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Vascular Flora of an Old-Growth Forest Remnant in the Ozark Hills of Southern Illinois - Updated Results

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ABSTRACT

The vascular flora of Weaver's Woods, a 7.2 ha old-growth forest remnant, was surveyed during the 1995 growing season. A total of 215 species and subspecific taxa in 77 families and 155 genera were identified, of which 24 (11.2%) were non-native. The predominant photosynthetic pathway was C_3 (96.3%), and only 8 taxa exhibited the C_4 pathway. The dominant growth form was perennial (78.1%), with most taxa being woody or herbaceous. The most common lifeforms were hemicryptophytes (76 taxa/35.3%) and phanerophytes (62 taxa/28.8%). Four habitats were identified, with species richness being highest in dry-mesic upland forest and lowest in forest edge. Non-native taxa were most common along intermittent streams in mesic upland forest and along the forest edge. Abundance ratings indicate that most taxa were not frequently encountered, which may be related to an increase in mesophytic species (increased shade) and limited habitat for shade intolerant plant species. Floristic comparison with 13 study sites in southwestern Illinois revealed that the families Asteraceae, Poaceae, Cyperaceae, Fabaceae, Rosaceae, and Liliaceae account for approximately 41% of the taxa in the flora, while the genera *Carex*, *Dichanthelium*, *Solidago*, *Aster*, and *Quercus* had the highest numbers of taxa. The average proportions of vascular cryptogams and gymnosperms, monocotyledonous angiosperms, and dicotyledonous angiosperms at each study site were 4%, 24%, and 72%, respectively.

INTRODUCTION

Old-growth mesic upland forests are rare in the central hardwood region (Parker 1989). It is estimated that less than 1% of the original forest in this region remains as old-growth, and the majority of these forests are small (< 15 ha), isolated, and within fragmented landscapes (Parker et al. 1985, Parker 1989). Upland oak-hickory forests are declining in the region from poor regeneration and are being replaced by *Acer saccharum* Marsh. and *Fagus grandifolia* Ehrh. (Boggess and Bailey, 1964, Weaver and Ashby 1971, Schmelz et al. 1974, Barton and Schmelz 1987, Shotola et al. 1992, Franklin et al. 1993). This decline is attributed to a combination of climatic change and removal of anthropogenic and natural disturbances (Parker 1989).

Weaver's Woods, one of the best documented old-growth forests in the midwest, provides an excellent opportunity to add to our knowledge of the old-growth condition (Weaver and

Ashby 1971, Shotola et al. 1992). An extensive data set on woody and herbaceous vegetation at Weaver's Woods has been collected since 1956, but no study of the complete vascular flora has been conducted. Therefore, the objectives of this study were, following guidelines in Palmer et al. (1995), (1) to survey the vascular flora of Weaver's Woods, (2) delineate habitats, (3) describe the flora in terms of growth forms, life forms, and photosynthetic pathways, and (4) compare the results with other floristic studies conducted in southwestern Illinois to complement results reported in Basinger and Robertson (1996).

STUDY AREA

Weaver's Woods is a privately owned 7.2 ha forest located approximately 8 km south of Jonesboro, Illinois (Figure 1). The study site is located within the Southern Section of the Ozark Division, a driftless region of dissected topography that is the eastern extent of the Salem Plateau (Schwegman et al. 1973). Braun (1950) included the Illinois Ozarks as part of the Hill Section of the Western Mesophytic Forest. Moist ravines and sheltered slopes are favorable for mixed mesophytic vegetation, while oak-hickory forests develop on drier uplands (Braun 1950).

Climate in southern Illinois is continental with warm summers and mild winters. Thornthwaithe (1948) considered the climate to be humid mesothermal with little to no water deficit in any season and a potential annual evapotranspiration of 76.2 cm. Average yearly precipitation is 117 cm at Anna, approximately 9 km north of the study site. Precipitation is evenly distributed throughout the year, though extended periods of drought can occur during the summer months. The mean January temperature is 2°C while the mean July temperature is 26°C at Anna. The average number of frost-free days is 206, extending between 7 April and 30 October (Miles et al. 1979).

Upland soils at Weaver's Woods consist primarily of Alford silt loam, a well-drained, high available water-holding capacity soil, formed from deep loessal deposits (typic hapludalf), covers approximately 81% of the study site. Other upland soils of minor importance comprise approximately 5% of the study area and are found on the steepest slopes. Ravine bottoms comprise approximately 15% of the study area and are composed of Elsah cherty silt loam and Haymond silt loam (typic udifluvents) which are moderate to well-drained soils (Weaver and Ashby 1971, Miles et al. 1979, Shotola et al. 1992).

Weaver's Woods, owned by the Weaver family since the 1820's, has remained free from fire and grazing for over 100 years (Weaver and Ashby 1971, Shotola et al. 1992). Selective tree removal occurred between 1871 and 1950, with approximately 100 trees removed from the stand in various size-classes. Among the species removed were *Carya ovata* (Mill.) K. Koch for firewood, and *Quercus alba* L., *Q. velutina* Lam., *Q. rubra* L., *Liriodendron tulipifera* L., and *Magnolia acuminata* L. for construction and stave bolts. This forest has been surrounded by farmland since the early 1900's and has experienced severe gully erosion to drainage channels and windstorm damage (Weaver and Ashby 1971, Shotola et al. 1992). Due to the degradation of the forest, mortality of many large oaks and hickories, and increase of *Acer saccharum* Marsh. and *Fagus grandifolia* Ehrh. in the understory, a timber harvest occurred at Weaver's Woods in November 1995. Future

management of this forest will include re-planting of oaks and hickories, removal of the mesophytic understory, and construction of water bars to control erosion.

METHODS

Thirty trips were made to Weaver's Woods from 1 April-15 November 1995 to collect voucher specimens, abundance and habitat information for each taxon, and delineate habitats. The entire forest was surveyed for vascular plants approximately once each week during the growing season with special attention given to areas with high species richness. Voucher specimens were deposited at the Illinois Natural History Survey Herbarium (ILLS). Identifications, along with criteria for native and non-native taxa designation and plant duration, were made using Fernald (1950), Radford et al. (1968), Mohlenbrock (1986), Gleason and Cronquist (1991), and Smith (1994). Nomenclature follows Mohlenbrock (1986).

Photosynthetic pathway (C_3/C_4) for each taxon collected at Weaver's Woods was determined using Downtown (1975), Raghavendra and Das (1978), Waller and Lewis (1979), Ueno et al. (1989), and Baskin et al. (1995) (Table 1). Plant duration (annual/perennial) was determined from taxonomic sources listed above. Annual designation also included those taxa, such as *Campanula americana* L., that have a biennial life cycle. Graminoids included Cyperaceae, Juncaceae, and Poaceae. Forbs included non-woody and non-graminoid vascular plants. Woody plants included trees, shrubs, and lianas, while ferns and fern allies were listed as pteridophytes. Woody plants and pteridophytes were assumed to have C_3 photosynthetic pathways (Baskin et al. 1995).

Plant life form (Raunkiaer 1934) was determined for each taxon using information in Ennis (1928), MacDonald (1937), Oosting (1942), Hansen (1952), Gibson (1961), and Baskin et al. (1995).

Abundance ratings (Appendix 1) have been defined to give a relative quantification to field observations and were modified from Murrell and Wofford (1987), Lortie et al. (1991), Looney et al. (1993), and Joyner and Chester (1994). Abundance rating refers to abundance of a taxon within habitats where it is known to occur. When a taxon occurs in more than one habitat, the first listed habitat (optimum) was used to calculate species richness by habitat (Table 2). Abundance ratings were: 1) abundant, species dominant in listed habitat(s), 2) frequent, species co-dominant or in large numbers in listed habitat(s), 3) occasional, species in moderate numbers in listed habitat(s), 4) infrequent, species in small numbers or few individuals in listed habitat(s), and 5) rare, species known from only one individual, a few individuals in a restricted habitat, or from one population.

Habitats for dry-mesic and mesic upland forest were designated using the system of White and Madany (1978). Canopy gap and forest edge habitats, not recognized by White and Madany (1978), were recognized in this study based upon floristic composition and canopy structure.

RESULTS AND DISCUSSION

Based upon 231 collections made during this study, the known vascular flora of Weaver's Woods consisted of 215 species and subspecific taxa in 77 families and 155 genera. No state threatened or endangered taxa were identified. Twenty-four taxa (11.2%) were non-native to the study site (Table 1). Families with greatest representation by individual taxa were Asteraceae (25 taxa), Poaceae (19), Cyperaceae (10), Liliaceae (7), Rosaceae (7), Fabaceae (6), and Juglandaceae (6). The largest genera were *Carex* (10 taxa), *Carya* (5), and *Polygonum*, *Quercus*, and *Smilax* (4 taxa each). Genera with 3 taxa included *Acer*, *Botrychium*, *Desmodium*, *Dichanthelium*, *Elymus*, *Galium*, and *Ranunculus*.

The flora of Weaver's Woods was dominated by C_3 perennial forbs (71 taxa/33.0%), woody plants (64/29.8%), and C_3 annual forbs (41/19.1%). There were 112 forb taxa (52.1%), 64 woody taxa (29.8%), 30 graminoid taxa (14.0%), and 9 pteridophytes (4.2%). The totals of 64 woody and 151 herbaceous taxa are higher than those established for mesic old-growth forests in the central hardwood region (Parker 1989). Of forb and graminoid taxa, 47 (33.1%) were annual and 95 (66.9%) were perennial. Of the 47 annual taxa, six (12.8%) were considered to be biennial: *Campanula americana* L., *Cirsium discolor* Muhl., *Hackelia virginiana* (L.) I.M. Johnston, *Lactuca canadensis* L., *L. floridana* (L.) Gaertn., and *Verbascum thapsus* L. The predominant photosynthetic pathway for all vascular taxa was C_3 (96.3%). Only 8 taxa (3.7%), all in the Poaceae, were considered to have the C_4 photosynthetic pathway. Several studies from the eastern United States in granite and limestone outcrops (Philips 1982, Baskin et al. 1995), and bottomland forests and swamps (Basinger et al. in press) also indicate that the C_3 photosynthetic pathway is most common.

Life forms of the 215 taxa identified from Weaver's Woods are as follows: hemicryptophytes (76 taxa/35.3%), phanerophytes (62/28.8%), therophytes (41/19.1%), cryptophytes (35/16.3%), and chamaephytes (1/0.5%). Six biennial and two *Rubus* taxa were considered as hemicryptophytes, although they were considered as annual and woody taxa, respectively, in plant duration. Studies in the eastern United States from localized granite and limestone outcrops (Phillips 1982, Baskin et al. 1995), regional areas (Oosting 1942), and statewide floras (MacDonald 1937, Hansen 1952, Gibson 1961) all note that the most prevalent life form is the hemicryptophyte.

Although habitats at Weaver's Woods were dominated by woody vegetation, the proportion of herbaceous growth forms within each habitat did vary. C_3 perennial forbs, C_3 perennial graminoids, and pteridophytes were common components of dry-mesic forest. C_3 annual forbs were most common along intermittent streams and alluvial terraces in mesic upland forest, while C_3 annual forbs and C_4 graminoids were common in canopy gaps. C_3 annual and C_3 perennial forbs were common along the forest edge.

Species richness was highest in dry-mesic (109 taxa/50.7%) and mesic upland forest (63/29.3%) habitats and lowest in forest edge (22/10.2%) and canopy gap (21/9.8%) habitats. The high species richness values for dry-mesic and mesic upland forest are primarily a function of the area of these habitats, since they occupy approximately 81% and 15% of the site, respectively. Species richness of non-native taxa was highest in mesic forest, primarily in rocky, intermittent stream beds (10 taxa/4.7%) and forest edge (9/4.2%) habitats and lowest in the canopy gap (4/1.9%) and dry-mesic forest (1/0.5%) habitats.

Abundance ratings indicate that only 7 taxa (3.3%) were abundant and 34 taxa (15.8%) were frequent within their respective habitat optima at Weaver's Woods. The majority of taxa (80.5%) were occasional (11.2%), infrequent (30.7%), or rare (38.6%) in abundance within their habitat optima. This was primarily due to fragmentation (edge effect) and increased canopy shade from mesophytic woody species (*Acer saccharum* Marsh., *Asimina triloba* (L.) Dunal, and *Fagus grandifolia* Ehrh.) during the growing season which limit habitat space and growth of shade intolerant plant species (Shotola et al. 1992).

The vascular flora of Weaver's Woods was compared to 13 floristic surveys of sites within the Ozark Hills and Greater Shawnee Hills of southwestern Illinois (Table 4). Mohlenbrock (1986) was used to reduce synonomy in cases where the floras used different taxonomic sources. The values for pteridophytes and gymnosperms in each floristic study ranged from 3.7% and 5.0% with a mean of 4.1% (standard deviation of 0.4%). The total values for monocotyledonous angiosperms in each flora ranged between 21.5% and 28.0% with mean of 24.4% (standard deviation of 1.9%), while the values for dicotyledonous angiosperms ranged between 67.9% and 74.5% with a mean of 71.5% (standard deviation of 1.9%). These values are very consistent with the values of 3.4% for pteridophytes and gymnosperms, 25.5% for monocots, and 71.1% for dicots reported by Mohlenbrock and Voigt (1959) for 1599 taxa within twelve counties of southern Illinois.

The number of non-native taxa exceeded 10% of the total flora at each study site except for Piney Creek Ravine in Jackson and Randolph counties (9.1%, Weber 1959) and Atwood Ridge Natural Area in Union County (4.4%, Phillippe 1992) (Table 4). The low number of non-native taxa at Atwood Ridge was attributed by Phillippe (1992) to lack of recent disturbance and a continuous forested canopy without openings or roads that would permit colonization of disturbance adapted non-native plant species. Sites that had the highest percentages of non-native taxa (13.2-16.8%), such as Little Grand Canyon (Johnson 1969), Touch of Nature (Davis 1987), Hidden Cove-Buttermilk Hill (Ketzner 1988), Cave Valley-Pomona Natural Bridge (Sadowski 1982), Devil's Kitchen Lake (Ulaszek 1988), and Trail of Tears State Forest (Evans 1981) are all open to the public as recreational and scientific areas for hiking, camping, picnicing, and research.

The most common plant families in each floristic survey were the Asteraceae, Poaceae, Cyperaceae, Fabaceae, Rosaceae, and Liliaceae (Table 5). The number of taxa that these families accounted for in the overall flora of each study site ranged from 34.4% to 45.5% with a mean of 41.3% (standard deviation of 2.7%). Additional plant families that were well represented in these surveys included the Lamiaceae, Scrophulariaceae, Brassicaceae, Ranunculaceae, Polygonaceae, Apiaceae, Euphorbiaceae, and Aspleniaceae.

The most common genera at each study site included *Carex*, *Solidago*, *Aster*, *Dichanthelium*, and *Quercus* (Table 6). *Carex* had the most taxa at every site except Trail of Tears State Forest (Evans 1980). These five genera accounted for 8.1% to 14.6% of the total flora at each study site with a mean of 10.9% (standard deviation of 1.9%). Other important genera at these sites were *Desmodium*, *Bromus*, *Lespedeza*, *Polygonum*, *Viola*, *Juncus*, *Ranunculus*, and *Carya*.

Future floristic study at Weaver's Woods will examine response of the vascular flora to tree harvesting, in particular potential increase and/or spread of non-native taxa.

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APPENDIX 1

The vascular flora of Weaver's Woods is arranged alphabetically by family, genus, and species. Non-native taxa are indicated by an asterisk (*). After the binomial and authority, a list of habitats (1 = dry-mesic forest, 2 = mesic forest, 3 = canopy gap, 4 = forest edge) where the taxon occurred most often is given, followed by an abundance statement (A = abundant, F = frequent, O = occasional, I = infrequent, R = rare), collection number of the first author, life form (Ph = phanerophyte, H = hemicryptophyte, Cr = cryptophyte, Th = therophyte, Ch = chamaephyte), and photosynthetic pathway.

ACERACEAE

Acer negundo L. 2; R; 10316; Ph; C_3.
Acer rubrum L. 2, 1; R; 10317; Ph; C_3.
Acer saccharum Marsh. 1, 2, 3, 4; A; 9654; Ph; C_3.

ADIANTACEAE

Adiantum pedatum L. 1; R; 9518; Cr; C_3.

ANACARDIACEAE

Rhus glabra L. 3; I; 9889; Ph; C_3.
Toxicodendron radicans (L.) Kuntze 1, 4, 2, 3; A; 9900; Ph; C_3.

ANNONACEAE

Asimina triloba (L.) Dunal 1, 2; A; 10362A; Ph; C_3.

APIACEAE

Chaerophyllum procumbens (L.) Crantz 2; I; 9507; Th; C_3.
Cryptotaenia canadensis (L.) DC. 1, 2; F; 9645, 9861; H; C_3.
Osmorhiza longistylis (Torr.) DC. 1, 2; F; 9515; H; C_3.
Sanicula canadensis L. 1, 2; F; 9644, 9860; H; C_3.

AQUIFOLIACEAE

Ilex decidua Walt. 1; R; 10255; Ph; C_3.

ARACEAE

Arisaema dracontium (L.) Schott 1, 2; O; 9509; Cr; C_3.
Arisaema triphyllum (L.) Schott 1, 2; F; 9519; Cr; C_3.

ARALIACEAE

Aralia spinosa L. 1, 4; I; 10249; Ph; C_3.
Panax quinquefolium L. 1, 2; O; 9514; Cr; C_3.

ARISTOLOCHIACEAE

Aristolochia serpenteria L. 1, I; 10241; Cr; C_3.

ASCLEPIADACEAE

Cynanchum laeve (Michx.) Pers. 4, 3; R; 10307; Cr; C_3.
Matelea gonocarpa (Walt.) Shinners 1; R; 10360; H; C_3.

ASPLENIACEAE

Asplenium platyneuron (L.) Oakes 1; I; 9481; H; C_3.
Cystopteris protrusa (Weatherby) Blasd. 1; O; 10361; Cr; C_3.
Polystichum acrostichoides (Michx.) Schott 1, 2; I; 9497; H; C_3.

ASTERACEAE

Ambrosia artemisiifolia L. 2, 3; R; 10294; Th; C_3.
Ambrosia trifida L. 4, 2, 3, 1; I; 10240; Th; C_3.
Aster lateriflorus (L.) Britt. 2, 4; I; 10331; H; C_3.

Aster simplex Willd. 2; R; 10362; H; C_3.
Bidens bipinnata L. 3; R; 10242; Th; C_3.
Bidens frondosa L. 3; R; 10333; Th; C_3.
Cirsium discolor (Muhl.) Spreng. 3, 4; R; 10296; H; C_3.
Conyza canadensis (L.) Cronq. 3, 4; R; 10246; Th; C_3.
Elephantopus carolinianus Willd. 3, 4; R; 10239; H; C_3.
Erechtites hieracifolia (L.) Raf. 3, 2, 1; O; 10247; Th; C_3.
Erigeron annuus (L.) Pers. 2, 1; I; 9668; Th; C_3.
Erigeron philadelphicus L. 2, 3; I; 9492; H; C_3.
Eupatorium rugosum Houtt. 1, 4, 3, 2; F; 10363; H; C_3.
Eupatorium serotinum Michx. 3, 4; I; 10250; H; C_3.
Gnaphalium purpureum L. 2; R; 10345; Th; C_3.
Helianthus divaricatus L. 4; R; 10251; Cr; C_3.
Lactuca canadensis L. 1, 4; R; 10295; H; C_3.
Lactuca floridana (L.) Gaertn. 1, 3, 4; I; 10252; H; C_3.
Prenanthes altissima L. var. *cinnamomea* Fern. 1; I; 10327; H; C_3.
Senecio glabellus Poir. 2; I; 9491; Th; C_3.
Solidago caesia L. 1, 2; R; 10329; H; C_3.
Solidago canadensis L. 4, 3; I; 10291; H; C_3.
**Taraxacum officinale* Weber 2, R; 10364; H; C_3.
Vernonia gigantea (Walt.) Trel. 2, 4; R; 10305; H; C_3.
Xanthium strumarium L. 3, 4; R; 10330; Th; C_3.

BALSAMINACEAE

Impatiens capensis Meerb. 2, 1, 3; F; 9862; Th; C_3.

BERBERIDACEAE

Podophyllum peltatum L. 1, A; 9864; Cr; C_3.

BIGNONIACEAE

Campsis radicans (L.) Seem. 4, 1; R; 9897; Ph; C_3.

BORAGINACEAE

Cynoglossum virginianum L. 1, 2; I; 9479; H; C_3.
Hackelia virginiana (L.) I.M. Johnston 1, 3; O; 10238; H; C_3.
Myosotis macrosperma Engelm. 2; R; 10365; Th; C_3.

BRASSICACEAE

**Cardamine hirsuta* L. 2, 1, 3; I; 9489; Th; C_3.
Dentaria laciniata Muhl. 1, 2; F; 9484; Cr; C_3.
**Thlaspi arvense* L. 2; R; 9493; Th; C_3.

CAESALPINIACEAE

Cercis canadensis L. 1, 4; R; 10341; Ph; C_3.
Gleditsia triacanthos L. 2, 4, 3; I; 9867; Ph; C_3.

CALLITRICHACEAE

Callitriche terrestris Raf. 2; R; 10366; Th; C_3.

CAMPANULACEAE

Campanula americana L. 2, 1; I; 10236; H; C_3.
Lobelia inflata L. 1, 2; I; 9881, 10292; Th; C_3.
Lobelia siphilitica L. 2; I; 10230; H; C_3.

CAPRIFOLIACEAE

**Lonicera japonica* Thunb. 4, 2, 1; O; 9871; Ph; C_3.
**Lonicera maackii* (Rupr.) Maxim. 4, 3, 1; I; 9659; Ph; C_3.

Sambucus canadensis L. 1, 3, 2; F; 9868; Ph; C_3.
Viburnum rufidulum Raf. 1; I; 9508; Ph; C_3.

CARYOPHYLLACEAE

**Stellaria media* (L.) Vill. 2, I; 10342; Th; C_3.

CELASTRACEAE

Celastrus scandens L. 4, 1; I; 9500; Ph; C_3.
Euonymus atropurpureus Jacq. 1, 2, 4; F; 9504, 10248; Ph; C_3.
**Euonymus fortunei* (Turcz.) Hand.-Maz. 4, 1; I; 9503; Ph; C_3.

CHENOPODIACEAE

Chenopodium album L. 1, 3, 4; I; 10318, 10337; Th; C_3.

COMMELINACEAE

**Commelina communis* L. 2; R; 9888; Th; C_3.

CONVOLVULACEAE

**Ipomoea hederacea* (L.) Jacq. 4, 3; R; 10323; Th; C_3.

CORNACEAE

Cornus drummondii C.A. Mey. 1, 4; I; 9873; Ph; C_3.
Cornus florida L. 1, 4; I; 9896; Ph; C_3.

CORYLACEAE

Carpinus caroliniana Walt. 1, 2; I; 9872; Ph; C_3.
Ostrya virginiana (Mill.) K. Koch 1, 2; O; 10299; Ph; C_3.

CUPRESSACEAE

Juniperus virginiana L. 1; R; 9648; Ph; C_3.

CYPERACEAE

Carex amphibola Steud. 1, 2; F; 9473, 9513; H; C_3.
Carex artitecta Mack. 1; I; 9501; H; C_3.
Carex blanda Dewey 1, 2; F; 9506; H; C_3.
Carex cephalophora Willd. 1; R; 9477; H; C_3.
Carex digitalis Willd. 1; I; 9494; H; C_3.
Carex hirsutella Mack. 1, 4; R; 9874; Cr; C_3.
Carex hirtifolia Mack. 1; R; 9512; Cr; C_3.
Carex jamesii Schwein. 1, 2; F; 9496; H; C_3.
Carex laxiflora Lam. 1; R; 9476, 9529; H; C_3.
Carex rosea Willd. 1, 2; R; 9498, 9524; H; C_3.

DIOSCOREACEAE

Dioscorea quaternata (Walt.) J.F. Gmelin 1, 2, 4; I; 9520; Cr; C_3.

EBENACEAE

Diospyros virginiana L. 1, 4, 3, 2; I; 10293; Ph; C_3.

ELAEAGNACEAE

**Elaeagnus umbellata* Thunb. 4; R; 9895; Ph; C_3.

EUPHORBIACEAE

Acalypha rhomboidea Raf. 3, 2; R; 10244; Th; C_3.
Acalypha virginica L. 3, 1; I; 10243, 10382; Th; C_3.

FABACEAE

Amphicarpaea bracteata (L.) Fern. 1, 2; I; 9878, 10301; Th; C_3.
Desmodium canescens (L.) DC. 4; R; 10319; H; C_3.
Desmodium glabellum (Michx.) DC. 1, 4; R; 10302, 10335; H; C_3.
Desmodium paniculatum (L.) DC. 1, 4; R; 10320; H; C_3.
**Robinia pseudo-acacia* L. 4, 1; I; 10328; Ph; C_3.

**Trifolium repens* L. 2; R; 10367; H; C_3.

FAGACEAE

Fagus grandifolia Ehrh. var. *caroliniana* (Loud.) Fern. & Rehd. 1, 2; F; 9649; Ph; C_3.
Quercus alba L. 1, 2, 4; F; 9639; Ph; C_3.
Quercus prinoides Willd. var. *acuminata* (Michx.) Gl. 2, 1; R; 9658; Ph; C_3.
Quercus rubra L. 1, 4; F; 9647; Ph; C_3.
Quercus velutina Lam. 1, 4; F; 9646; Ph; C_3.

FUMARIACEAE

Corydalis flavula (Raf.) DC. 1, 3, 2; F; 9475; Th; C_3.

HAMAMELIDACEAE

Liquidambar styraciflua L. 2, 1, 3, 4; I; 9667; Ph; C_3.

HYDRANGEACEAE

Hydrangea arborescens L. 1, 2; R; 9876; Ph; C_3.

HYPERICACEAE

Hypericum punctatum Lam. 1; R; 10322B; H; C_3.

IRIDACEAE

Sisyrinchium angustifolium Mill. 2; R; 9886; H; C_3.

JUGLANDACEAE

Carya cordiformis (Wang.) K. Koch 1, 2; I; 9663; Ph; C_3.
Carya glabra (Mill.) Sweet 1, 2, 4; F; 9655; Ph; C_3.
Carya ovalis (Wang.) Sarg. 1, 2, 4; F; 9656; Ph; C_3.
Carya ovata (Mill.) K. Koch 1, 2, 4; F; 9641; Ph; C_3.
Carya tomentosa (Poir.) Nutt. 1, 4; R; 10257; Ph; C_3.
Juglans nigra L. 1, 2, 4; I; 9653; Ph; C_3.

JUNCACEAE

Juncus tenuis Willd. 2, 1; I; 9885; H; C_3.

LAMIACEAE

**Perilla frutescens* (L.) Britt. 2, 3; O; 10325; Th; C_3.
Prunella vulgaris L. var. *elongata* Benth. 2; I; 10231; H; C_3.
Teucrium canadense L. var. *virginicum* (L.) Eat. 4; I; 9866; H; C_3.

LAURACEAE

Sassafras albidum (Nutt.) Nees 1, 4, 3, 2; O; 9643; Ph; C_3.

LILIACEAE

Allium canadense L. 2; R; 9480; Cr; C_3.
**Allium vineale* L. 1, 4; R; 9522; Cr; C_3.
**Ornithogalum umbellatum* L. 4, 1; I; 10368; Cr; C_3.
Polygonatum biflorum (Walt.) Ell. 1; R; 9517; Cr; C_3.
Smilacina racemosa (L.) Desf. 1, 2; I; 9516; Cr; C_3.
Trillium recurvatum Beck 1; F; 9488; Cr; C_3.
Uvularia grandiflora Sm. 1; I; 9526; Cr; C_3.

MAGNOLIACEAE

Liriodendron tulipifera L. 4, 1, 3; O; 9642; Ph; C_3.
Magnolia acuminata L. 1, 2; I; 9499; Ph; C_3.

MENISPERMACEAE

Cocculus carolinus (L.) DC. 1; R; 10369; Ph; C_3.
Menispermum canadense L. 1, 4, 2; O; 9521; Ph; C_3.

MORACEAE

**Morus alba* L. 4; R; 9904; Ph; C_3.

Morus rubra L. 2, 1, 4, 3; F; 9482; Ph; C_3.

NYSSACEAE

Nyssa sylvatica Marsh. 1, 4, 2, 3; O; 9666; Ph; C_3.

OLEACEAE

Fraxinus americana L. 1, 4, 2, 3; F; 9661; Ph; C_3.

ONAGRACEAE

Circaea lutetiana Aschers. & Magnus ssp. *canadensis* (L.) Aschers. & Magnus 1, 3, 2; F; 9859; Cr; C_3.

OPHIOGLOSSACEAE

Botrychium dissectum Spreng. var. *dissectum*. 2; R; 10304; Cr; C_3.
Botrychium dissectum Spreng. var. *obliquum* (Muhl.) Clute 2, 1; I; 10235; Cr; C_3.
Botrychium virginianum (L.) Swartz 1, 2; I; 9485; Cr; C_3.
Ophioglossum vulgatum L. var. *pycnostichum* Fern. 2; R; 9486; Cr; C_3.

ORCHIDACEAE

Aplectrum hyemale (Willd.) Nutt. 1, 2; F; 9528; Cr; C_3.
Corallorhiza wisteriana Conrad 1; R; 9474; Cr; C_3.
Tipularia discolor (Pursh) Nutt. 2; R; 9527; Cr; C_3.

OXALIDACEAE

Oxalis stricta L. 1, 2; I; 9875; H; C_3.

PASSIFLORACEAE

Passiflora lutea L. var. *glabriflora* Fern. 3, 1, 4; I; 9523, 9893; H; C_3.

PHRYMACEAE

Phryma leptostachya L. 1, 2, 3; F; 9863; H; C_3.

PHYTOLACCACEAE

Phytolacca americana L. 3, 1, 4, 2; F; 9870; Cr; C_3.

PLANTAGINACEAE

Plantago rugelii Dcne. 2; R; 9879, 10381; H; C_3.

PLATANACEAE

Platanus occidentalis L. 2, 4; I; 9650; Ph; C_3.

POACEAE

Agrostis perennans (Walt.) Tuckerm. 2, 1; R; 10245, 10343; H; C_3.
Bromus pubescens Muhl. 1; R; 10370; H; C_3.
Dichanthelium acuminatum (Swartz) Gould & Clark var. *fasciculatum* (Torr.) Freckm. 2; R; 10297; H; C_3.
Dichanthelium boscii (Poir.) Gould & Clark 1; R; 9877; H; C_3.
Dichanthelium clandestinum (L.) Gould 2; I; 10324; H; C_3.
**Digitaria ischaemum* (Schreb.) Muhl. 2; R; 10339; Th; C_4.
**Digitaria sanguinalis* (L.) Scop. 3; R; 10322; Th; C_4.
Echinochloa muricata (Beauv.) Fern. 2; R; 10338; Th; C_4.
Elymus hystrix L. 2; R; 9884; H; C_3.
Elymus villosus Muhl. 2; R; 9665; H; C_3.
Elymus virginicus L. 1, 2, 4; O; 9887; H; C_3.
Leersia virginica Willd. 2, 1, 3; F; 10232; H; C_3.
Muhlenbergia sobolifera (Muhl.) Trin. 2; R; 10371; H; C_4.
Panicum dichotomiflorum L. 2; R; 10340; Th; C_4.
Poa sylvestris Gray 1, 4; R; 10372; H; C_3.
**Setaria faberi* Herrm. 3; R; 10254; Th; C_4.
**Setaria viridis* (L.) Beauv. var. *major* (Gaudin) Pospichal. 3; R; 10334; Th; C_4.

**Sorghum halepense* (L.) Pers. 3, 4; R; 10373; Cr; C_4.
Sphenopholis obtusata (Michx.) Scribn. 1; R; 9478; H; C_3.

POLEMONIACEAE

Phlox divaricata L. ssp. *laphamii* (Wood) Wherry 1, 2; O; 9505; Ch; C_3.

POLYGONACEAE

**Polygonum cespitosum* Blume var. *longisetum*(DeBruyn) Stewart 2; I; 10298; Th; C_3.
Polygonum punctatum Ell. 2, 3; I; 9903, 10336; Th; C_3.
Polygonum scandens L. 1, 3, 4; O; 10326; H; C_3.
Polygonum virginianum L. 1, 2, 3; F; 10237; H; C_3.

PORTULACACEAE

Claytonia virginica L. 1, 2; F; 10374; Cr; C_3.

PRIMULACEAE

Samolus valerandii L. 2; R; 10303; H; C_3.

RANUNCULACEAE

Clematis virginiana L. 3; R; 10321; H; C_3.
Hydrastis canadensis L. 1, 2; O; 9664; Cr; C_3.
Ranunculus abortivus L. 2; R; 9495; H; C_3.
Ranunculus micranthus Nutt. 2; R; 9487; H; C_3.
Ranunculus recurvatus Poir. 1, 2; I; 9525; H; C_3.

ROSACEAE

Agrimonia parviflora Ait. 2; R; 10300; H; C_3.
Agrimonia rostellata Wallr. 1, 2; I; 9898; H; C_3.
Geum canadense Jacq. 1, 2, 4; F; 9883; H; C_3.
Prunus serotina Ehrh. 1, 4, 3, 2; F; 9652; Ph; C_3.
**Rosa multiflora* Thunb. 4, 2; I; 9894; Ph; C_3.
Rubus allegheniensis Porter 4; I; 10375; H; C_3.
Rubus occidentalis L. 4; R; 10376; H; C_3.

RUBIACEAE

Galium aparine L. 1, 3, 2, 4; F; 10377; Th; C_3.
Galium circaezans Michx. 1, 2; O; 9640; H; C_3.
Galium triflorum Michx. 1, 2; O; 9882; H; C_3.

SCROPHULARIACEAE

Gratiola neglecta Torr. 2; R; 10378; Th; C_3.
Scrophularia marilandica L. 1, 3, 4; I; 10233; H; C_3.
**Verbascum thapsus* L. 2; R; 10344; H; C_3.
Veronica peregrina L. 2; R; 9490; Th; C_3.

SMILACACEAE

Smilax glauca Walt. 1, 3; I; 9483; Ph; C_3.
Smilax hispida Muhl. 1, 3, 2, 4; O; 9502, 10380; Ph; C_3.
Smilax pulverulenta Michx. 1; R; 9472; H; C_3.
Smilax rotundifolia L. 1, 3, 4; O; 9892; Ph; C_3.

SOLANACEAE

Physalis heterophylla Nees 3; R; 9869; Cr; C_3.
Physalis pruinosa L. 3; O; 10253; Th; C_3.
Solanum ptycanthum Dunal 3, 1; O; 10256; Th; C_3.

THELYPTERIDACEAE

Phegopteris hexagonoptera (Michx.) Fee 1, 2; I; 9510; Cr; C_3.

ULMACEAE

Celtis laevigata Willd. 2, 1, 3, 4; I; 9657; Ph; C_3.
Celtis occidentalis L. 1, 2, 3, 4; I; 9651; Ph; C_3.
Ulmus americana L. 2, 1, 3; I; 9662; Ph; C_3.
Ulmus rubra Muhl. 1, 2, 3, 4; A; 9902; Ph; C_3.

URTICACEAE

Boehmeria cylindrica (L.) Swartz 2, 1, 3; I; 9880; Cr; C_3.
Parietaria pensylvanica Muhl. 1, 2, 3; I; 9511; Th; C_3.
Pilea pumila (L.) Gray 2, 3, 1; A; 10234; Th; C_3.

VERBENACEAE

Verbena urticifolia L. 4; R; 9899; H; C_3.

VIOLACEAE

Viola sororia Willd. 2, 1, 3; F; 10379; H; C_3.

VITACEAE

Ampelopsis cordata Michx. 4; R; 10306; Ph; C_3.
Parthenocissus quinquefolia (L.) Planch. 1, 4, 3, 2; A; 9901; Ph; C_3.
Vitis aestivalis Michx. 1, 3, 4, 2; O; 9891; Ph; C_3.
Vitis vulpina L. 1, 3, 4, 2; O; 9890; Ph; C_3.

Table 1. Distribution of growth forms at Weaver's Woods, Union County, Illinois.

Growth Form	Annual	Perennial
C_3 Graminoid	0	22
C_4 Graminoid	6	2
C_3 Forb	41	71
Woody		64
Pteridophyte		9
Totals	47	168

Table 2. Species richness per habitat at Weaver's Woods, Union County, Illinois.

	Habitat				
Frequency Distribution	Dry-Mesic Forest	Mesic Forest	Canopy Gap	Forest Edge	Total
Abundant	6	1	0	0	7 (0)
Frequent	29	4	1	0	34 (0)
Occasional	18	1	3	2	24 (2)
Infrequent	30	22	4	10	66 (8)
Rare	26	35	13	10	83 (14)
Totals	109 (1)	63 (10)	21 (4)	22 (9)	215 (24)

Table 3. Summary of the vascular flora of Weaver's Woods, Union County, Illinois.

			Species and Lesser Taxa		
	Families	Genera	Native	Introduced	Total
Pteridophyta	4	7	9	0	9
Coniferophyta	1	1	1	0	1
Anthophyta					
A. Monocotyledoneae	10	28	41	8	49
B. Dicotyledoneae	62	119	140	16	156
Totals	77	155	191	24	215

Table 4. Comparison of floristic surveys of sites within the Ozark Hills (OH) and Greater Shawnee Hills (GSH) Divisions of Alexander, Jackson, Randolph, Union and Williamson counties (in parentheses).

Study Site	Total Taxa	Monocots	Dicots	Percent Non-Native	Source
Weaver's Woods (OH, Union)	215	49	156	24 (11.2%)	This study
Ripple Hollow (OH, Union-Alexander)	496	115	361	58 (11.7%)	Alice (1989)
Wolf Creek Botanical Area (OH, Alexander)	424	104	304	45 (10.6%)	Pusateri (1975)
Atwood Ridge Natural Area (OH, Union)	431	93	317	19 (4.4%)	Phillippe (1992)
Trails of Tears State Forest (OH, Union)	619	133	461	104 (16.8%)	Evans (1981)
Cave Valley-Pomona (GSH, Jackson)	588	154	411	90 (15.3%)	Sadowski (1982)
Little Grand Canyon (GSH, Jackson)	560	145	387	74 (13.2%)	Johnson (1969)
Hidden Cove-Buttermilk Hill (GSH, Jackson)	684	173	483	106 (15.5%)	Ketzner (1988)
Degognia Hollow (GSH, Jackson-Randolph)	443	109	317	55 (12.4%)	Nash (1991)
Piney Creek Ravine (GSH, Jackson-Randolph)	441	106	318	40 (9.1%)	Weber (1959)
Rock Castle Creek (GSH, Randolph)	358	86	258	38 (10.6%)	Faulkner (1971)
Giant City State Park (GSH, Jackson-Union)	801	185	586	114 (14.2%)	Mohlenbrock (1953)
Touch of Nature (GSH, Jackson-Williamson)	639	179	434	99 (15.5%)	Davis (1987)
Devil's Kitchen Lake (GSH, Union-Williamson)	762	206	525	125 (16.4%)	Ulaszek (1988)

Table 5. Comparison of family relationships of study sites within the Ozark Hills (OH) and Greater Shawnee Hills (GSH) Divisions of Alexander, Jackson, Randolph, Union and Williamson counties (in parentheses). ASTER = Asteraceae, POA = Poaceae, FABA = Fabaceae, ROSA = Rosaceae, and LILI = Liliaceae.

Study Site	ASTER	POA	CYPER	FABA	ROSA	LILI	Souce
Weaver's Woods (OH, Union)	25	19	10	6	7	7	This study
Ripple Hollow (OH, Union-Alexander)	63	46	33	19	19	14	Alice (1989)
Wolf Creek Botanical Area (OH, Alexander)	62	61	17	16	17	12	Pusateri (1975)
Atwood Ridge Natural Area (OH, Union)	60	39	26	20	18	7	Phillippe (1992)
Trails of Tears State Forest (OH, Union)	81	82	18	36	26	14	Evans (1981)
Cave Valley-Pomona (GSH, Jackson)	68	74	38	30	20	14	Sadowski (1982)
Little Grand Canyon (GSH, Jackson)	67	70	19	30	22	20	Johnson (1969)
Hidden Cove-Buttermilk Hill (GSH, Jackson)	89	78	36	36	26	12	Ketzner (1988)
Degognia Canyon (GSH, Jackson-Randolph)	57	52	26	18	12	13	Nash (1991)
Piney Creek Ravine (GSH, Jackson-Randolph)	52	63	20	22	14	7	Weber (1959)
Rock Castle Creek (GSH, Randolph)	54	44	21	22	12	10	Faulkner (1971)
Giant City State Park (GSH, Jackson-Union)	99	97	44	49	31	24	Mohlenbrock (1953)
Touch of Nature (GSH, Jackson-Williamson)	75	80	45	35	24	19	Davis (1987)
Devil's Kitchen Lake (GSH, Union-Williamson)	85	84	47	45	32	22	Ulaszek (1988)

Table 6. Comparison of genus relationships of study sites within the Ozark Hills (OH) and Greater Shawnee Hills (GSH) Divisions of Alexander, Jackson, Randolph, Union and Williamson counties (in parentheses). *Dichan* = *Dichanthelium*.

Study Site	*Carex*	*Dichan*	*Solidago*	*Aster*	*Quercus*	Source
Weaver's Woods (OH, Union)	10	3	2	2	4	This study
Ripple Hollow (OH, Union-Alexander)	31	5	11	9	8	Alice (1989)
Wolf Creek Botanical Area (OH, Alexander)	12	7	8	11	9	Pusateri (1975)
Atwood Ridge Natural Area (OH, Union)	26	9	10	10	8	Phillippe (1992)
Trails of Tears State Forest (OH, Union)	12	12	9	9	10	Evans (1981)
Cave Valley-Pomona (GSH, Jackson)	32	10	8	9	10	Sadowski (1982)
Little Grand Canyon (GSH, Jackson)	17	11	10	11	10	Johnson (1969)
Hidden Cove-Buttermilk Hill (GSH, Jackson)	30	8	9	10	11	Ketzner (1988)
Degognia Hollow (GSH, Jackson-Randolph)	20	9	5	10	8	Nash (1991)
Piney Creek Ravine (GSH, Jackson-Randolph)	14	10	7	6	8	Weber (1959)
Rock Castle Creek (GSH, Randolph)	15	6	5	10	10	Faulkner (1971)
Giant City State Park (GSH, Jackson-Union)	32	15	10	15	11	Mohlenbrock (1953)
Touch of Nature (GSH, Jackson-Williamson)	36	9	9	8	15	Davis (1987)
Devil's Kitchen Lake (GSH, Union-Williamson)	33	10	6	9	12	Ulaszek (1988)

Figure 1. Location of Weaver's Woods, Union County, Illinois.