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FLORA AND VEGETATION OF CONEFLOWER GLACIAL  
DRIFT HILL PRAIRIE NATURAL AREA, MOULTRIE  
COUNTY, ILLINOIS

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**ABSTRACT.** The vascular flora of Coneflower Glacial Drift Hill Prairie Natural Area in Moultrie County, east-central Illinois, was studied during the growing seasons of 2002 and 2003. The prairie is located on a steep SW-facing hillside of the Cerro Gordo Glacial Moraine, overlooking the Kaskaskia River Valley and Lake Shelbyville. The flora was documented by general reconnaissance, and the structure of the vegetation was sampled in September 2003 using 0.25 m<sup>2</sup> plots placed along two transects. The site supported 164 vascular plant species (including one named hybrid). The native grasses with the highest importance values were *Andropogon gerardii* (big bluestem) and *Schizachyrium scoparium* (little bluestem). Important forbs included *Euphorbia corollata* (flowering spurge), *Helianthus divaricatus* (woodland sunflower), *Ratibida pinnata* (drooping coneflower), and *Comandra umbellata* (false toadflax). Exotic species were represented by 28 taxa, 16.4% of the flora. The community had a Floristic Quality Index of 38.82, indicating a site of statewide significance.

Key Words: glacial drift hill prairie, Illinois, *Andropogon*, *Schizachyrium*

At the time Europeans settled Illinois in the early 1800s, small openings covered with prairie vegetation occurred in the forests on glacial moraines and river valleys within the Prairie Peninsula (Transeau 1935; Vestal 1918). Many of these small openings were on upland sites and have since been destroyed by cultivation. Others were associated with steep hillsides and have escaped destruction (Hanson 1922). These small hill prairie inclusions were first studied in 1916 in the vicinity of Charleston, Coles County, Illinois (Vestal 1918), about 40 km to the east of the present study site. Most of these inclusions, which seldom exceed one hectare in size, are associated with the Embarras, Illinois, and Middle Fork of the Vermilion river systems in central Illinois (Ebinger 1981; Evers 1955; Vestal 1918). These prairies are very rare in east-central Illinois; only five high quality remnants are known.

Glacial drift hill prairies are not associated with loess deposits, having developed on glacial drift of Wisconsin and Illinoian age, from which the loess has been lost due to erosion and soil slumping. Edaphic conditions are, in part, probably responsible for their existence because they occur on low-nutrient, rocky, and clayey soils that contain little organic material (McClain et al. 2002). A combination of factors, including south- to west-facing slope aspect, steep slope angle, dry prevailing winds, and soils that allow for rapid water runoff (Robertson et al. 1995) results in the droughty conditions that slow woody encroachment. Even with these environmental conditions, however, woody plant encroachment does slowly take place. Of the nine small prairie inclusions reported by Vestal (1918), only three were found in 1978 (Reeves et al. 1978). More recently, Behnke and Ebinger (1989) found only one inclusion that still contained typical prairie vegetation, and three others degraded by woody species encroachment, while there was no trace of the other five. Owens and Cole (2003) found only one of these prairie openings remaining.

Present observations indicate that glacial drift hill prairies are relatively transient communities. While degraded small remnants occasionally are found, the few that remain are being rapidly eliminated by woody encroachment. One remnant, the Coneflower Glacial Drift Hill Prairie Natural Area, was nearly lost due to woody encroachment, and to a conservation plantation of *Pinus banksiana* (jack pine) and wildlife food plots of *Elaeagnus umbellata* (autumn olive) and *Lonicera maackii* (Amur honeysuckle; Bob Szafoni, Natural Heritage Biologist, Illinois Dept. Natural Resources, pers. comm.). Removal of the woody exotics in 1990, and active management using brush removal and fire, have dramatically improved the natural quality of the site. The present study was undertaken to determine the vascular plant species composition, vegetation structure, and floristic quality of this small hill prairie.

STUDY AREA

The Coneflower Glacial Drift Hill Prairie Natural Area (or Coneflower Prairie), about 1.2 ha in size, is located in east-central Illinois, about 3 km west of Allenville, Moultrie County (SE1/4 SW1/4 S19 T13N R6E; 39°33'03"N, 88°34'33"W). This hill prairie is situated near the top of a southwest-facing hillside that overlooks the Kaskaskia River Valley and Lake Shelbyville (Figure 1). This

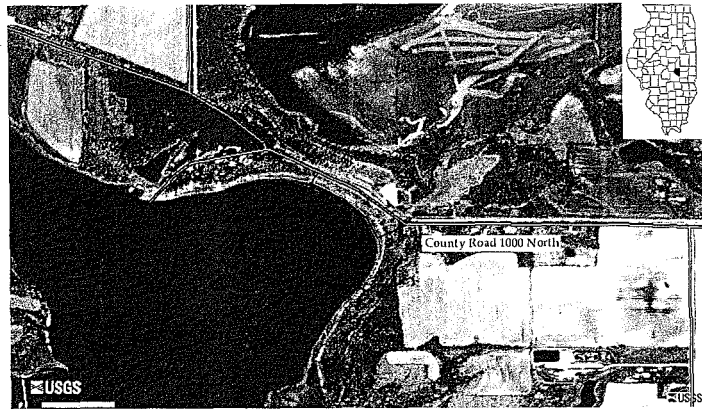


Figure 1. Aerial photograph showing the location and extent of Coneflower Glacial Drift Hill Prairie Natural Area, Moultrie Co., Illinois. The body of water at the lower left is the NE cove of Lake Shelbyville. Inset shows location of Moultrie Co. in central Illinois. Scale bar at lower left indicates 80 m. From The National Map (U.S. Geological Survey).

site is located at an elevation of about 185 m on the Cerro Gordo recessional moraine of Wisconsin glaciation in the Grand Prairie Section of the Grand Prairie Natural Division (Schwegman 1973). Most of the vegetation of this division was dry to wet "black soil" tallgrass prairie found on nearly level ground, while on the more dissected moraines, river valleys, and other hilly areas, the vegetation was dominated by forest (Anderson 1991; Ebinger and McClain 1991). Prairie openings were common on these areas of rough topography, when edaphic and microclimatic conditions combined to produce excessively droughty sites.

The soil of the Coneflower Prairie is classified as Miami loam, with 18 to 35% slope (Leeper and Gotsch 1998). These soils are highly eroded with little of the original A horizon present, are well drained, low in organic content, and slightly acid. Some soil slumping has occurred on the steeper slopes, exposing the clayey subsoil. Many gravel-sized pebbles and a few stones to 15 cm in diameter are imbedded in these soils. According to Leeper and Gotsch (1998) loess deposits originally covered these soils but have been eroded away. In this part of Illinois, precipitation averages 97.5 cm, with April having the highest rainfall (9.4 cm). Mean

annual temperature is 11.8°C, the hottest month being July (average of 24.6°C), the coldest being January (average of -3°C). The average number of frost-free days is 171 (Midwestern Regional Climate Center 2004).

#### MATERIALS AND METHODS

Coneflower Prairie was visited every 3–4 weeks during the growing seasons of 2002 and 2003. During each trip, all new flowering or fruiting species encountered were collected. Voucher specimens of each plant species were deposited in the Stover-Ebinger Herbarium of Eastern Illinois University, Charleston, Illinois (EIU). Duplicates, as available, were sent to the Illinois Natural History Survey, Champaign, Illinois (ILLS), and to GH, ISM, and SIU. Nomenclature follows Mohlenbrock (2002) and the assignment of non-native status was determined using Taft et al. (1997) and Mohlenbrock (2002).

Ground-layer species were analyzed in early September 2003 using 0.25 m<sup>2</sup> quadrats located at one-meter intervals along two randomly placed 25 m transects oriented perpendicular to the slope (N = 25 per transect). Even-numbered quadrats were placed to the right, odd-numbered to the left side of the transect lines. Thus, a total of 50 plots were used to determine the ground-level species cover. Herbaceous species, shrubs, and tree seedlings and saplings up to one meter in height were included in the sampling; no woody species greater than one meter in height was encountered in the transects. Percent cover for each species, as well as for bare ground and litter, was determined by using the Daubenmire cover class system (Daubenmire 1959) as modified by Bailey and Poulton (1968), in which class 1 = 0–1%, class 2 = 2–5%, class 3 = 6–25%, class 4 = 26–50%, class 5 = 51–75%, class 6 = 76–95%, and class 7 = 96–100%. Mean cover, relative cover, frequency (%), relative frequency, and importance value (IV) of each species were determined. As used here, IV is the sum of the relative frequency and relative cover.

The Floristic Quality Index (FQI) of the site was determined using the coefficient of conservatism (CC) assigned to each species by Taft et al. (1997). For each species in the Illinois flora, the CC was determined by subjectively assigning an integer from 0 to 10, based on its tolerance to disturbance and its fidelity to habitat integrity. The FQI is a weighted index of species richness (N =

Table 1. Mean cover, relative cover, frequency, relative frequency, and importance value (IV) for the species encountered in the quadrats on Coneflower Glacial Drift Hill Prairie Natural Area, Moultrie County, Illinois. \* = non-native species (Mohlenbrock 2002; Taft et al. 1997). "Others" category includes *Aster pilosus*, *Cornus drummondii*, *Diospyros virginiana*, *Penstemon digitalis*, *Arnoglossum muhlenbergii*, *Quercus alba*, *Quercus velutina*, and *Vernonia gigantea*. Woody taxa were represented by seedlings and saplings up to one meter tall.

Species	Mean Cover (%)	Relative Cover	Frequency (%)	Relative Frequency	IV
<i>Andropogon gerardii</i>	21.18	30.71	76	11.48	42.19
<i>Euphorbia corollata</i>	5.03	7.29	58	11.78	19.07
<i>Helianthus divaricatus</i>	5.48	7.95	72	10.88	18.83
<i>Ratibida pinnata</i>	3.19	4.62	68	10.28	14.90
<i>Comandra umbellata</i>	4.68	6.78	44	6.66	13.44
<i>Rosa carolina</i>	3.24	4.71	50	7.56	12.27
<i>Echinacea pallida</i>	3.87	5.61	34	5.14	10.75
<i>Chamaecrista fasciculata</i>	2.18	3.16	40	6.04	9.20
<i>Monarda fistulosa</i>	1.25	1.81	32	4.83	6.64
<i>Solidago canadensis</i>	2.30	3.33	18	2.72	6.05
<i>Schizachyrium scoparium</i>	2.20	3.19	14	2.11	5.30
<i>Dichanthelium acuminatum</i>	1.76	2.55	16	2.42	4.97
<i>Verbesina helianthoides</i>	2.30	3.33	6	0.91	4.24
<i>Sporobolus heterolepis</i>	2.01	2.91	6	0.91	3.82
<i>Smilax tannoides</i>	1.15	1.67	14	2.11	3.78
<i>Pycnanthemum pilosum</i>	1.02	1.48	10	1.51	2.99
<i>Dalea purpurea</i>	1.20	1.74	8	1.21	2.95
<i>Sorghastrum nutans</i>	1.25	1.81	2	0.30	2.11
<i>Cercis canadensis</i>	0.82	1.19	6	0.91	2.10
<i>Sassafras albidum</i>	0.33	0.48	8	1.21	1.69
<i>Hypericum sphaerocarpum</i>	0.10	0.14	10	1.51	1.65
<i>Conyza canadensis</i>	0.75	1.09	2	0.30	1.39
<i>Lithospermum canescens</i>	0.04	0.06	8	1.21	1.27
<i>Solidago nemoralis</i>	0.36	0.52	4	0.60	1.12
* <i>Melilotus officinalis</i>	0.31	0.45	4	0.60	1.05
<i>Vitis aestivalis</i>	0.31	0.45	4	0.60	1.05
* <i>Achillea millefolium</i>	0.08	0.12	6	0.91	1.03
* <i>Poa pratensis</i>	0.12	0.17	4	0.60	0.77
<i>Cirsium discolor</i>	0.30	0.43	2	0.30	0.73
Others	0.18	0.25	16	2.40	2.65

Table 1. Continued.

Species	Mean Cover (%)	Relative Cover	Frequency (%)	Relative Frequency	IV
TOTALS	68.99	100.00	—	100.00	200.00
Average bare ground and litter	31.01				

number of species present), and is the arithmetic product of the average coefficient of conservatism (C-Value = the average of all species CCs) multiplied by the square root of the species richness ( $\sqrt{N}$ ):

$$FQI = C\text{-Value} \times \sqrt{N}$$

Therefore, the FQI indicates the level of habitat degradation and provides an assessment of the quality of each tract based on the taxa present. It is particularly useful when combined with quadrat-based sampling methods and provides a way of making quantitative comparisons among sites.

## RESULTS

A total of 164 species representing 52 families and 127 genera was documented for Coneflower Prairie (Appendix). Ferns and gymnosperms were represented by one species each. Of the remainder, 122 were dicots in 43 families and 101 genera, and 41 were monocots in 7 families and 24 genera. Of these totals, 33 were woody species, while 28 were exotic. The predominant plant families were the Asteraceae with 29 species and the Poaceae with 22 species (including one hybrid). No state-listed endangered or threatened species were found (Herkert and Ebinger 2002).

Of the 164 species encountered, 37 were recorded in the quadrats (Table 1). Of these, *Andropogon gerardii* (big bluestem) was the most plentiful, having a frequency of 76%, a relative cover of 30.71, and an IV of 42.19. The other common prairie grass was *Schizachyrium scoparium* (little bluestem), which ranked eleventh with an IV of 5.30. *Euphorbia corollata* (flowering spurge) ranked second in importance with an IV of 19.07, *Helianthus divaricatus* (woodland sunflower) ranked third with an IV of 18.83, followed by *Ratibida pinnata* (drooping coneflower), and *Comandra umbellata* (false toadflax). In total at this site, seven native prairie species that

are common components of glacial drift hill prairies had IVs greater than 10 (the five listed plus *Rosa carolina* and *Echinacea pallida*; White and Madany 1978). The FQI for this site, when non-native species were included, was 38.82 with a mean C-value of 3.07; with the non-native species excluded from the calculations the FQI was 42.90 with a mean C-value of 3.75. This indicates that, due to its species diversity, the site is of statewide significance (Taft et al. 1997).

Though 28 non-native species were found during the present study, only *Achillea millefolium* (common yarrow), *Melilotus officinalis* (white sweet clover), and *Poa pratensis* (Kentucky bluegrass) were encountered in the quadrats, all with low IVs (Table 1). The remaining non-native species were restricted to disturbed habitats or along the roadside at the northeast edge of the prairie. The exotic shrubs *Elaeagnus umbellata* (autumn olive) and *Lonicera maackii* (Amur honeysuckle), species previously planted in the area, were occasionally encountered at the edges of the prairie.

Of the 33 woody species observed on Coneflower Prairie, *Rosa carolina* (pasture rose) was common, ranking sixth in importance with a frequency of 50% and an IV of 12.27 (Table 1). Other woody species were occasionally found in the quadrats, including *Sassafras albidum* (sassafras), *Cornus drummondii* (rough-leaved dogwood), *Quercus alba* (white oak), and *Diospyros virginiana* (persimmon). The remaining 28 woody species were represented as seedlings or small plants, mostly restricted to the prairie edge or in several small gullies at the lower edge of the prairie.

#### DISCUSSION

Glacial drift hill prairies are small, relatively transient communities on heavy, clayey, glacial soils in which the overlying loess has been removed by erosion. These openings are created by soil slumping that exposes bare ground, which rapidly succeeds to a community containing many prairie grasses and forbs. The steep slope, poor soil low in nutrients, and the xeric conditions, particularly on south- and southwest-facing steep slopes, initially prevents the establishment of most woody species. *Schizachyrium scoparium* is one of the early invaders on these sites. With the increased organic material and soil stability, other xeric prairie species become established. Once the prairie flora has developed, woody encroachment occurs along all edges of the hill prairie and

rapidly increases in extent and diversity. Between 50 and 80 years are usually necessary to completely eliminate a small prairie opening. Only a few hardy prairie grasses and forbs are found in the ground-layer of the immature forest.

Glacial drift hill prairies typically have low species diversity, which is probably related to their origin. These communities develop on hillsides where the soil has slumped, leaving an extensive bare area. On these exposed areas the soil typically has a high clay content, and is subjected to severe soil erosion as little vegetation is present. At our study site, Coneflower Prairie, bare ground ranged from 22 to 45% in the study plots (average of 31%; Table 1). McClain et al. (2002) found that bare ground ranged from 10 to 33% in the four small glacial drift prairies in Macoupin County, while Owens and Cole (2003) reported an average of 69% bare ground for a glacial drift prairie in Coles County. Their small size, poor soil, and their rapid loss by forest encroachment are probably the reasons why glacial drift prairies have low species diversity and rarely support endangered or threatened species.

Woody encroachment was extensive around the edges of Coneflower Prairie. Without continued management involving brush removal and fire, this encroachment would soon eliminate the prairie. This pattern of encroachment proceeds relatively slowly at first, but rapidly increases as patch size becomes smaller (Schwartz et al. 1997). Generally, native and introduced exotic shrubs encircle the prairie edge. These shrubs rapidly increase in abundance, shading and competing with the prairie vegetation for light, water, and soil nutrients. This encroachment and the planting of introduced exotic species on the prairie in the late 1970s nearly eliminated Coneflower Prairie. The removal of these exotic plantings in 1990, and the continued management using fire and cutting has dramatically improved the natural quality of this site. This intensive management has resulted in Coneflower Prairie being one of the few areas added to the Illinois Natural Areas Inventory due to management activities.

Coneflower Prairie is very similar in species composition to other glacial drift hill prairies throughout central Illinois. Ebinger (1981) found many of the same prairie species in five hill prairies in Coles and Vermilion Counties, east-central Illinois. More recently, McClain et al. (2002) examined a few glacial drift prairies on Illinoian glacial till in Macoupin County, central Illinois. On these small prairies, *Andropogon gerardii* and *Schizachyrium scoparium*

were the common grasses while many of the forbs encountered were the same as those found at Coneflower Prairie.

Other glacial drift hill prairies studied had higher concentrations of legumes than Coneflower Prairie. McClain et al. (2002) recorded five species of native legumes in their plots in Macoupin County glacial drift prairies, while Ebinger (1981) recorded eight native legumes in glacial drift prairies in east-central Illinois. The only native legumes encountered at Coneflower Prairie were *Dalea purpurea* and *Orbexilum onobrychis*, with only *D. purpurea* in the transect study plots (Table 1). A few exotic legumes were uncommon, and except for *Melilotus officinalis*, were not recorded in the plots. It is possible that the low number of legumes recorded for Coneflower Prairie is the result of past grazing. We have no knowledge of past grazing for this area, but nearly all parts of central Illinois that were not under cultivation were commonly used for grazing into the 1950s. Heavy grazing and shading from the plantings of exotic species could have impacted the native legumes.

Continued management will be necessary to maintain Coneflower Prairie. Hill prairies, both loess and glacial till, are rapidly disappearing due to woody species encroachment. McClain and Anderson (1990) found loess hill prairies were decreasing in size due to woody encroachment and that many had disappeared. More recently, Schwartz et al. (1997) found that most hill prairies have diminished in size by more than 50% since 1940, with many of the smaller ones being completely eliminated. These studies showed a clear trend toward hill prairie loss, along with a corresponding decrease in species diversity in the few remaining hill prairies.

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## APPENDIX

Vascular plant species encountered at Coneflower Glacial Drift Hill Prairie Natural Area, Moultrie County, Illinois. Species are listed alphabetically by family under divisions of the Plant Kingdom. An asterisk indicates non-native species (Mohlenbrock 2002; Taft et al. 1997). Nomenclature follows Mohlenbrock (2002). The following terms are used to describe the abundance: rare (one or two occurrences), occasional (of sporadic occurrence), frequent (of widespread occurrence), abundant (plentiful or dominant). The distribution and abundance of each species is given, according to the following vegetation types: forest border (FB), hill prairie (HP), shrub thicket border (STB), roadside border (RB), seep (S). For woody species, an indication of the size of the plants (seedling, sapling, shrub, or tree) is also provided. Collection numbers are those of Gordon C. Tucker. Specimens are housed in the Stover-Ebinger Herbarium (EU), with some duplicates at GH, ILLS, ISM, and SIU.

## POLYPODIOPHYTA (Ferns)

## OPHIOGLOSSACEAE

*Botrychium virginianum* (L.) Sw. – rare; FB; 13147.

## PINOPHYTA (Gymnosperms)

## CUPRESSACEAE

*Juniperus virginiana* L. – occasional; FB (saplings), HP (saplings), STB (small trees to 3 m); 12745.

## MAGNOLIOPHYTA (Angiosperms)

## MAGNOLIOPSIDA (Dicotyledons)

## ACANTHACEAE

*Ruellia humilis* Nutt. – occasional; HP; 13136.

## ANACARDIACEAE

*Rhus glabra* L. – occasional; STB (shrubs to 2 m tall); 13120.

## APIACEAE

\**Daucus carota* L. – occasional; HP, RB; 13138.

*Sanicula canadensis* L. – frequent; FB; 13134.

*Taenidia integerrima* (L.) Drude – frequent; FB, HP, STB; 12734.

\**Torilis japonica* (Houtt.) DC. – rare; FB; 12735.

## ASCLEPIADACEAE

*Ampelamus albidus* (Nutt.) Britton – occasional; HP, STB; 13118.

*Asclepias purpurascens* L. – rare; HP; 13152.

*Asclepias syriaca* L. – frequent; HP, RB; 13522.

## ASTERACEAE

\**Achillea millefolium* L. – frequent; HP, RB; 12725.

*Ageratina altissima* (L.) R.M. King & H. Robins. – occasional; FB; 13530.

*Ambrosia artemisiifolia* L. – frequent; FB, HP, RB; 13100.

*Antennaria plantaginifolia* (L.) Richards. – occasional; FB, HP; 13260.

*Arnoglossum muhlenbergii* (Sch.-Bip.) Fernald – occasional; HP, STB; 13099.

*Aster drummondii* Lindl. – occasional; FB, HP; 13534.

*Aster pilosus* Willd. – occasional; HP; 13217.

*Aster sagittifolius* Wedemeyer ex Willd. – occasional; HP; 13203.

*Aster turbinellus* Lindl. – occasional; FB, HP; 13204.

*Brickellia eupatorioides* (L.) Shinnars – occasional; HP; 13543.

*Cirsium discolor* (Muhl. ex Willd.) Spreng. – frequent; HP, RB; 13132.

*Conoclinium coelestinum* (L.) DC. – occasional; FB, HP, S; 13115.

*Conyza canadensis* (L.) Cronquist – frequent; HP; 13528.

*Echinacea pallida* (Nutt.) Nutt. – abundant; HP; 13131.

*Echinacea purpurea* (L.) Moench – occasional; HP, RB; 13546.

*Erigeron annuus* (L.) Pers. – occasional; HP, RB; 12738.

*Eupatorium serotinum* Michx. – occasional; FB, HP; 13529.

*Helianthus divaricatus* L. – frequent; FB, HP, STB; 13211.

\**Lactuca serriola* L. – occasional; HP, RB; 13119.

*Ratibida pinnata* (Vent.) Barnhart – abundant; HP; 13145.

*Rudbeckia hirta* L. – occasional; HP, RB; 13154.

*Rudbeckia triloba* L. – occasional; HP; 13153.

*Senecio glabellus* Poir. – occasional; FB, HP, STB; 12723.

*Solidago canadensis* L. – frequent; FB, HP, STB; 13212.

*Solidago nemoralis* Aiton – frequent; HP; 13215.

*Solidago ulmifolia* Muhl. ex Willd. – occasional; FB; 13201.

- \**Taraxacum officinale* G.H. Weber ex Wiggers – occasional; HP, RB; 13268.  
*Verbesina helianthoides* Michx. – abundant; HP, STB; 13130.  
*Vernonia gigantea* (Walter) Trel. – occasional; HP; 13129.

## BERBERIDACEAE

- Podophyllum peltatum* L. – occasional; FB; 13266.

## BIGNONIACEAE

- Campsis radicans* (L.) Seem. ex Bureau – occasional; FB, HP, STB (vines 0.5–2 m long); 13117.

## BORAGINACEAE

- Lithospermum canescens* (Michx.) Lehm. – frequent; HP, RB; 12748.

## BRASSICACEAE

- \**Barbarea vulgaris* Aiton f. – occasional; RB; 13264.  
 \**Capsella bursa-pastoris* (L.) Medic. – occasional; RB; 13269.  
*Lepidium virginicum* L. – rare; RB; 13304.

## CAESALPINIACEAE

- Cercis canadensis* L. – frequent; FB, HP (saplings up to 3 m tall); 13263.  
*Chamaecrista fasciculata* (Michx.) Greene – abundant; HP, RB; 13135.  
*Senna marilandica* (L.) Link – rare; STB; 13210.

## CAPRIFOLIACEAE

- \**Lonicera maackii* (Rupr.) Maxim. – occasional; FB, STB (shrubs to 2 m tall); 13535.  
*Symphoricarpos orbiculatus* Moench – frequent; FB, STB (shrubs 40–75 cm tall); 13106.  
*Triosteum aurantiacum* E.P. Bicknell – occasional; FB, HP; 13146.  
*Viburnum prunifolium* L. – occasional; FB, STB (shrubs 1–2 m tall); 13536.

## CARYOPHYLLACEAE

- \**Cerastium semidecandrum* L. – occasional; HP, RB; 12717.  
 \**Dianthus armeria* L. – rare; RB; 13139.  
 \**Holosteum umbellatum* L. – occasional; RB; 13261.  
*Silene stellata* (L.) Aiton f. – occasional; FB, HP; 13108.

## CELASTRACEAE

- Celastrus scandens* L. – frequent; FB, STB; 13126.

## CONVOLVULACEAE

- Calystegia spithamea* (L.) Pursh – occasional; HP, STB; 12721.  
 \**Convolvulus arvensis* L. – occasional; HP, RB; 13104.

## CORNACEAE

- Cornus drummondii* C.A. Mey. – frequent; HP, STB (shrubs 0.5–1.5 m tall); 13541.

## CORYLACEAE

- Corylus americana* Walter – occasional; FB, STB (shrubs 1–2 m tall); 13214.

## EBENACEAE

- Diospyros virginiana* L. – occasional; HP (saplings to 50 cm), STB (saplings to 2 m); 13520.

## ELAEAGNACEAE

- \**Elaeagnus umbellata* Thunb. – occasional; HP (shrubs to 1 m), STB (shrubs to 2 m); 13262.

## EUPHORBIACEAE

- Euphorbia corollata* L. – abundant; HP; 13133.

## FABACEAE

- Dalea purpurea* Vent. – abundant; HP; 13113.  
 \**Kummerowia striata* (Thunb.) Schindl. – occasional; HP, RB; 13205.  
 \**Medicago lupulina* L. – occasional; HP, RB; 12724.  
 \**Melilotus officinalis* (L.) Pallas – frequent; HP, RB; 12737.  
*Orbexilum onobrychis* (Nutt.) Rydb. – rare; STB; 13216.  
 \**Trifolium pratense* L. – occasional; HP, RB; 12720.

## FAGACEAE

- Quercus alba* L. – occasional; FB (trees up to 15 m tall), HP (one large tree about 12 m tall near RB), STB (saplings to 2 m tall); 13521.  
*Quercus imbricaria* Michx. – occasional; FB (trees up to 15 m tall), HP (saplings to 1.5 m tall), STB (saplings to 2 m tall); 13539.  
*Quercus muhlenbergii* Engelm. – occasional; FB (saplings to 2 m tall and several trees to 6 m tall); 13531.  
*Quercus velutina* Lam. – occasional; FB (trees up to 15 m tall), HP (saplings to 1.5 m tall), STB (saplings to 2.5 m tall); 13540.

## GERANIACEAE

- Geranium carolinianum* L. – occasional; HP; 12743.

## HYPERICACEAE

- Hypericum sphaerocarpum* Michx. – frequent; FB, HP; 13112.

## JUGLANDACEAE

- Carya ovata* (Mill.) K. Koch – occasional; FB (trees to 12 m tall); 13220.  
*Carya tomentosa* (Poir. ex Lam.) Nutt. – occasional; FB (trees to 12 m tall); 13219.  
*Juglans nigra* L. – occasional; FB, STB (saplings to 1.5 m); 13545.

## LAMIACEAE

- Monarda bradburiana* Beck – occasional; FB, HP; 12740.  
*Monarda fistulosa* L. – abundant; HP; 13103.  
*Physostegia virginiana* (L.) Benth. – occasional; HP; 13202.



*Pycnanthemum virginianum* (L.) T. Durand & B.D. Jackson ex B.L. Robins. & Fernald – abundant; HP; 13142.

*Scutellaria leonardii* Epling – rare; FB, HP; 13302.

*Teucrium canadense* L. – occasional; HP, STB; 13151.

## LAURACEAE

*Sassafras albidum* (Nutt.) Nees – occasional; FB (small trees to 4 m), HP (saplings to 1 m), STB (saplings to 2 m); 13532.

## MORACEAE

\**Maclura pomifera* (Raf.) Schneider – occasional; FB (saplings to 50 cm), HP (saplings to 1 m), STB (saplings to 1.5 m); 13209.

## OXALIDACEAE

*Oxalis fontana* Bunge – rare; FB, STB; 13306.

*Oxalis stricta* L. – occasional; FB, STB; 12722.

*Oxalis violacea* L. – occasional; FB, HP; 12732.

## PASSIFLORACEAE

*Passiflora lutea* L. var. *glabriflora* Fernald – occasional; STB; 13155.

## PLANTAGINACEAE

*Plantago rugelii* Dcne. – occasional; RB; 13121.

*Plantago virginica* L. – occasional; HP, RB; 13305.

## POLEMONIACEAE

*Phlox bifida* Beck – occasional; FB, HP; 13267.

## PORTULACACEAE

*Claytonia virginica* L. – occasional; FB, HP; 13265.

## RANUNCULACEAE

*Anemone virginiana* L. – occasional; FB, HP; 13116.

*Clematis pitcheri* Torr. & A. Gray – rare; STB; 13213.

*Thalictrum revolutum* DC. – occasional; FB, HP, STB; 13125.

## ROSACEAE

*Agrimonia pubescens* Waltr. – occasional; FB; 13149.

*Crataegus mollis* (Torr. & A. Gray) Scheele – occasional; FB (saplings and small trees to 2.5 m), HP (saplings to 50 cm), STB (saplings to 1.5 m), RB (saplings to 50 cm); 13542.

*Potentilla simplex* Michx. – occasional; FB, HP; 13298.

*Prunus serotina* Ehrh. – occasional; FB (small trees to 5 m), HP (saplings to 50 cm), STB (saplings and small trees to 3 m), RB (saplings to 50 cm); 13538.

*Rosa carolina* L. – abundant; HP (shrubs 25–50 cm tall), STB (shrubs 50–100 cm tall); 13207.

*Rubus occidentalis* L. – occasional; FB, STB (shrubs to 1 m tall); 13301.

*Rubus pensilvanicus* Poir. – rare; STB (shrubs to 75 cm tall); 12705.

## RUBIACEAE

*Galium circaeans* Michx. – occasional; FB; 13148.

*Galium triflorum* Michx. – rare; FB; 13156.

*Houstonia purpurea* L. – occasional; FB, HP; 13293.

## RUTACEAE

*Ptelea trifoliata* L. – occasional; HP, STB (shrubs to 2.5 m tall); 12744.

*Zanthoxylum americanum* Mill. – occasional; FB, STB (shrubs to 2 m tall); 13127.

## SANTALACEAE

*Comandra umbellata* (L.) Nutt. – abundant; HP; 12731.

## SCROPHULARIACEAE

*Dasistoma macrophylla* (Nutt.) Raf. – rare; STB; 13102.

*Penstemon digitalis* Nutt. – occasional; HP; 13537.

\**Verbascum blattaria* L. – occasional; HP, RB; 13547.

\**Verbascum thapsus* L. – occasional; HP, RB; 13533.

\**Veronica arvensis* L. – occasional; HP, RB; 12715.

## SOLANACEAE

*Physalis subglabrata* Mack. & Bush – occasional; FB, HP, STB; 12728.

## ULMACEAE

*Celtis occidentalis* L. – occasional; FB (trees to 8 m), STB (saplings and small trees to 2 m); 13544.

*Ulmus rubra* Muhl. – occasional; FB (trees to 6 m), HP (saplings to 50 cm), STB (saplings and small trees to 3 m); 12739.

## VERBENACEAE

*Verbena urticifolia* L. – occasional; HP, STB; 13150.

## VIOLACEAE

*Viola pratincola* Greene – occasional; FB, HP; 13271.

## VITACEAE

*Vitis aestivalis* Michx. – occasional; FB, HP, STB (vines to 2 m long); 13110.

*Vitis vulpina* L. – rare; STB (vines to 1 m long); 12726.

## LILIOPSIDA (Monocots)

## CYPERACEAE

*Carex blanda* Dewey – occasional; FB, HP; 12713.

*Carex davisii* Schwein. & Torr. – rare; HP, S; 12714.

*Carex gravida* L.H. Bailey – rare; HP; 12712.

*Carex grisea* Wahlenb. – occasional; HP; 13294.

*Carex hirsutella* Mack. – occasional; HP; 12711.

*Carex leavenworthii* Dewey – occasional; HP; 13295.

- Carex meadii* Dewey – occasional; HP; 13296.  
*Carex molesta* Mack. ex Bright – occasional; RB; 12709.  
*Carex radiata* (Wahlenb.) Small – rare; FB; 12710.  
*Scirpus pendulus* Muhl. – frequent; S; no voucher.

## DIOSCOREACEAE

- Dioscorea villosa* L. – frequent; STB; 13128.

## IRIDACEAE

- Sisyrinchium albidum* Raf. – rare; HP; 13299.  
*Sisyrinchium campestre* E.P. Bicknell – occasional; HP; 13307.

## JUNCACEAE

- Juncus interior* Wiegand – occasional; HP; 13109.

## LILIACEAE

- Allium canadense* L. – occasional; FB, HP, S; 12747.  
\**Asparagus officinalis* L. – occasional; RB; 12727.  
*Camassia scilloides* (Raf.) Cory – occasional; HP, S; 12729.  
*Trillium recurvatum* Beck – rare; FB; 13221A.

## POACEAE

- Andropogon gerardii* Vitman – abundant; HP; 13123.  
*Bromus inermis* Leyss. – occasional; HP, RB; 13137.  
*Bromus pubescens* Muhl. – occasional; RB; 13098.  
\**Dactylis glomerata* L. – occasional; RB; 12746.  
*Dichanthelium acuminatum* (Sw.) Gould & Clark – occasional; FB, HP; 12707.  
*Dichanthelium oligosanthes* (Schult.) Gould – occasional; FB, HP; 12706.  
*Elymus* × *ebingeri* G.C. Tucker – occasional; FB; 13141.  
*Elymus hystrix* L. – frequent; FB; 13114.  
*Elymus villosus* Muhl. ex Willd. – frequent; FB; 13525.  
*Elymus virginicus* L. – occasional; FB, HP, STB; 13122.  
\**Eragrostis pilosa* (L.) P. Beauv. – occasional; RB; 13124.  
*Eragrostis spectabilis* (Pursh) Steudel – occasional; HP; 13206.  
\**Festuca arundinacea* Schreb. – occasional; HP, RB; 12736.  
*Hordeum pusillum* Nutt. – rare; RB; 12718.  
*Panicum virgatum* L. – abundant; HP; 13526.  
\**Phleum pratense* L. – occasional; RB; 13144.  
\**Poa compressa* L. – rare; FB; 13143.  
\**Poa pratensis* L. – occasional; FB, RB; 12749.  
*Schizachyrium scoparium* (Michx.) Nash – abundant; HP; 13208.  
*Sporobolus compositus* (Poir.) Merr. – occasional; HP; 13524.  
*Sporobolus heterolepis* (A. Gray) A. Gray – abundant; HP; 13548.  
*Tridens flavus* (L.) Hitchc. – occasional; HP; 13218.

## SMILACACEAE

- Smilax tamnoides* L. var. *hispida* (Muhl.) Fernald – frequent; HP (vines to 1 m long), STB (vines to 2.5 m long); 12742.