 H709

CAPRIFOLIACEAE

Lonicera japonica Thunb. Japanese Honeysuckle Disturbed areas R K442 * **
Lonicera maackii (Rupr.) Herder Honeysuckle Various C K564 H761 * **
Lonicera reticulata Raf. Vine honeysuckle Submesic forest O K948 H587 **
Sambucus nigra L. ssp. *canadensis* (L.) R. Bolli Elderberry Mesic forest A K470 H796
Triosteum aurantiacum E.P. Bicknell Horse gentian Mesic forest C K274 H819
Viburnum acerifolium L. Maple-leaved viburnum Submesic forest O K551 H740
Viburnum lentago L. Nannyberry Young forest O K1013
Viburnum opulus L. v. *opulus* Highbush cranberry Roadside O K622 H956 * **
Viburnum prunifolium L. Blackhaw Mesic forest A K414 H678
Viburnum rafinesqueanum Schult. Downy arrowwood Submesic forest O K594

CARYOPHYLLACEAE

Arenaria serpyllifolia L. Thyme-leaved sandwort Disturbed O K364 * **
Cerastium arvense L. Field chickweed Disturbed areas C K327 H858

Dianthus armeria L. Deptford pink Old field C K487 H939 * **
Silene stellata (L.) W.T. Aiton Whorled catchfly Mesic forest O K634
Silene virginica L. Fire pink Submesic forest O K345 H888
Stellaria media (L.) Vill. Chickweed Crop field C K305 H900 *

CELASTRACEAE

Celastrus scandens L. Bittersweet Roadside R K624
Euonymus atropurpureus Jacq. Wahoo Mesic forest O K420
Euonymus obovatus Nutt. Running strawberry bush Streambank C K375 H693

CHENOPODIACEAE

Chenopodium album L. Lamb's quarters Crop field O H993 * **

CLUSIACEAE

Hypericum punctatum Lam. St. John's wort Old field O K497
Hypericum sphaerocarpum Michx. St. John's wort Riverbank O K242

CONVOLVULACEAE

Calystegia sepium (L.) R. Br. Hedge bindweed Disturbed areas O H974 **
Convolvulus arvensis L. Field bindweed Old field O K599 * **

CORNACEAE

Cornus alternifolia L.f. Alternate-leaved dogwood Mesic forest O K391 H812 **
Cornus drummondii C.A. Mey. Roughleaf dogwood Forest edge O K271 H808
Cornus florida L. Flowering dogwood Mesic forest O K392 H765
Cornus obliqua Raf. Dogwood Riverbank O K226
Cornus racemosa Gray dogwood Riverbank C K458

CRASSULACEAE

Penthorum sedoides L Ditch stonecrop Streambank O K640 H769
Sedum ternatum Michx. Woodland stonecrop Mesic forest O K554 H707

CUSCUTACEAE

Cuscuta cephalanthi Engelm. Dodder Streambank O H760 **

DIPSACACEAE

Dipsacus fullonum L. Teasel Roadside O K495 H731 * **

ELAEAGNACEAE

Elaeagnus umbellata Thunb. Autumn olive Old field C K330 H807 * **

EUPHORBIACEAE

Acalypha rhomboidea Raf. Three-seeded mercury Crop field O K635 H968
Chamaesyce nutans (Lag.) Small Spurge Roadside O H725 **
Euphorbia corollata L. Spurge Submesic forest O K601
Euphorbia dentata Michx. Spurge Roadside O K541 **

FABACEAE

Apios americana Medik. Groundnut Riverbank O K250 **
Cercis canadensis L. Redbud Mesic forest C K389
Desmodium canadense (L.) DC Tick trefoil Forest edge O K221 H982
Desmodium glutinosum (Muhl. ex Willd.) Alph. Wood Tick trefoil Riverbank O K227 **
Desmodium paniculatum (L.) DC Tick trefoil Old field O K659 **
Gleditsia triacanthos L. Honey locust Streambank C K462 H768
Glycine max (L.) Merr. Soybean Planted C H958 * **
Gymnocladus dioicus (L.) K. Koch Kentucky coffee tree Mesic forest, young forest R K527
Lespedeza virginica (L.) Britton Bush clover Submesic forest O K220 **
Lotus corniculatus L. Bird's foot trefoil Roadside O H954 * **
Medicago lupulina L. Black medic Disturbed areas O K419 H887 *
Melilotus officinalis (L.) Pall. Yellow sweet clover Disturbed areas C K340 H886 *
Robinia pseudoacacia L. Black locust Young forest O K370
Securigera varia (L.) Lassen Crown vetch Disturbed areas O K433 * **
Senna hebecarpa (Fernald) Irwin & Barneby Wild Senna Forest edge O K483 **
Trifolium pratense L. Red clover Roadside O K480 * **
Trifolium repens L. White clover Disturbed areas C K455 H692 * **
Vicia villosa Roth Vetch Wet, open areas O H955 * **

FAGACEAE

Fagus grandifolia Ehrh. Beech Mesic forest C K393 H742
Quercus alba L. White oak Submesic forest A K407 H743
Quercus muehlenbergii Englm. Chinquapin oak Mesic forest C K468 H770
Quercus rubra L. Red oak Mesic forest C K569 H704
Quercus velutina Lam. Black oak Submesic forest A K408

FUMARIACEAE

Corydalis flavula (Raf.) DC. Yellow corydalis Submesic forest O K319
Dicentra canadensis (Goldie) Walp. Squirrel corn Mesic forest O K300 H847
Dicentra cucullaria (L.) Bernh. Dutchman's breeches Mesic forest C K283 H823

GENTIANACEAE

Frasera caroliniensis Walter American columbo Submesic forest O K359 H850 **
Gentianella quinquefolia (L.) Small Stiff gentian Riverbank O K276 **

GERANIACEAE

Geranium maculatum L. Wild geranium Mesic forest A K334 H871

GROSSULARIACEAE

Ribes cynosbati L. Gooseberry Mesic forest A K575 H710

HAMAMELIDACEAE

Hamamelis virginiana L. Witch hazel Submesic forest C K397

HIPPOCASTANACEAE

Aesculus glabra Willd. Ohio buckeye Mesic forest C K384 H751

HYDRANGEACEAE

Hydrangea arborescens L. Wild hydrangea Riverbank, gorge walls C K440 H684

HYDROPHYLLACEAE

Hydrophyllum appendiculatum Michx. Appendaged waterleaf Mesic forest A K352 H848
Hydrophyllum canadense L. Canada water leaf Mesic forest O K421
Hydrophyllum macrophyllum Nutt. Large-leafed waterleaf Mesic forest O K398

JUGLANDACEAE

Carya cordiformis (Wangenh.) K. Koch Bitternut hickory Submesic forest C K385 H741
Carya ovalis (Wangenh.) Sarg. Sweet pignut hickory Submesic forest C K386
Carya ovata (Mill.) K. Koch Shagbark hickory Submesic forest C K387 H747
Juglans nigra L. Black walnut Mesic forest A K585 H715

LAMIACEAE

Agastache nepetoides (L.) Kuntze Giant hyssop Disturbed areas O K626 H776 **
Blephilia ciliata (L.) Benth. Hairy wood mint Submesic forest O K675 **
Blephilia hirsuta (Pursh) Benth. Wood mint Mesic forest C K474
Collinsonia canadensis L. Richweed Mesic forest C K511 **
Glechoma hederacea L. Ground ivy Disturbed areas O K572 H834 *
Lamium purpureum L. Purple deadnettle Disturbed areas O K338 H835 * **
Leonurus cardiaca L. Motherwort Old field O K476 *
Lycopus americanus Muhl. ex. W. Bartram Bugle Forest edge O K638 H809
Lycopus rubellus Moench Water horehound Riverbank R K666
Mentha ×*gracilis* Sole Red mint Riverbank O K660 * **
Mentha ×*piperita* L. Peppermint Fen O K254 * **
Mentha arvensis L. Field mint Fen O K253
Monarda fistulosa L. Bergamot Old field C K502 H970
Nepeta cataria L. Catnip Disturbed areas O H688 *
Prunella vulgaris L. Healall Various O K478 H755 *
Pycnanthemum virginianum (L.) T. Dur. & B.D. Jacks. ex B.L. Rob. & Fernald Mountain mint Fen R K450 **
Scutellaria incana Biehler Skullcap Mesic forest O K219 **
Scutellaria lateriflora L. Blue skullcap Mesic forest O K644 H977
Scutellaria ovata Hill Skullcap Mesic forest O K210
Stachys cordata Riddell Hedge nettle Mesic forest O K238 **
Stachys tenuifolia Willd. Hedge nettle Riverbank O K259
Teucrium canadense L. Germander Mesic forest O K490 H717

LAURACEAE

Lindera benzoin (L.) Blume Spicebush Mesic forest C K291 H681
Sassafras albidum (Nutt.) Nees Sassafras Forest edge O K547

LEMNACEAE

Lemna minor L. Duckweed Aquatic O H798 **

LIMNANTHACEAE

Floerkea proserpinacoides Willd. False mermaid Mesic forest C K301 H826

LINACEAE

Linum virginianum L. Yellow wild flax Submesic forest O K615 **

LYTHRACEAE

Lythrum alatum Pursh Winged loosestrife Fen R K244

MAGNOLIACEAE

Liriodendron tulipifera L. Tulip tree Mesic forest A K400

MALVACEAE

Abutilon theophrasti Medik. Velvetleaf Crop field O H991 *

MENISPERMACEAE

Menispermum canadense L. Moonseed Mesic forest O K463 H677

MONOTROPACEAE

Monotropa uniflora L. Indian pipe Mesic forest O K1011 **

MORACEAE

Maclura pomifera (Raf.) C.K. Schneid. Osage orange Young forest R K669 H1010 * **
Morus rubra L. Mulberry Young forest O K625 H907

OLEACEAE

Forsythia viridissima Lindl. Forsythia Planted R K673 * **
Fraxinus americana L. White ash Mesic forest A K394 H697
Fraxinus nigra Marsh. Black ash Seep O K417
Fraxinus pennsylvanica Marsh. Green ash Mesic forest O K614
Fraxinus quadrangulata Michx. Blue ash Mesic forest O K395 H754
Ligustrum vulgare L. European privet Various O K586 H759 * **

ONAGRACEAE

Circaea lutetiana L. Enchanter's nightshade Mesic forest C K431 H957
Epilobium coloratum Biehler Willowherb Wet, open areas O K552 H989
Oenothera biennis L. Evening primrose Roadside C K529 H729 **

OXALIDACEAE

Oxalis stricta L. Yellow sorrel Disturbed areas C K361 H724

PAEONACEAE

Paeonia officinalis L. Peony Planted R K654 * **

PAPAVERACEAE

Sanguinaria canadensis L. Bloodroot Mesic forest O K293 H822
Stylophorum diphyllum (Michx.) Nutt. Wood poppy Mesic forest O K323 H837

PHYTOLACCACEAE

Phytolacca americana L. Pokeweed Disturbed areas O K515 H687

PLANTAGINACEAE

Plantago rugelii Decne. Plantain Disturbed areas O K532 H767 **
Plantago lanceolata L. Narrow-leaved plantain Roadside O K447 *

PLATANACEAE

Platanus occidentalis L. Sycamore Streambank C K466 H737

POLEMONIACEAE

Phlox divaricata L. Blue phlox Mesic forest C K341 H854
Phlox paniculata L. Fall phlox Riverbank O K641 **
Polemonium reptans L. Jacob's ladder Mesic forest O K303 H846

POLYGONACEAE

Polygonum arenastrum Jord. ex Boreau Knotweed Crop field O H936 * **
Polygonum cespitosum Blume Smartweed Streambank O K533 H979 * **
Polygonum hydropiperoides Michx. Smartweed Disturbed areas O H716
Polygonum lapathifolium L. Smartweed Wet, open areas O K663 H986 **
Polygonum pensylvanicum L. Smartweed Wet, open areas O H988
Polygonum persicaria L. Lady's thumb Wet, open areas O H937 *
Polygonum punctatum Elliot Smartweed Streambank O K517 H773
Polygonum scandens L. Climbing false buckwheat Disturbed areas O K543 H950
Polygonum virginianum L. Virginia knotweed Mesic forest C K505 H706 **
Rumex acetosella L. Sheep sorrel Disturbed areas O K371 *
Rumex crispus L. Curly dock Crop field O K469 H895 * **
Rumex obtusifolius L. Dock Seep O K592 * **

PORTULACACEAE

Claytonia virginica L. Spring beauty Mesic forest C K282 H832

PRIMULACEAE

Lysimachia ciliata L. Fringed loosestrife Mesic forest O K443 H940
Lysimachia lanceolata Walter Lanceleaf loosestrife Submesic forest O K218 **
Lysimachia nummularia L. Moneywort Streambank O K424 H698 * **
Samolus valerandi (L.) ssp. *parviflorus* (Raf.) Hultén Water pimpernel Disturbed areas O K607 **

RANUNCULACEAE

Actaea pachypoda Elliott Doll's eyes Mesic forest O K363
Anemone quinquefolia L. Wood anemone Mesic forest O K295 H874
Anemone virginiana L. Thimbleweed Forest edge O K611 H926
Aquilegia canadensis L. Columbine Submesic forest, gorge wall C K347 H870
Caltha palustris L. Marsh marigold Fen O K298
Clematis virginiana L. Virgin's bower Disturbed areas O K525
Delphinium tricorne Michx. Larkspur Mesic forest O K350
Enemion biternatum Raf. False rue anemone Mesic forest C K302 H824
Hepatica nobilis Schreb. Hepatica Mesic forest O K285 H831
Ranunculus abortivus L. Littleleaf buttercup Various O K304 H859
Ranunculus hispidus Michx. var. *nitidus* (Chapm.) T. Duncan Buttercup Streambank O K322 H863
Ranunculus recurvatus Poir. Hooked buttercup Young forest O K369 H872
Thalictrum dioicum L. Early meadow rue Mesic, submesic forest O K306 H865
Thalictrum revolutum DC. Meadow rue Mesic forest O K645 **
Thalictrum thalictroides (L.) Eames & B. Boivin Rue anemone Mesic forest O K313 H856 **

RHAMNACEAE

Frangula alnus Mill. Buckthorn Fen R K670 * **

ROSACEAE

Agrimonia gryposepala Wallr. Agrimony Old field O H987
Agrimonia pubescens Wallr. Agrimony Forest edge O K636 H965
Amelanchier laevis Wiegand Alleghany serviceberry Mesic forest O K312 H862
Chaenomeles speciosa (Sweet) Nakai Flowering quince Planted R K674 * **
Crataegus punctata Jacq. Hawthorn Forest edge O H774 **
Fragaria virginiana Duchesne Strawberry Old field O K332
Geum canadense Jacq. White avens Mesic forest C K423 H933
Geum vernum (Raf.) Torr. & A. Gray Spring avens Mesic forest C K335 H845
Malus pumila Mill. Apple Roadside O H735 * **
Physocarpus opulifolius (L.) Maxim Ninebark Submesic forest O K402
Potentilla norvegica L. Cinquefoil Roadside O K449 H727
Potentilla recta L. Cinquefoil Old field O K616 *
Potentilla simplex Michx. Cinquefoil Forest edge O K343 H915 **
Prunus serotina Ehrh. Black cherry Mesic, submesic forest A K405 H703
Prunus virginiana L. Chokecherry Mesic, submesic forest O (K), C(H) K868 H702
Rosa canina L. Dog rose Old field O H911 * **
Rosa carolina L. Pasture rose Submesic forest O K617
Rosa multiflora Thunb. Multiflora rose Young forest, old field C K409 H696 * **
Rosa setigera Michx. Climbing rose Roadside O K618 H951
Rubus allegheniensis Porter Blackberry Old field O H967
Rubus flagellaris Willd. Trailing blackberry Old field O H479 **
Rubus occidentalis L. Black raspberry Old field C K619 H708 **

RUBIACEAE

Galium aparine L. Bedstraw Various C K333 H861
Galium circaezans Michx. Bedstraw Submesic forest O K579 H748
Galium concinnum Torr. & A. Gray Bedstraw Mesic forest O K580 H920 **
Galium triflorum Michx. Bedstraw Mesic forest O K602 H757 **
Houstonia longifolia Gaertn. Bluets Submesic forest O K583
Mitchella repens L. Partridgeberry Submesic forest O H739 **

RUTACEAE

Ptelea trifoliata L. Wafer ash Forest edge O K406 H753 **
Zanthoxylum americanum Mill. Prickly ash Mesic forest C K418

SALICACEAE

Populus deltoides Marshall Cottonwood Streambank O K425
Populus grandidentata Michx. Bigtooth Aspen Young forest O K605 **
Salix discolor Muhl. Pussy willow Fen O K647

Salix eriocephala Michx. Missouri River willow Forest edge O K534 **
Salix interior Rowlee Sandbar willow Fen O K606
Salix nigra Marsh. Black willow Roadside O H960

SANTALACEAE

Comandra umbellata (L.) Nutt. Bastard toadflax Submesic forest O K328 **

SAXIFRAGACEAE

Heuchera americana L. Alumroot Submesic forest O K367 H890
Mitella diphylla L. Miterwort Mesic forest R K867 H857
Parnassia glauca Raf. Grass of parnassus Fen O K530

SCROPHULARIACEAE

Agalinis tenuifolia (Vahl) Raf. Gerardia Submesic forest O K655
Aureolaria virginica (L.) Pennell False foxglove Submesic forest R K628 **
Mimulus alatus Aiton Monkeyflower Streambank R H976
Mimulus ringens L. Monkeyflower Streambank O K255
Pedicularis lanceolata Michx. Fen betony Fen O K542
Penstemon calycosus Small Beardtongue Fen O K588 **
Penstemon digitalis Nutt. ex Sims Beardtongue Pond margin O K574 **
Penstemon hirsutus (L.) Willd. Beardtongue Submesic forest O K589
Scrophularia marilandica L. Figwort Disturbed areas O K643 H778
Verbascum thapsus L. Mullein Disturbed areas O K664 H689 * **
Veronica officinalis L. Common speedwell Various O K413 H912 * **
Veronica peregrina L. Neckweed Crop field O H898
Veronica serpyllifolia L. Thymeleaf speedwell Roadside O K566 * **

SIMAROUBACEAE

Ailanthus altissima (Mill.) Swingle Tree of heaven Old field O K508 * **

SOLANACEAE

Physalis heterophylla Nees Ground cherry Disturbed areas O K503 H722
Solanum carolinense L. Horse nettle Old field O K454 H969
Solanum ptycanthum Dunal Black nightshade Riverbank O K257 **

STAPHYLEACEAE

Staphylea trifolia L. Bladdernut Streambank O K426 H781

THYMELAEACEAE

Dirca palustris L. Leatherwood Seep R K578

TILIACEAE

Tilia americana L. Tiliaceae Basswood Mesic forest A K410 H744

ULMACEAE

Celtis occidentalis L. Hackberry Mesic forest C K388 H695
Ulmus americana L. American elm Mesic forest A K411 H734
Ulmus rubra Muhl. Slippery elm Mesic forest A K412 H763

URTICACEAE

Boehmeria cylindrica (L.) Sw. False nettle Young forest O H683
Laportea canadensis (L.) Wedd. Wood nettle Mesic forest C K501 H946
Pilea pumila (L.) A. Gray Clearweed Various C K504 H712
Urtica dioica L. Stinging nettle Various O H766 *

VALERIANACEAE

Valeriana pauciflora Michx. Valerian Mesic forest O K355 **

VERBENACEAE

Phryma leptostachya L. Lopseed Mesic forest O K465 H676
Phyla lanceolata (Michx.) Greene Fogfruit Riverbank O K642
Verbena urticifolia L. White vervain Disturbed areas O K472 H690 **

VIOLACEAE

Hybanthus concolor (T.F. Forst.) Spreng. Green violet Mesic forest O (K), C (H) K351 H787 **
Viola canadensis L. Canada violet Mesic forest O K567 **
Viola labradorica Schrank Alpine violet Submesic forest O K924 H875 **
Viola pubescens Aiton Downy yellow violet Mesic forest C K311 H853
Viola rostrata Pursh Beaked violet Submesic forest O H851 **
Viola sororia Willd. Common blue violet Various C K373 H836
Viola striata Aiton Cream violet Mesic forest C K346 H852

VITACEAE

Parthenocissus quinquefolia (L.) Planch. Virginia creeper Various C K531 H679
Vitis aestivalis Michx. Summer grape Young forest O H905 **
Vitis riparia Michx. River grape Various C K595 H810

ANGIOSPERMS
MONOCOTYLEDONS

ALISMATACEAE

Alisma subcordatum Raf. American water plantain Pond margin O K627 **

ARACEAE

Arisaema dracontium (L.) Schott Green dragon Mesic forest O K374
Arisaema triphyllum (L.) Schott Jack in the pulpit Mesic forest C K316 H841
Symplocarpus foetidus (L.) Salisb. ex Nutt. Skunk cabbage Seep C K286 **

COMMELINACEAE

Tradescantia subaspera Ker Gawl. Spiderwort Various A K471 H788

CYPERACEAE

Carex albursina E. Sheld. Sedge Mesic forest C K560 H880 **
Carex amphibola Steudel Sedge Mesic forest R K236 **
Carex blanda Dewey Sedge Submesic forest O K230
Carex cephalophora Muhl. ex Willd. Sedge Mesic forest R K231 **

Carex conjuncta Boott Sedge Wet, open areas O H910 **
Carex cristatella Britton Sedge Young forest O K613 **
Carex davisii Schwein. & Torr. Sedge Young forest O K672 H909 **
Carex emoryi Dewey Sedge Riverbank C K232 **
Carex frankii Kunth Cattail sedge Wet, open areas O K597 H935
Carex gracillima Schwein. Sedge Mesic forest O K237 **
Carex granularis Muhl. ex Willd. Sedge Old field C K228 H917 **
Carex grayi Carey Gray's sedge Young forest O H682
Carex grisea Wahlenb. Sedge Mesic forest O H882 **
Carex hirsutella Mack. Sedge Mesic forest O K228 H892 **
Carex hirtifolia Mack. Sedge Young forest O K415
Carex hitchcockiana Dewey Sedge Submesic forest O K416 **
Carex hystericina Muhl. ex Willd. Sedge Fen O K211 **
Carex jamesii Schwein. Sedge Mesic forest C K377 H881
Carex laevivaginata (Kük.) Mack. Sedge Fen O K212 **
Carex laxiculmis Schwein. Sedge Mesic forest O K378 **
Carex laxiflora Lam. Sedge Submesic forest O K233
Carex molesta Mack ex Bright Sedge Wet, open areas O H942
Carex normalis Mack. Sedge Streambank O K376
Carex oligocarpa Schkuhr ex Willd. Sedge Young forest R K422 **
Carex pensylvanica Lam. Sedge Submesic forest O K561 H821 **
Carex radiata (Wahlenb.) Small Sedge Mesic forest O K349 **
Carex rosea Schkuhr ex Willd. Sedge Submesic forest O K568 H929 **
Carex shortiana Dewey Sedge Disturbed areas O H916
Carex sparganioides Muhl. ex Willd. Sedge Submesic forest O K207 H879
Carex stipata Muhl. ex Willd. Sedge Seep O K202 **
Carex swanii (Fern.) Mack Sedge Submesic forest O K485 H928 **
Carex vulpinoidea Michx. Sedge Forest edge O K623 H918
Cyperus strigosus L. Nutsedge Wet, open areas O K653 H972
Eleocharis erythropoda Steud. Spikerush Fen R K475
Eleocharis obtusa (Willd.) Schult. Spikerush Pond margin O K571
Eleocharis palustris (L.) Roem. & Schult. Spikerush Fen O K475 **
Rhynchospora capillacea Torr. Needle beaksedge Fen O K519
Scirpus atrovirens Willd. Bulrush Disturbed areas O K215 H801
Scirpus hattorianus Makino Woolgrass Fen O K215 **
Scirpus pendulus Muhl. Bulrush Pond margin O K453

DIOSCOREACEAE

Dioscorea villosa L. Wild yam Submesic forest O K460

IRIDACEAE

Iris germanica L. Iris Planted R K337 * **
Sisyrinchium angustifolium Mill. Blue-eyed grass Disturbed areas O K203 H923

JUNCACEAE

Juncus dudleyi Wiegand Rush Fen O H243
Juncus tenuis Willd. Path rush Disturbed areas O K441 H896 **
Luzula multiflora (Ehrh.) Lej. Woodrush Mesic forest O K339 H884

LILIACEAE

Allium canadense L. Wild onion Mesic forest O K201 H889
Allium cernuum Roth Nodding onion Submesic forest O K239
Allium tricoccum Aiton Ramps Mesic forest C K610 H829 **
Camassia scilloides (Raf.) Cory Wild camas Mesic forest O K224
Erythronium americanum Ker Gawl. Trout lily Mesic forest O K290 H842 **
Hemerocallis fulva L. Day lily Roadside O K438 H952 *
Hypoxis hirsuta (L.) Coville Yellow star grass Submesic forest O K336
Maianthemum racemosum (L.) Link False solomon's seal Mesic forest C K608 H752
Maianthemum stellatum (L.) Link Starry solomon's seal Fen O K372
Polygonatum biflorum (Walter) Elliot Solomon's seal Mesic forest O K516
Polygonatum pubescens (Willd.) Pursh True solomon's seal Mesic forest O H792
Trillium flexipes Raf. Drooping trillium Mesic forest O K354 **
Trillium grandiflorum (Michx.) Salisb. White trillium Mesic forest O K307 H840
Trillium nivale Riddell Snow trillium Mesic forest O K287 H827
Trillium recurvatum Beck Prairie trillium Mesic forest C K308 H843
Trillium sessile L. Toadshade trillium Mesic forest C K309 H833
Uvularia grandiflora Sm. Bellwort Mesic forest O K324 **
Veratrum woodii J.W. Robbins ex Alph. Wood False hellebore Mesic, submesic forest O K491 **

ORCHIDACEAE

Dactylorhiza viridis (L.) R.M. Bateman, A.M. Pridgeon & M.W. Chase Long-bracted orchid Young forest R K1016
Goodyera pubescens (Willd.) R. Br. Rattlesnake plantain Young forest R K396 **
Liparis liliifolia (L.) Rich. ex Ker Gawl. Twayblade Mesic, submesic forest O K379 H980
Liparis loeselii (L.) Rich. Orchidaceae Twayblade Fen R K229 **
Spiranthes cernua (L.) Rich. Ladies tresses orchid Old field O K553
Spiranthes lacera (Raf.) Raf. Ladies tresses orchid Old field O K537 **

POACEAE

Agrostis gigantea Roth Bentgrass Old field O K235 * **
Andropogon gerardii Vitman Big bluestem Riverbank R K509
Brachyelytrum erectum (Schreb. ex Spreng.) P. Beauv. Long-awned woodrush Mesic forest O K629 **
Bromus inermis Leyss. Brome Roadside C K570 * **
Bromus pubescens Muhl. ex Willd. Woodland brome Submesic forest O K206 H927 **
Bromus racemosus L. Brome Crop field R H938 * **
Calamagrostis canadensis (Michx.) P. Beauv. Bluejoint grass Riverbank R K240
Cinna arundinacea L. Wood reed Mesic forest C K661 H775
Dactylis glomerata L. Orchard grass Crop field O K358 H901 * **
Danthonia spicata (L.) P. Beauv. ex Roem. & Schult. Poverty grass Various O K208 H919

Diarrhena obovata (Gleason) Brandenburg Beak grass Riverbank O K252 **
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark var. *fasciculatum* (Torr.) Freckmann Panic grass Old field O K603 H943 **
Dichanthelium latifolium (L.) Gould & C.A. Clark Panic grass Riverbank O K213
Dichanthelium linearifolium (Scribn. ex Nash) Gould Panic grass Submesic forest R K209 **
Digitaria sanguinalis (L.) Scop. Crabgrass Roadside O K539 * **
Echinochloa crus-galli (L.) Beauv. Barnyard grass Wet, open area O H973 *
Elymus hystrix L. Bottlebrush grass Mesic forest O K436 H750
Elymus riparius Wiegand Ryegrass Streambank C K204 H772 **
Elymus villosus Muhl. ex Willd. Hairy wild rye Mesic forest C K234 **
Elymus virginicus L. Ryegrass Mesic forest O H718
Eragrostis spectabilis (Pursh) Steud. Love grass Old field O K540 **
Festuca pratensis (Huds.) P. Beauv. Fescue Old field O K437 * **
Festuca rubra L. Red fescue Old field O K488 * **
Festuca subverticillata (Pers.) Alexeev Fescue Young forest C K205 H922
Glyceria striata (Lam.) Hitchcock Fowl mannagrass Streambank C K216 H794
Leersia oryzoides (L.) Sw. Rice cutgrass Open, wet area O K820 H1002 **
Leersia virginica Willd. Whitegrass Mesic forest C K245 H720
Lolium perenne L. Ryegrass Disturbed areas O H945 * **
Muhlenbergia glomerata (Willd.) Trin. Muhly grass Fen R K279 **
Muhlenbergia mexicana (L.) Trin. Muhly grass Submesic forest O K223 **
Panicum capillare L. Witch grass Roadside O K662
Panicum dichotomiflorum Michx. Panic grass Wet, open areas O H1001 **
Phalaris arundinacea L. Reed canary grass Disturbed areas O K590 H780 * **
Phleum pratense L. Timothy Disturbed areas O K446 H941 * **
Poa pratensis L. Bluegrass Young forest O K604 H921 * **
Poa sylvestris A. Gray Bluegrass Mesic forest C K404 H883
Schedonorus phoenix (Scop.) Holub Tall fescue Disturbed areas C K671 H719 * **
Schizachyrium scoparium (Michx.) Nash Little bluestem Submesic forest O K263 **
Setaria faberi Herrm. Foxtail grass Disturbed areas O H814 * **
Setaria pumila (Poir.) Roem. & Schult. Foxtail grass Roadside O K535 H726 * **
Setaria viridis (L.) P. Beauv. Foxtail grass Roadside O K544 * **
Tridens flavus (L.) Hitchc. var. flavus Redtop Old field O K545 **

POTAMOGETONACEAE

Potamogeton nodosus Poir. Pondweed Aquatic O K448 **

SMILACACEAE

Smilax herbacea L. Carrion flower Forest edge O K665 H906 **
Smilax tamnoides L. Greenbrier Forest edge O K536 H758

SPARGANIACEAE

Sparganium eurycarpum Engelm. Burreed Pond margin O K576

TYPHACEAE

Typha latifolia L. Cattail Pond margin O K481 **

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