VEGETATION OF STEMLER CAVE WOODS NATURE PRESERVE, ST. CLAIR COUNTY, ILLINOIS

John E. Ebinger

Botany Department

Eastern Illinois University

Charleston, Illinois 61920

Few studies of Illinois sinkhole vegetation have been undertaken. This is mostly due to the small number of areas where sinks are found in the state, no sinks are located near universities or other institutions, and the vegetation of only a few of the sinkhole localities is of high enough quality for study. Presently no article has been published on the sinkhole vegetation of Illinois though Bollwinkel (1958) completed a Masters Thesis concerning the vegetation of sinkhole ponds, finding a number of relatively rare and interesting aquatic vascular plant species.

The microclimate of the sinkholes has generally been though to be cooler and more moist than the surrounding uplands, and therefore there should be differences in the vegetation associated within the sinks as compared to that of the surrounding uplands. The present study was undertaken to document the vegetation found in the sinkholes at Stemler Cave Woods Nature Preserve, and to compare this vegetation with that found in the upland forests immediately surrounding these sinks.

DESCRIPTION OF THE STUDY AREA

Stemler Cave Woods Nature Preserve is a 49 ha (120 acres) area with numerous solution sinks and surrounding uplands forest of varying quality located in the Northern Section of the Ozark Division in southwestern

Illinois (Schwegman 1973). This section is distinguished from the other sections of the Ozark Division of Illinois by its limestone bedrock and the presence of numerous caves and sinkholes. These sinks were formed when rain water combining with carbon dioxide to produce and acid which dissolved the bedrock from the surface downward, creating a depression and are referred to as solution sinks (Clark and Stearn 1968). In these areas of karst topography, ponds are formed when the drainage cave become clogged.

The preserve is located about 2.5 miles NE of Columbia, Illinois (Sec 11 & 12, T1S R10W), and is divided into two sections. The small eastern section, about 20 acres in size, is dominated by numerous small sinks less than 75 m across and 15 m deep, with relatively mature forest vegetation that shows few indications of recent disturbance. The larger western section, about 100 acres in size, also contains a number of sinks, but many fallow fields exist in the area, and the forest, in general, is of poorer quality, showing signs of recent cutting.

Hutchison (1982), based on a study of the General Land Office survey records, indicated that prior to settlement the forest canopy in this karst region was open and that there was an almost continuous ground cover of grasses. The trees grew thicker in the sinks, but the dry ridges had scattered Quercus stellata (post oak) and Q. velutina (black oak) trees of short stature. Shortly after settlement this barrens community began to disappear as woody species replaced the prairie, fire suppression resulting in a closed forest forming were the presettlement barrens had existed. Also, tree shape and size changed, the old stunted trees, shaped by repeated fires, were replaced by forest-grown individuals that had straight trunks and larger diameters. Presently most of the old, open-grown trees are dead, the taller, forest-grown individuals dominate the site.

MATERIALS AND METHODS

All of the sinks and surrounding upland forest studied were located in the eastern section of the Stemler Cave Woods Nature Preserve. In each of ten sinks, 4 points were randomly located along the four cardinal compass directions about midway between the top and bottom of the sink (40 points). Also, immediately above each sink in the flat upland, two points were randomly located (20 points). At each point, nested circular plots centered on each point, were used to survey the vegetation. In 0.001 ha plots the woody seedlings (<50 cm tall) and small saplings (>50 cm tall but <2.5 cm dbh) were recorded, in 0.01 ha plots the large saplings (2.5–10.0 cm dbh) were surveyed, while the trees (>10.0 cm dbh) were surveyed using 0.02 ha plots. In each plot the species were identified, counted and their diameters recorded. From this data the density of the woody seedlings and saplings was determined, while for the woody overstory the density in broad diameter classes (#/ha), total density (#/ha), basal area (m^2/ha), relative density, relative dominance, importance value, and average diameter (cm) were calculated. The determination of the relative values and the importance values (IV) follows the procedure outlined by McIntosh (1957).

At each survey point where the woody vegetation was studied, the ground cover species were identified and their cover estimated in quarter meter square quadrats located at one meter intervals along alternate sides of a metric tape. Within each sinkhole seven or eight quadrats (a total of 25 for each sink) were located on the lower side of each survey point, perpendicular to the cardinal direction of that point. In each quadrat each species cover was estimated using the following scale.

Cover Class 1 = 0–1% cover; 2 = 1–5% cover; 3 = 6–25% cover; 4 = 26–50% cover; 5 = 51–75% cover; 6 = 76–95% cover; 7 = 96–100% cover. From these

data the relative frequency, relative cover, and importance value of each species were calculated following the procedure developed by Daubenmire (1959).

The vascular plant species found in the preserve are listed in Appendix I. Many species were collected, preserved, identified, and incorporated into the Stover/Ebinger Herbarium of Eastern Illinois University (EIU). Many exotic and weedy species were not collected, but each species encountered was identified and recorded. Nomenclature follows Mohlenbrock (1986).

RESULTS AND DISCUSSION

Differences in the vegetation of the sinkholes as compared to that of the uplands surrounding the sinks was more a differences in the frequency and density of species rather than in species diversity. Most species occurred in both habitats, but were more common in one of the habitats.

Overstory: Within the sinkholes the overstory trees averaged 311.6 #/ha with a basal area of 24.83 m^2/ha (Table 1). Quercus alba (white oak) was the dominant species with a density of 74.0 #/ha and an IV of 59.8 (out of 200), followed by Q. velutina (black oak) with a density of 31.4 #/ha and an IV of 37.2. Other important species included Carya ovata (shagbark hickory) with an IV of 21.3, Fraxinus pennsylvanica (green ash) with an IV of 16.1 and Ulmus rubra (slippery elm) with an IV of 15.7, along with 12 other species having corresponding lower importance values (Table 1). Most of these species had good diameter class distribution with many individuals in the smaller diameter classes and progressively fewer individuals in the larger diameter classes. Black oak, in contrast, was poorly represented in the

lower diameter classes, most individuals exceeding 50 cm dbh, as indicated by its average diameter of 51.3 cm.

In the uplands surrounding the sinks the overstory trees averaged 420 #/ha with a basal area of 39.73 m^2/ha (Table 2). Here black oak dominated with 70 #/ha and an IV of 66, followed by white oak with 105 #/ha and an IV of 44. Other important species included shagbark hickory (IV of 16.3), Prunus serotina (black cherry) with an IV of 12.0 and Quercus stellata (post oak) with an IV of 10.8, along with 11 other species with lower importance values. As in the sinkholes, except for black oak, most of the trees species has good diameter class distribution.

As would be expected, the overstory of the uplands and sinks is very similar, most of the same species being present, and the major dominants (white oak, black oak, shagbark hickory) being the same. Though the subordinant species are not exactly the same, and their ranking differs, most would be expected in a closed, upland forest in southern Illinois. The major overstory differnces between the sink and upland habitat is in tree density (311 #/ha in the sinks vs. 420 #/ha in the uplands), and in the amount of basal area (24 m^2/ha in the sinks vs. 39 m^2/ha in the uplands). These differences are probably due to past disturbances, which probably resulted in the removed of the larger oak, particularly white oak, more than 75 years ago, along with grazings and an occasional fire. The size class distribution of white oak suggests that this species has, until recently, been reproducing in the forest, with 40 #/ha (uplands) and 13.8 #/ha (sinks) in the 10-19 cm diameter class. Also, this species is well represented in the 20-29 and 30-39 cm diameter classes, indicating that canopy openings, or other disturbances, have been common for a number of years. The overstory differences between the uplands and the sinks are probably due to more

disturbances, particularly cutting, in the uplands.

Woody Understory: The woody understory of the sinkholes and the uplands differed extensively in seedling density, averaging 10,575 stems/ha in the sinks verses 20,350 stems/ha in the uplands. In contrast, total sapling density was similar between the two habitats (Table 3), but overall, seedling and sapling densities were higher in the uplands. The most common understory species in both habitats was slippery elm which dominated the seedling and small sapling categories, and ranked second in large saplings. Other species with large numbers of seedling were black cherry, Sassafras albidum (sassafras), green ash, and black oak. Most of these species were of minor importance in the canopy, with relatively few individuals in the sapling categories. Black oak, in contrast, though common in the seedling categories, and being a canopy dominant, lacked saplings, and had few individuals in the lower tree diameter classes (Tables 1 & 2). Large saplings of Cornus florida (flowering dogwood) were extremely common, exceeding all other species and accounting for nearly half of the large sapling density in both the sinkholes and the adjacent uplands. Its low seedling density is probably due to Discula destructiva (dogwood anthracnose), as many dead and dying individuals were encountered during this study (Schwegman 1996). Most of the woody understory consisted of native species that would be expected in these habitats. A few exotic species were rarely encountered, including Lonicera maackii (Rupr.) Maxim. (Amur honeysuckle), L. japonica Thunb. (Japanese honeysuckle), and Ligustrum vulgare L. (common privet).

Ground Cover: The ground cover (including woody seedlings) was not

particularly diverse, only 53 species being encountered (Table 4). Of these 25 were seedlings of woody species, including six woody vines, four shrubs, and the remainder overstory tree species. Parthenocissus quinquefolia (Virginia creeper) dominated both the sinkholes and the uplands. Circaea lutetiana (enchanter's nightshade) and Smilacina racemosa (false Solamon's seal) were second and third in importance in the sinkholes, while slippery elm and Podophyllum peltatum (mayapple) took these positions in the uplands. Many of the species encountered in one of the habitats, was also present in the other, but rarely with the same importance, 19 species occurring in the sinks but not in the uplands, and six species found in the uplands that were not recorded for the sinks. All of these species were of minor importance, none with an IV exceeding 2.8 in the habitat in which they occurred.

LITERATURE CITED

Bollwinkel, C.W. 1958. Sink-hole pond vegetation of southern Illinois. M.S. Thesis, Southern Illinois University, Carbondale, Illinois. v+52 pages.

Clark, T.H. and C. Stearn. 1968. Geological evolution of North America. The Ronald Press Company, New York.

Daubenmire, R. 1959. A canopy-coverage method of vegetation analysis. Northwest Science 33:43-64.

Hutchison, M.D. 1982. A protection plan for elements of biotic diversity occurring on the Oerter tract and including the major part of Stemler Cave Woods Natural Area in St. Clair County, Illinois. Natural Land Institute, Belknap, Illinois. 22 pages.

McIntosh, R. 1957. The York Woods; a case history of forest succession in southern Wisconsin. Ecology 38:29-37.

Mohlenbrock, R.H. 1986. Guide to the vascular flora of Illinois. Southern Illinois University Press, Carbondale and Edwardsville, Illinois. viii+ 507 pages.

Schwegman, J. 1973. Comprehensive plan for the Illinois nature preserve system. Part 2. The natural divisions of Illinois. Illinois Nature Preserves Commission, Springfield, Illinois. 32 pages.

Schwegman, J. 1996. Flowering dogwoods in peril. The Illinois Steward 5(2):8-11.

Table 1. Densities (stems/ha), diameter classes, basal areas (m^2/ha), relative values, importance values and average diameters of the woody species in the sinks at the Stemler Cave Woods Nature Preserve, St. Clair County, Illinois

Species	Diameter Classes (cm) 10-19	20-29	30-39	40-49	50-59	60+	Total #/ha	Basal Area m^2/ha	Rel. Den.	Rel. Dom.	I.V.	Av. Diam. (cm)
Quercus alba	13.8	18.8	16.3	12.5	3.8	8.8	74.0	8.93	23.8	36.0	59.8	35.5
Quercus velutina	--	1.3	5.0	3.8	13.8	7.5	31.4	6.74	10.1	27.1	37.2	51.3
Carya ovata	27.5	11.3	5.0	1.3	--	--	45.1	1.68	14.5	6.8	21.3	20.0
Fraxinus pennsylvanica	6.3	11.3	5.0	2.5	--	1.3	26.4	1.89	8.5	7.6	16.1	27.9
Ulmus rubra	21.3	2.5	6.3	--	--	1.3	31.4	1.40	10.1	5.6	15.7	20.8
Quercus rubra	2.5	3.8	6.3	--	--	1.3	13.9	1.21	4.5	4.9	9.4	30.6
Acer saccharum	7.5	5.0	--	--	--	1.3	13.8	0.72	4.4	2.9	7.3	21.9
Carya tomentosa	5.0	2.5	1.3	1.3	1.3	--	11.4	0.79	3.7	3.2	6.9	26.5
Cornus florida	13.8	--	--	--	--	--	13.8	0.16	4.4	0.6	5.0	12.0
Quercus stellata	--	3.8	--	1.3	1.3	--	6.4	0.68	2.0	2.8	4.8	35.4
Sassafras albidum	12.5	--	--	--	--	--	12.5	0.15	4.0	0.6	4.6	12.2
Cercis canadensis	10.0	--	--	--	--	--	10.0	0.15	3.2	0.6	3.8	13.3
Ulmus americana	7.5	1.3	--	--	--	--	8.8	0.13	2.8	0.5	3.3	13.2
Celtis occidentalis	7.5	--	--	--	--	--	7.5	0.10	2.4	0.4	2.8	13.0
Diospyros virginiana	1.3	1.3	--	--	--	--	2.6	0.06	0.8	0.2	1.0	16.7
Carya glabra	1.3	--	--	--	--	--	1.3	0.02	0.4	0.1	0.5	14.7
Prunus serotina	1.3	--	--	--	--	--	1.3	0.02	0.4	0.1	0.5	12.8
Totals	139.1	62.9	45.2	22.7	20.2	21.5	311.6	24.83	100.0	100.0	200.0	

Table 2. Densities (stems/ha), diameter classes, basal areas (m^2/ha), relative values, importance values and average diameters of the woody species in the uplands at the Stemler Cave Woods Nature Preserve, St. Clair County, Illinois

Species	Diameter Classes (cm) 10-19	20-29	30-39	40-49	50-59	60+	Total #/ha	Basal Area m^2/ha	Rel. Den.	Rel. Dom.	I.V.	Av. Diam. (cm)
Quercus velutina	--	--	2.5	15.0	20.0	32.5	70.0	19.58	16.7	49.3	66.0	58.7
Quercus alba	40.0	22.5	20.0	17.5	2.5	2.5	105.0	7.54	25.0	19.0	44.0	27.3
Carya ovata	27.5	17.5	5.0	--	--	--	50.0	1.74	11.9	4.4	16.3	20.1
Prunus serotina	15.0	10.0	10.0	--	--	--	35.0	1.47	8.3	3.7	12.0	22.1
Quercus stellata	5.0	2.5	7.5	7.5	--	--	22.5	2.15	5.4	5.4	10.8	33.4
Carya tomentosa	2.5	10.0	7.5	--	2.5	--	22.5	1.68	5.4	4.2	9.6	29.2
Quercus rubra	--	2.5	5.0	--	--	5.0	12.5	2.58	3.0	6.5	9.5	46.2
Ulmus rubra	22.5	2.5	--	2.5	--	--	27.5	0.77	6.5	1.9	8.4	16.9
Cornus florida	20.0	--	--	--	--	--	20.0	0.22	4.8	0.5	5.3	11.7
Acer saccharum	10.0	5.0	--	--	--	--	15.0	0.37	3.6	0.9	4.5	17.2
Sassafras albidum	10.0	2.5	--	--	--	--	12.5	0.21	3.0	0.5	3.5	14.1
Carya glabra	12.5	--	--	--	--	--	12.5	0.14	3.0	0.4	3.4	11.9
Fraxinus pennsylvanica	--	--	--	5.0	--	--	5.0	0.74	1.2	1.9	3.1	43.4
Tilia americana	--	2.5	2.5	--	--	--	5.0	0.33	1.2	0.8	2.0	28.1
Carya cordiformis	--	2.5	--	--	--	--	2.5	0.15	0.5	0.4	0.9	27.7
Acer rubrum	2.5	--	--	--	--	--	2.5	0.06	0.5	0.2	0.7	17.2
Totals	167.5	80.0	60.0	47.5	25.0	40.0	420.0	39.73	100.0	100.0	200.0	

Table 3. Density (stems/ha) of seedlings (<50 cm tall), small saplings (>50 cm tall but <2.5 cm dbh), and large saplings (2.5-10 cm dbh) in the sinks and the uplands at Stemler Cave Woods Nature Preserve, St. Clair County, Illinois.

Species	SINKS			UPLAND		
	Seedlings	Small Saplings	Large Saplings	Seedlings	Small Saplings	Large Saplings
Ulmus rubra	4100	1425	158	7550	1700	140
Prunus serotina	1975	75	3	2600	50	--
Sassafras albidum	750	150	45	2250	350	70
Fraxinus pennsylvanica	675	700	10	850	50	5
Quercus velutina	650	—	—	2100	—	—
Carya ovata	575	50	20	250	50	35
Celtis occidentalis	475	325	23	600	—	—
Diospyros virginiana	325	--	—	200	50	—
Quercus alba	275	25	28	550	200	10
Cornus florida	175	525	370	50	150	405
Ulmus americana	100	—	23	1000	100	—
Quercus rubra	100	25	--	1500	—	5
Lonicera maackii	100	50	3	100	150	—
Carya glabra	75	25	5	550	—	40
Morus rubra	75	150	10	--	—	5
Acer saccharum	25	175	43	—	—	60
Acer negundo	25	--	18	—	—	10
Others (6 species)	100	200	46	200	100	45
Totals	10575	3900	805	20350	2950	830

Table 4. Relative frequency, relative cover and importance value of the ground cover species, herbaceous and woody, at the Stemler Cave Natural Area, St. Clair County, Illinois.

Species	SINKS Rel. Freq.	SINKS Rel. Cover	SINKS I.V.	UPLANDS Rel. Freq.	UPLANDS Rel. Cover	UPLANDS I.V.
Partenocissus quinquefolia	27.4	46.8	74.2	20.8	30.6	51.4
Circaea lutetiana	17.1	23.0	40.1	4.0	10.3	14.3
Smilacina racemosa	4.3	6.0	10.3	0.3	0.9	1.2
Arisaema triphyllum	6.0	1.4	7.4	2.3	1.6	3.9
Toxicodendron radicans	2.5	4.6	7.1	3.3	5.4	8.7
Podophyllum peltatum	3.6	2.9	6.5	4.0	12.8	16.8
Ulmus rubra	4.1	2.1	6.2	10.0	12.1	22.1
Arisaema dracontium	3.1	1.7	4.8	1.0	0.5	1.5
Vitus vulpina	2.8	1.0	3.8	5.6	1.4	7.0
Prunus serotina	3.3	0.4	3.7	8.6	5.1	13.7
Pilea pumila	2.8	0.6	3.4	1.0	1.6	2.6
Galium circaezans	2.0	0.8	2.8	—	—	—
Quercus velutina	2.0	0.3	2.3	4.7	1.4	6.1
Rubus allegheniensis	1.3	1.0	2.3	—	—	—
Sassafras albidum	1.7	0.4	2.1	5.0	1.4	6.4
Sanicula canadensis	1.3	0.6	1.9	3.0	1.7	4.7
Viola pratincola	1.3	0.3	1.6	—	—	—
Potentilla simplex	0.8	0.7	1.5	—	—	—
Phryma leptostachya	0.8	0.7	1.5	—	—	—
Phytolacca americana	1.3	0.1	1.4	4.7	1.0	5.7
Ulmus americana	1.0	0.3	1.3	1.0	0.1	1.1
Fraxinus pennsylvanica	0.7	0.5	1.2	1.3	1.9	3.2
Osmorhiza claytonii	0.7	0.4	1.1	—	—	—
Quercus rubra	0.8	0.2	1.0	1.0	1.0	2.0
Hackelia virginiana	0.5	0.3	0.8	0.3	0.1	0.4
Cornus florida	0.7	0.1	0.8	0.3	0.3	0.6
Quercus alba	0.5	0.3	0.8	—	—	—
Desmodium glutinosum	0.3	0.4	0.7	—	—	—
Dioscorea villosa	0.5	0.2	0.7	0.7	0.4	1.1
Botrychium virginianum	0.5	0.1	0.6	0.3	0.1	0.4
Eupatorium rugosum	0.3	0.2	0.5	4.3	2.6	6.9
Parietaria pensylvanica	—	—	—	6.6	3.8	10.4
Carya ovata	0.3	0.1	0.4	1.0	0.8	1.8
Celtis occidentalis	—	—	—	1.3	0.3	1.6
Geum canadense	0.3	0.1	0.4	0.7	0.4	1.1
Acer rubrum	—	—	—	0.7	0.0	0.7
Cardamine pensylvanica	—	—	—	0.7	0.0	0.7
Sambucus canadensis	—	—	—	0.3	0.3	0.6
Diospyros virginiana	0.3	0.1	0.4	0.3	0.1	0.4
Scutellaria ovata	0.3	0.1	0.4	0.3	0.0	0.3
Triodanis perfoliata	—	—	—	0.3	0.0	0.3
Lonicera japonica	0.2	0.1	0.3	0.3	0.0	0.3
Celastrus scandens	0.3	0.1	0.4	—	—	—
Lonicera maackii	0.3	0.1	0.4	—	—	—
Polygonum virginianum	0.3	0.1	0.4	—	—	—
Others (8 species)	1.7	0.8	2.5	—	—	—
Totals	100.0	100.0	200.0	100.0	100.0	200.0

APPENDIX I. Vascular plant species list for Stemler Cave Woods Nature Preserve, St. Clair County, Illinois. Nomenclature follows Mohlenbrock (1986)

ASPLENIACEAE
Asplenium platyneurin (L.) Oakes

DRYOPTERIDACEAE
Cystopteris protrusa (Weatherby) Blasd.
Polystichum acrostichoides (Michx.) Schott.
Woodsia obtusa (Spreng.) Torr.

OPHIOGLOSSACEAE
Botrychium virginianum (L.) Sw.
Botrychium dissectum Spreng.
Ophioglossum vulgatum L.

PTERIDACEAE
Adiantum pedatum L.

CUPRESSACEAE
Juniperus virginiana L.

ARACEAE
Arisaema dracontium (L.) Schott.
Arisaema triphyllum (L.) Schott.

COMMELINACEAE
Tradescantia ohiensis Raf.

CYPERACEAE
Carex blanda Dewey
Carex cephalophora Muhl.
Carex grisea Wahl.
Carex hirsutella Mack.
Carex muhlenbergii Schk.

DIOSCOREACEAE
Dioscorea villosa L.

IRIDACEAE
Sisyrinchium albidum Raf.

JUNCACEAE
Juncus tenuis Willd.

LILACEAE
Allium canadense L.
Hemerocallis fulva (L.) L.
Smilacina racemosa (L.) Desf.
Uvularia grandiflora Sm.

POACEAE
Agrostis alba L.

Agrostis hyemalis (Walt.) BSP.
Alopecurus carolinianus Watt.
Andropogon gerardii Vitman
Bromus commutatus Schrad.
Bromus pubescens Muhl.
Bromus tectorum L.
Cinna arundinacea L.
Dactylis glomerata L.
Dichanthelium acuminatum (Sw.) Gould & Clark
Digitaria ischaemum (Schreb.) Muhl.
Digitaria sanguinalis (L.) Scop.
Elymus villosus L.
Festuca pratensis Huds.
Festuca obtusa Biehler
Lolium perenne L.
Phleum pratense L.
Poa compressa L.
Poa pratense L.
Poa sylvestris Gray
Setaria faberi Herrm.
Setaria glauca (L.) Beauv.
Sorghastrum nutans (L.) Nash
Sphenopholis obtusa (Michx.) Scribn.
Tridens flavus (L.) Hitchcock

SMILACEAEAE
Smilax hispida L.

ACERACEAE
Acer negundo L.
Acer rubrum L.
Acer saccharinum L.
Acer saccharum Marsh.

ANACARDIACEAE
Rhus aromatica Ait.
Rhus copallina L.
Rhus glabra L.
Toxicodendron radicans (L.) Kuntze

ANNONACEAE
Asimina triloba (L.) Dunal.

APIACEAE
Chaerophyllum procumbens (L.) Crantz
Cryptotaenia canadensis (L.) DC.
Daucus carota L.
Eryngium yuccifolium Michx.
Osmorhiza claytonii (Michx.) Clarke
Osmorhiza longistylis (Torr.) DC.
Pastinaca sativa L.
Sanicula canadensis L.
Sanicula gregaria Bickn.

APOCYNACEAE
Vinca minor L.

AQUIFOLIACEAE
Ilex decidua Walt.

ARISTOLOCHIACEAE
Aristochia serpentaria L.

ASCLEPIADACEAE
Asclepias syriaca L.

ASTERACEAE
Ambrosia artemisiifolia L.
Ambrosia trifida L.
Aster lateriflorus (L.) Britt.
Aster ontarionis Wieg.
Conyza canadensis (L.) Cronq.
Erigeron annuus (L.) Pers.
Erigeron philadelphicus L.
Eupatorium rugosum Houtt.
Helianthis mollis Lam.
Lactuca canadensis L.
Ratibida pinnata (Vent.) Barnh.
Rudbeckia hirta L.
Solidago canadensis L.
Solidago juncea Ait.
Taraxacum officinale Weber

BALSAMINACEAE
Impatiens capensis Meerb.

BERBERIDACEAE
Podophyllum peltatum L.

BIGNONIACEAE
Campsis radicans (L.) Seem.

BORAGINACEAE
Hackelia virginiana (L.) I. M. Johnston
Myosotis verna Nutt.

BRASSICACEAE
Arabis laevigata (Muhl.) Poir.
Barbarea vulgaris R. Br.
Capsella bursa-pastoris (L.) Medic.
Cardamine pensylvanica Muhl.
Lepidium virginicum L.
Thlaspi arvense L.

CAESALPINACEAE
Cercis canadensis L.

CALLITRICHACEAE
Callitriche terrestris Raf.

CAMPANULACEAE
Triodanis perfoliata (L.) Nieuwl.

CAPRIFOLIACEAE
Lonicera japonica Thunb.
Lonicera maackii (Rupr.) Maxim.
Sambucus canadensis L.
Symphoricarpos orbiculatus Moench.
Viburnum rufidulum Raf.

CARYOPHYLLACEAE
Arenaria serpyllifolia L.
Cerastium vulgatum L.
Stellaria media (L.) Vill.

CELASTRACEAE
Celastrus scandens L.
Euonymus alatus (Thunb.) Sieb.

CONVOLVULACEAE
Convolvulus arvensis L.
Calystegia sepium (L.) R. Br.

CORNACEAE
Cornus drummondii C.A. Mey.
Cornus florida L.

CORYLACEAE
Carpinus caroliniana Walt.
Ostrya virginiana (Mill.) K. Koch

EBENACEAE
Diospyros virginiana L.

ELAEAGNACEAE
Elaeagnus umbellata Thunb.

FABACEAE
Amphicarpa bracteata (L.) Fern.
Desmodium glutinosum (Muhl.) Wood.
Lespedeza capitata Michx.
Lespedeza cuneata (Dum.-Cours.) G. Don
Melilotus officinalis (L.) Pers.
Medicago lupulina L.
Trifolium pratense L.
Trifolium repens L.

FAGACEAE
Quercus alba L.
Quercus imbricaria Michx.
Quercus marilandica Muenchh.

Quecus rubra L.
Quecus stellata Wangh.
Quecus velutina Lam.

FUMARIACEAE
Corydalis flavula (Raf.) DC.

GERANIACEAE
Geranium carolinianum L.
Geranium maculatum L.

JUGLANDACEAE
Carya glabra (Mill.) Sweet
Carya ovalis (Wang.) Sarg.
Carya ovata (Mill.) K. Koch
Carya tomentosa (Poir.) Nutt.

LAMIACEAE
Glechoma hederacea L.
Monarda bradburiana Beck.
Prunella vulgaris L.
Scutellaria ovata Hill.

LAURACEAE
Lindera benzoin (L.) Blume.
Sassafras albidum (Nutt.) Nees

MORACEAE
Morus alba L.
Morus rubra L.

OLEACEAE
Fraxinus americana L.
Fraxinus pennsylvanica Marsh.
Ligustrum vulgaris L.

ONAGRACEAE
Circaea lutetiana Aschers. & Magnus.
Oenother biennis L.

OXALIDACEAE
Oxalis dillenii Jacq.
Oxalis stricta L.

PHRYMACEAE
Phryma leptostachya L.

PHYTOLACCACEAE
Phytolacca americana L.

PLANTAGINACEAE
Plantago lanceolata L.
Plantago rugelii Dcne.

POLYGONACEAE
Rumex acetosella L.
Rumex altissimus Wood.
Rumex crispus L.
Polygonum cespitosum Blum.
Polygonum pensylvanicum L.
Polygonum scandens L.
Polygonum virginianum L.

PORTULACACEAE
Claytonia virginica L.

PRIMULACEAE
Dodecatheon meadia L.

RANUNCULACEAE
Anemone virginiana L.
Aquilegia canadensis L.
Ranunculus abortivus L.
Ranunculus hispidus Michx.
Ranunculus micranthus Nutt.

ROSACEAE
Amelanchier arborea (Michx. f.) Fern.
Aruncus dioicus (Walt.) Fern.
Crataegus mollis (T. & G.) Scheele
Fragaria virginiana Duchesne
Geum canadense Jacq.
Geum vernum (Raf.) Torr. & Gray
Malus ioensis (Wood) Britt.
Potentilla simplex Michx.
Prunus angustifolia Marsh.
Prunus munsoniana Wright & Hedrick
Prunus serotina Ehrh.
Rosa carolina L.
Rosa multiflora Thunb.
Rosa setigera Michx.
Rubus allegheniensis Porter

RUBIACEAE
Galium aparine L.
Galium circaezans Michx.
Galium triflorum Michx.

SALICACEAE
Populus deltoides Marsh.
Salix exigua Nutt.
Salix nigra Marsh.

SAXIFRAGACEAE
Heuchera americana L.

SCROPULARIACEAE
Penstemon digitalis Nutt.
Penstemon pallidus Small
Verbascum thapsus L.
Veronica arvensis L.
Veronica peregrina L.

SIMAROUBACEAE
Ailanthus altissima (Mill.) Swingle

SOLANACEAE
Physalis heterophylla Nees.
Solanum carolinense L.

TILIACEAE
Tilia americana L.

ULMACEAE
Celtis occidentalis L.
Ulmus americana L.
Ulmus rubra Muhl.

URTICACEAE
Parietaria pensylvanica Muhl.
Pilea pumila (L.) Gray

VIOLACEAE
Viola pratincola Greene
Viola rafinesquii Greene
Viola triloba Schwein.

VITACEAE
Partenocissus quinquefolia (L.) Planch.
Vitis cinerea Engelm.
Vitis vulpina L.