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Vegetation of Tomlinson Pioneer Cemetery Prairie Nature Preserve, Champaign County, Illinois

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ABSTRACT

Tomlinson Pioneer Cemetery Prairie Nature Preserve, located in Champaign County, Illinois, USA, is a 0.4 ha savanna remnant. This plant community type was once common across central Illinois. During the 2013 growing season, we visited the site to record vascular plant species present. We also conducted a quantitative vegetation survey late in the growing season to determine species composition. From these surveys measures of floristic conservation value were calculated including the Floristic Quality Index (*I*), Shannon diversity index (H'), and Effective Species Richness. A total of 125 vascular plant species were found comprised of 87 species of dicots and 38 species of monocots. Twenty-two non-native species were found comprising about 17% of the site flora. Dominant species were *Helianthus hirsutus* and *Poa pratensis* followed by *Corylus americana*, *Andropogon gerardii*, and *Sorghastrum nutans*. The site had an *I* value of 32.7, an H' of 3.3, and Effective Species Richness of 27.1. Species richness and diversity is comparable to prairie and savanna remnants in the region but floristic conservation value is slightly lower due to relatively high presence of non-native species. Continued management to control unwanted woody and non-native plant species is recommended to maintain the uncommon vegetation community at this site.

INTRODUCTION

Tallgrass prairie is one of the most endangered ecosystems in the world (Noss et al. 1995, Samson and Knopf 1996), and savannas associated with tallgrass prairie are even more imperiled (Nuzzo 1986). Savannas were thought to have once been among the most widespread and characteristic plant communities in Illinois often occurring in broad belts where oak-hickory forests and tallgrass prairie met (Anderson 1983, 2006). In the early 19th century, approximately 11-13 million ha of savanna existed within portions of Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, and Ohio (Nuzzo 1986). Today, an estimated 0.2% of original savanna remains (Nuzzo 1986).

Savanna is a vegetation community transitional between forest and prairie (Curtis 1959, Nuzzo 1986, Taft 1997). Forests are dominated by trees with a distinct leaf-canopy; savannas are characterized by widely spaced trees and an understory of grasses, forbs, sedges, and shrubs (IDNR 2012); and tallgrass prairies are dominated by grasses and forbs with very few or no trees. Historically in areas with deep soils that did not limit tree growth due to edaphic factors, fire regimes helped determine savanna vegetation structure (Abrams 1992, Bowles et al. 1994, Faber-Langendoen and Davis 1995, Tester 1989). Few intact savannas exist today due to agricultural land conversion as well as fire cessation. When periodic fires ceased, many savannas rapidly converted to closed-canopy forest (Curtis 1959, Bowles and McBride 1998).

With so little extant savanna, it is imperative to document the vegetation composition of high-quality remnants. This study was undertaken to record vascular plant species at a remnant savanna and to determine the vascular plant species composition, floristic quality, and diversity.

STUDY SITE

Tomlinson Pioneer Cemetery Prairie Nature Preserve (TPCP) is located in Kerr Township in the northeastern corner of Champaign County (NE ¼ of the NW ¼ SEC 21, T22N R14 W 2PM; 40.356455° N, 87.943949° W), about 38 km northeast of Urbana, Illinois (Figure 1). This 0.4 ha (1 acre) preserve is owned by the Champaign County Forest Preserve District. TPCP sits on a gently sloping ridge above the Middle Fork of the Vermilion River. The ridge is composed of sands and gravels that are part of a valley train, which is a long, narrow body of glacial outwash confined within a valley. The soils at TPCP are comprised of well-drained Ockley and Kishwaukee soils. Both soil series consists of silt and clay loam soils on stream terraces and outwash plains formed in a thin layer of loess and in the underlying loamy, sandy, and gravelly outwash over sand and gravel (Soil Survey Staff 2018). TPCP is surrounded by row-crop agriculture except for the northeast corner that is adjacent to a fallow agricultural field. This fallow field is in the riparian zone of the Middle Fork of the Vermilion River and is dominated by non-native plant species.

At first glance vegetation at TPCP is characteristic of tallgrass prairie with *Andropogon gerardii* and *Sorghastrum nutans* evident, but further examination reveals a natural plant community more accurately described as dry-mesic savanna (White and Madany 1978, McFall 1983). Clues include a few large, mature *Quercus macrocarpa* and *Quercus imbricaria* trees within the preserve as well as characteristic savanna plants such as *Silene stellata*, *Camassia scilloides*, *Corylus americana*, and *Smilax tamnoides* var. *hispida* (Betz and Lamp 1992, Taft 1997). An examination of the historic vegetation based on the Public Land Survey plats (ca. 1821) show that TPCP sat in an area marked "Prairie" and just west of an area marked "Timber" along the Middlefork of the Vermilion River (Szafoni et al. 2002).

The earliest burial at TPCP was in 1846, and the land was deeded as cemetery in 1852. There were about 250 burials from 1846 to 1945. It is assumed that the land was never plowed for agriculture; soil was periodically disturbed for human burial. Notes made by E. Hanson (unpublished data) show that the cemetery was essentially abandoned in the 1930s and was covered in 'woody brush.' It was cleared of brush by 1940, but by 1970 it was abandoned again. In 1976, Hanson and others started management of the prairie by clearing woody brush, removing invasive plant species, and implementing pre-

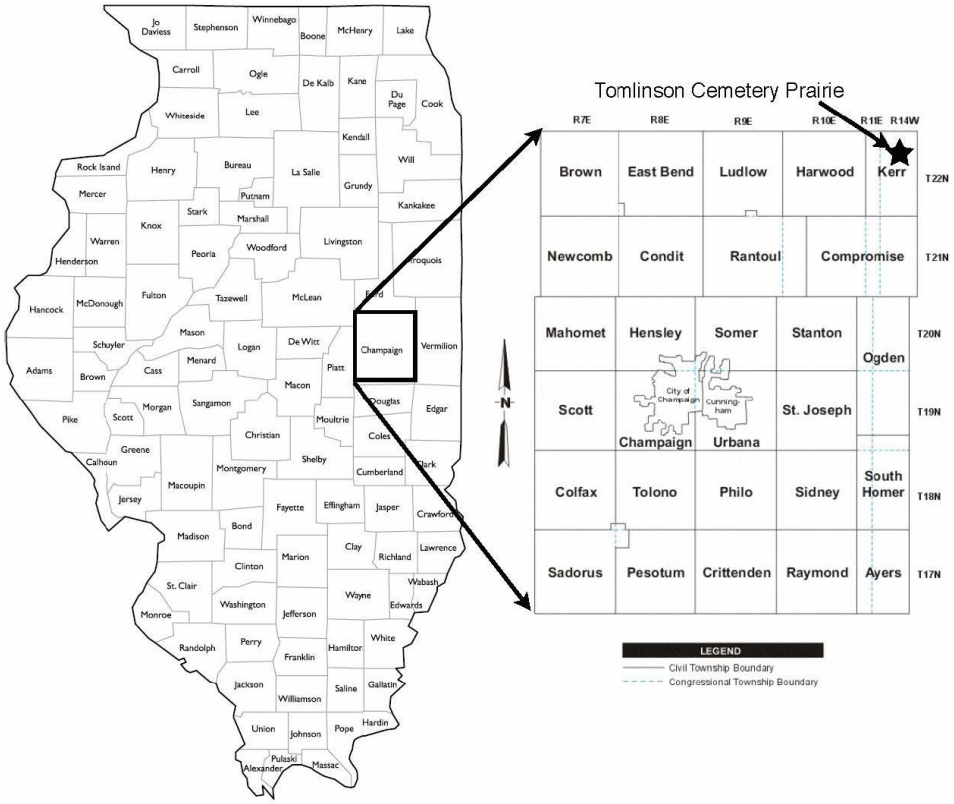

Figure 1. Location of the study area, Tomlinson Pioneer Cemetery Prairie Nature Preserve, in Kerr Township, northeast corner of Champaign County, east-central Illinois, USA.

scribed fire. TPCP was formally dedicated and protected as nature preserve in 1985 (McFall and Karnes 1995). At the time of dedication, McFall (1983) noted 45 native species with *Quercus macrocarpa* and *Q. imbricaria* as the dominant trees and *Andropogon gerardii* and *Sorghastrum nutans* as the dominant groundcover species. Since 1985 management of TPCP, conducted by Champaign County Forest Preserve District staff, has consisted of prescribed fire every one to two years, occasional mechanical thinning of *Corylus americana*, and annual removal (i.e. hand pulling) of *Melilotus* spp. (M. Daab, pers. comm.).

Climate at TPCP is continental with warm summers and cold winters. Based on weather data from Urbana, about 38 km to the southwest of TPCP, the mean annual precipitation (1981-2010) is 105.1 cm, with July having the highest average rainfall amount (11.9 cm). Mean annual temperature (1981-2010) is 10.9° C with the hottest month being July (average of 23.8° C), and the coldest January (average of -4.4° C). Average length of growing season (i.e. temperature above 0° C, 1981-2010) is 183 days (Midwestern Regional Climate Center 2018).

METHODS

We visited TPCP seven times during the 2013 growing season: May 14, June 3, June 24, July 15, August 6, August 26, and September 16. During each visit, we walked through the entire preserve and recorded vascular plant species observed, particularly those in flower or fruit. Plants that could not be readily identified in the field were sparingly collected for determination in the laboratory. No voucher specimens were made during this study due to the small size of the preserve, concern for potential impact to the population of uncommon plants, and lack of permission to collect voucher specimens. Nomenclature follows Mohlenbrock (2014). Determination of native and non-native species follows Taft et al. (1997).

The floral conservation value was assessed based on species observed using floristic quality assessment, *I* (Swink and Wilhelm 1994, Taft et al. 1997). Floristic quality assessment utilizes "coefficient of conservatism" (*C*) values, ranging from 0 to 10 that have been assigned to each plant species in Illinois based on the species tolerance to disturbance and its fidelity to habitat integrity (Taft et al. 1997). For example, highly conservative species (*C*=7-10) are only found in minimally degraded natural areas whereas species that persist in or readily invade degraded areas are given lower numbers. Non-native species are assigned a *C* value of zero. The mean coefficient of conservatism ($\overline{C}$) is calculated first: $\overline{C} = (\Sigma C)/N$ where *C* is the coefficient of conservatism of each species observed and *N* is the total number of species. Floristic quality assessment follows: $I = \overline{C}\sqrt{N}$. Mean *C* has been shown to be a successful metric of anthropogenic disturbance (e.g. Matthews 2003).

In late August and early September of 2013 five 50 m long transects were located at even intervals (10 m apart) running east west across the preserve to quantitatively survey the vegetation. Surveys were conducted in the late summer to maximize the number of species that could be successfully identified and coincide with other grassland sampling protocols (e.g. Molano-Flores 2002). The start and end points of each transect were 10 m from the east and west edges of the preserve. Along each transect, ten ¼ m^2 (0.5 x 0.5 m) quadrats were located at 5 m intervals for a total of 50 quadrats. A coin flip was used to determine if the quadrat was placed on the north or south side of the transect line at each interval. A random number generator (Random # app v. 2.2.2, Alejandro Vargas) was used to determine the number of meters (0 to 4) the quadrat was located perpendicular from the transect line. All plant species rooted within each quadrat were identified and cover estimated. Species cover was determined using a modified Daubenmire system (Daubenmire 1959, Bailey and Poulton 1968) as follows: Class A = <1%; class B = >1 to 5%; class C = >5 to 25%; class D = >25 to 50%; class E = >50 to 75%; class F = >75 to 95%; class G = >95 to 100%. The midpoint value of each class was used to calculate total and relative cover of each species observed in each quadrat. Midpoints were transformed into an area value (m^2) by multiplying the fractional midpoint value by the

total quadrat area (0.25 m^2). The frequency of each species encountered was calculated (number of occurrences/50). An importance value (IV200) was then calculated for each species by summing relative cover and relative frequency. Shannon's diversity index (H') was calculated as $H' = -\Sigma(p_i)\ln(p_i)$ where p_i is the relative cover of species i. This index takes into account the number of species present (i.e. richness) as well as the abundance (i.e. cover) of each species. Evenness (E) was calculated, E = H'/ln(s) where s is species richness, as a measure of relative species abundance. Effective species richness was then calculated as $e^{H'}$; $e^{H'}$ is the number of equally abundant species necessary to produce the observed value of diversity. The conversion from an index of diversity (H') to an effective number of species ($e^{H'}$) mathematically produces a true diversity of the community, measured in units of species, and allows for direct comparison and interpretation (Jost 2006).

RESULTS

A total of 125 species within 97 genera and 50 families were observed (Appendix I). No ferns or fern allies were found. There were 24 genera of monocots in 11 families and 73 genera of dicots in 39 families. We observed 20 species of woody plants (16%) and 22 species considered non-native (17.6%). The predominant plant families were the Asteraceae with 24 species observed (19.2%), the Poaceae with 16 species (12.8%), and the Cyperaceae with 10 species (8%). No species listed as threatened or endangered were encountered. The Floristic Quality Index (*I*) for TPCP was 32.7 with a $\overline{C}$ value of 2.9 for all species. When calculated using native species only, the FQI is 36.1 with a $\overline{C}$ value of 3.6.

Seventy five species were encountered in the quantitative survey. Of these taxa *Helianthus hirsutus* was most important having a frequency of 94%, a total cover of 3.1 m^2, and an importance value (IV200) of 27.57 (Table 1). A close second was a non-native grass, *Poa pratensis*, with a frequency of 90%, a total cover of 1.5 m^2, and an IV of 17.96, followed by *Corylus americana*, *Andropogon gerardii*, and *Sorghastrum nutans*. The Shannon diversity index (H') for TPCP was 3.26, evenness (E) was 0.68, and the effective species richness was 26.05.

Table 1. Frequency (%), cover (m^2), relative frequency (%), relative cover (%), and importance values (relative frequency + relative cover = IV 200) of vascular plant species sampled at Tomlinson Pioneer Cemetery Prairie Nature Preserve (N = 50 0.5 x 0.5 m quadrats), Champaign County, Illinois. Species are listed in descending rank order by importance value.

Species	Frequency (%)	Total Cover (m^2)	Rel. Frequency (%)	Rel. Cover (%)	IV200 (%)
Helianthus hirsutus	94	3.11	9.79	17.78	27.57
Poa pratensis	90	1.50	9.38	8.59	17.96
Corylus americana	42	1.69	4.38	9.67	14.05
Andropogon gerardii	48	1.46	5.00	8.38	13.38
Sorghastrum nutans	46	1.20	4.79	6.85	11.64
Solidago canadensis	38	0.67	3.96	3.84	7.80
Rubus occidentalis	28	0.64	2.92	3.64	6.56
Carex gravida	16	0.09	4.38	1.73	6.10
Rubus pensilvanicus	26	0.57	2.71	3.26	5.97
Rosa carolina	30	0.41	3.13	2.36	5.49
Celastrus scandens	22	0.56	2.29	3.19	5.48
Silene stellata	30	0.26	3.13	1.50	4.63
Muhlenbergia sobolifera	20	0.33	2.08	1.90	3.98
Desmodium illinoense	18	0.30	1.88	1.74	3.61
Ambrosia trifida	18	0.24	1.88	1.40	3.27
Brickellia eupatorioides	12	0.28	1.25	1.61	2.86
Toxicodendron radicans	14	0.23	1.46	1.31	2.77
Oligoneuron rigida	8	0.33	0.83	1.86	2.69
Viola sororia	16	0.15	1.67	0.86	2.53
Calystegia sepium	16	0.09	1.67	0.52	2.18
Carex grisea	12	0.13	1.67	0.52	2.18
Fragaria virginiana	16	0.09	1.67	0.52	2.18
Elymus virginicus	14	0.11	1.46	0.64	2.10
Smilacina racemosa	10	0.18	1.04	1.05	2.09
Carex jamesii	10	0.13	1.25	0.74	1.99
Ambrosia artemisiifolia	10	0.14	1.04	0.81	1.85
Carex normalis	42	0.30	1.04	0.73	1.77
Elymus villosus	14	0.05	1.46	0.30	1.76
Smilacina stellata	14	0.05	1.46	0.30	1.76
Ceanothus americanus	4	0.19	0.42	1.11	1.53
Eupatorium altissimum	4	0.19	0.42	1.11	1.53
Hypericum perforatum	12	0.04	1.25	0.22	1.47
Bromus inermis	10	0.07	1.04	0.39	1.43
Melilotus sp. (*albus/officinalis*)	10	0.07	1.04	0.39	1.43
Cirsium discolor	6	0.14	0.63	0.79	1.42
Smilax tamnoides var. *hispida*	6	0.14	0.63	0.79	1.42
Desmodium canadense	6	0.11	0.63	0.64	1.27
Elymus canadensis	8	0.06	0.83	0.34	1.18
Sanicula odorata	8	0.06	0.83	0.34	1.18
Apocynum cannabinum	6	0.08	0.63	0.47	1.10
Ratibida pinnata	4	0.10	0.42	0.58	1.00
Smilax lasioneuron	6	0.05	0.63	0.30	0.93
Euphorbia corollata	4	0.08	0.42	0.43	0.85
Anemone virginiana	6	0.02	0.63	0.13	0.75
Antenoron virginanum	2	0.09	0.21	0.54	0.75
Galium concinnum	6	0.02	0.63	0.09	0.72
Symphyotrichum urophyllum	4	0.05	0.42	0.26	0.67
Comandra umbellata	4	0.05	0.42	0.26	0.67
Festuca arundinacea	4	0.05	0.42	0.26	0.67
Panicum virgatum	4	0.05	0.42	0.26	0.67
Lactuca canadensis	4	0.02	0.42	0.09	0.50
Polygonatum commutatum	4	0.02	0.42	0.09	0.50
Teucrium canadense var. *canadense*	4	0.02	0.42	0.09	0.50
Carex blanda	4	0.01	0.42	0.05	0.47
Taraxacum officinale	4	0.01	0.42	0.05	0.47
Allium canadense	4	0.00	0.42	0.01	0.43
Asclepias syriaca	2	0.04	0.21	0.21	0.42
Chenopodium album	2	0.04	0.21	0.21	0.42
Gentiana alba	2	0.04	0.21	0.21	0.42
Menispermum canadense	2	0.04	0.21	0.21	0.42
Monarda fistulosa	2	0.04	0.21	0.21	0.42
Prunus serotina	2	0.04	0.21	0.21	0.42
Quercus imbricaria	2	0.04	0.21	0.21	0.42
Quercus macrocarpa	2	0.04	0.21	0.21	0.42
Salix humilis	2	0.04	0.21	0.21	0.42
Achillea millefolium	2	0.01	0.21	0.04	0.25
Carex sp.	2	0.01	0.21	0.04	0.25
Daucus carota	2	0.01	0.21	0.04	0.25
Lysimachia ciliata	2	0.01	0.21	0.04	0.25
Oxalis stricta	2	0.01	0.21	0.04	0.25
Parthenocissus quinquefolia	2	0.01	0.21	0.04	0.25
Physalis heterophylla	2	0.01	0.21	0.04	0.25
Ribes missouriense	2	0.01	0.21	0.04	0.25
Unknown dicot	2	0.01	0.21	0.04	0.25
Geum canadense	2	0.00	0.21	0.01	0.22
Totals	960	17.46375	100.00	100.00	200.00

DISCUSSION

The number of native species we recorded at this small preserve (103) is similar to reports from other prairie remnants (Robertson et al. 1997). We might have missed some early spring species by starting in May, though we did record spring ephemeral species like *Erythronium albidum*, *Claytonia virginiana*, and *Camassia scilloides*. We recorded more native species than Betz and Lamp (1989) in their survey of 29 prairie remnants (range of 30-89 native species per site) and their survey of eight savanna remnants (range of 33-75 native species per site; Betz and Lamp 1992). Subsequent surveys of some of those remnants (e.g. Loda Cemetery Prairie Nature Preserve) have revealed more than 100 native plant species (Taft 2016). The relatively high number of non-native species might be due to the small size and high perimeter to area ratio in a highly disturbed (i.e. agricultural) landscape. Taft (2016) showed that even in protected prairie remnants, there is a significant decline in species richness, diversity, and measures of floristic quality between the interior and zones near the edge.

An *I* value of 32.7 (36.1 native species only) shows relatively high floristic value. Prairie sites with an *I* of 35 or higher are considered good quality (Taft et al. 1997). The relatively high number of non-native species and native ruderal species (*C* values of 0-3, n=44) along with few highly conservative species (*C* values 7-10, n=8) likely account for the diminished *I* value.

The relatively high species richness in this small preserve is comforting from a conservation perspective but there is a seemingly large gap between survey species richness and effective species richness (75 vs. 26.05). This is likely because the plant community is dominated by relatively few species. Eight species encountered in the quantitative survey accounted for over half of the importance value (Table 1). Sites with a few, very dominant species tend to reduce the Shannon diversity index and hence reduce effective species richness. Species evenness, another aspect of diversity, is also a bit low (0.68), again driven by a few, dominant species.

The dominance of *Helianthus hirsutus* at this site could be a reflection of survey time (late summer) when *H. hirsutus* is at its peak of growth and flower. Interestingly, when TPCP was being considered for dedication as an Illinois Nature Preserve, McFall (1983) did not note the presence of *H. hirsutus*. Betz and Lamp (1989, 1992) also did not note this species in their survey of remnant prairies and savannas across northern Illinois and Indiana. They did note a few sites with *Helianthus strumosus* and *H. divaricatus*, two closely related species. It could be that this rhizomatous, native perennial has responded well to management activities such as prescribed fire and thinning of woody species such as *Corylus americana* (M. Daab, pers. comm.). If it truly wasn't present during McFall's survey (1983), *H. hirsutus* may have moved into the site from nearby areas.

McFall (1983) noted the presence of *Lilium michiganense* at TPCP, but we did not encounter *L. michiganense* during this study. This does not necessarily indicate that it's no longer extant at TPCP as this species might not produce flowers every year and hence at low densities is hard to detect. McFall (1983) also noted *Carex bicknelli*, *C. cephalophora*, *C. davisii*, *C. meadii*, *Galium asprellum*, *Oenothera biennis*, *Rudbeckia* sp., *Scrophularia marilandica*, *Thalictrum dasycarpum*, and *Tradescantia ohiensis* which we did not find. Some *Carex* species are notoriously difficult to identify in the field, so we cannot confirm with this study if these species are still extant at the site. *Galium asprellum*, *Thalictrum dasycarpum*, *Tradescantia ohiensis* were likely misidentified; we did confirm the presence of *Galium concinuum*, *Thalictrum revolutum*, and *Tradescantia virginiana*, species that closely resemble the aforementioned. *Oenothera biennis* is a disturbance tolerant species which likely persists at edges of the preserve. *Scrophularia marilandica* is a species of open woodlands that may still persist at the site.

The dominance of *Corylus americana* at this site is a good indicator that this area was a transition zone from prairie to forest. Bowles et al. (1994) reported that *C. americana* was frequently encountered in oak savanna in northeastern Illinois in the early 19th century. Stands of "hazel-brush" (i.e. *C. americana*) were noted by Isaac Busey in 1833 at the south edge of the Big Grove in Champaign County (White 1997), an area of transition between forest and prairie. The presence of species typical of savanna and open-canopy forest like *Camassia scilloides*, *Dodecatheon meadia*, *Erythronium albidum*, *Geranium maculatum*, *Silene stellata*, *Symphyotrichum urophyllum*, *Trillium recurvatum*, *Smilax tamnoides* var. *hispida*, and *Veronicastrum virginicum* also indicate this site is a remnant savanna (Betz and Lamp 1992). The two big oak trees at the site also support savanna classification though Szafoni et. al (1994) cautions that large, open-grown trees may not indicate presettlement savanna.

This small remnant of savanna provides valuable clues to the vegetation composition of this now rare ecosystem, but it does not necessarily reflect a complete or accurate picture of savanna. Savannas were by definition a transition zone between forest and prairie and there would have been a gradient of species (Anderson 1991, Anderson and Bowles 1999) across an area much larger than now encompassed by TPCP, and plant species would not necessarily be static as they responded to fire frequency, weather, and other disturbances (Anderson 2006). Thus the vegetation composition presented by this study reflects historic species still extant, immigration of adventive species, and the interaction of natural processes and human management over time. Careful thought as well as explicit management goals (e.g. maintain native botanical diversity) and actions (e.g. remove non-native plant species, conduct prescribed fire) are needed to continue to maintain this savanna remnant.

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Appendix 1. Vascular plant taxa encountered at Tomlinson Pioneer Cemetery Prairie Nature Preserve (TPCP), Champaign County, Illinois in 2013. Species are listed by dicots followed by monocots. Families, genera, and species are arranged alphabetically within groups. Taxa considered non-native are indicated by an asterisk (*). Nomenclature follows Mohlenbrock (2014) and non-native taxa determined following Taft et al. (1997).

ANGIOSPERMS

DICOTYLEDONS

Anacardiaceae
Toxicodendron radicans L. (Kuntze)
Apiaceae
**Daucus carota* L.
**Pastinaca sativa* L.
Sanicula canadensis L.
Sanicula odorata (Raf.) K.M. Pryer & L.R. Phillippe
Apocynaceae
Apocynum cannabinum L.
Apocynum sibiricum Jacq.
Asclepiadaceae
Asclepias syriaca L.
Asteraceae
**Achillea millefolium* L.
Ambrosia artemisiifolia L.
Ambrosia trifida L.
Brickellia eupatorioides (L.) Shinners
Cirsium discolor (Muhl. ex Willd.) Spreng.
Conyza canadensis (L.) Cronquist
Erigeron annuus (L.) Pers.
Erigeron strigosus Muhl. ex Willd.
Eupatorium altissimum L.
Helianthus hirsutus Raf.
Helianthus pauciflorus Nutt.
Heliopsis helianthoides (L.) Sweet
Lactuca canadensis L.
Oligoneuron rigidum (L.) Small
Parthenium integrifolium L.
Ratibida pinnata (Vent.) Barnhart
Silphium integrifolium Michx.
Silphium perfoliatum L.
Silphium terebinthinaceum Jacq.
Solidago canadensis L.
Symphyotrichum urophyllus (Lindl.) G.L. Nesom
Symphyotrichum pilosum (Willd.) G.L. Nesom
**Taraxacum officinale* F.H. Wigg
**Tragopogon dubius* Scop.
Boraginaceae
*Mertensia virginic*a (L.) Pers. ex Link
Brassicaceae
**Barbarea vulgaris* W.T. Aiton
**Lepidium campestre* (L.) W.T. Aiton
Caesalpiniaceae
Gleditsia triacanthos L.
Caprifoliaceae
Triosteum perfoliatum L.
Caryophyllaceae
**Dianthus armeria* L.
Silene stellata (L.) W.T. Aiton
Celastraceae
Celastrus scandens L.
Chenopodiaceae
**Chenopodium album* L.
Convolvulaceae
Calystegia sepium (L.) R. Br.
Ipomoea pandurata (L.) G. Mey.
Corylaceae
Corylus americana Walter
Euphorbiaceae
Euphorbia corollata L.
Fabaceae
Amorpha canescens Pursh.
Astragalus canadensis L.
Desmodium canadense (L.) DC.
Desmodium illinoense A. Gray
**Melilotus albus* Medikus
**Melilotus officinalis* (L.) Pallas
Fagaceae
Quercus imbricaria Michx.
Quercus macrocarpa Michx.
Gentianaceae
Gentiana alba Muhl. ex Nutt.
Geraniaceae
Geranium maculatum L.
Grossulariaceae
Ribes missouriense Nutt.
Hypericaceae
Hypericum perforatum L.
Lamiaceae
Monarda fistulosa L.
Teucrium canadense L. var. *canadense*
Menispermaceae
Menispermum canadense L.
Moraceae
**Morus alba* L.
Onagraceae
Gaura biennis L.
Oxalidaceae
Oxalis stricta L.
Polygonaceae
Antenoron virginianum (L.) Roberty & Vautier
Fallopia scandens (L.) Holub.
Portulaceae
Claytonia virginica L.
Primulaceae
Dodecatheon meadia L.
Lysimachia ciliata L.
Ranunculaceae
Anemone virginiana L.
Thalictrum revolutum DC.
Rhamnaceae
Ceanothus americanus L.
Rosaceae
Fragaria virginiana Duchesne
Geum canadense Jacq.
Prunus serotina Ehrh.
Rosa carolina L.
**Rosa multiflora* Thunb.
Rubus occidentalis L.
Rubus pensilvanicus Poir.
Rubiaceae
Galium aparine L.
Galium concinnum Torr. & A. Gray
Salicaceae
Salix humilis Marsh.
Santalaceae
Comandra umbellata Nutt.
Scrophulariaceae
Veronicastrum virginicum (L.) Farw.
Solanaceae
Physalis heterophylla Nees.
Violaceae
Viola sororia Willd.
Vitaceae
Parthenocissus quinquefolia (L.) Planch.
Vitis riparia Michx.

MONOCTYLEDONS

Agavaceae
**Yucca smalliana* Fern.
Alliaceae
Allium canadense L.
Asparagaceae
**Asparagus officinalis* L.
Commelinaceae
Tradescantia virginiana L.
Cyperaceae
Carex blanda Dewey
Carex cephaloidea (Dewey) Dewey
Carex gravida L.H. Bailey
Carex grisea Wahl.
Carex jamesii Schwein
Carex meadii Dewey
Carex molesta Mack. ex Bright
Carex normalis Mack.
Carex pellita Willd.
Carex sp. L.
Hyacinthaceae
Camassia scilloides (Raf.) Cory.
Liliaceae
Erythronium albidum Nutt.
Poaceae
Andropogon gerardii Vitman
**Bromus commutatus* L.
**Bromus inermis* Leyss.
Dichanthelium oligosanthes (Schult.) Gould var. *oligosanthes*
Elymus canadensis L.
Elymus villosus Muhl.
Elymus virginicus L.
**Festuca arundinacea* Schreb.
Heterostipa spartea (Trin.) Barkworth
Melica nitens (Scribn.) Nutt.
Muhlenbergia sobolifera (Muhl. ex Willd.) Trin.
Panicum virgatum L.
**Phalaris arundinacea* L.
**Phleum pretense* L.
**Poa pratensis* L.
Sorghastrum nutans (L.) Nash.
Ruscaceae
Polygonatum commutatum (Schult.) A. Dietr.
Smilacina racemosa (L.) Desf.
Smilacina stellata (L.) Desf.
Smilacaceae
Smilax tamnoides L. var. *hispida* (Muhl.) Fern.
Smilax lasioneuron Hook.
Trilliaceae
Trillium recurvatum Beck.