

Seep Community at White Oak Creek Woods Natural Area, Mason County, Illinois

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ABSTRACT

A series of small seeps were studied at White Oak Creek Woods Natural Area, Mason County, Illinois. The seep community in full sunlight had 23 species present in the plots ($n = 30$). *Apios americana* (groundnut) was dominant with a mean cover of 33.88% and an IV of 31.5 (possible 200), followed by *Impatiens capensis* (spotted touch-me-not), *Leersia oryzoides* (rice cut grass), *Decodon verticillatus* (swamp loosestrife), and *Saururus cernuus* (lizard's-tail) all with IV's >15.0 . In the shaded seep, of the 19 species in the plots ($n = 30$), *Symplocarpus foetidus* (skunk cabbage) was dominant with a mean cover of 39.75% and an IV of 70.2. *Impatiens capensis* and *Saururus cernuus* were second and third with IV's of 41.7 and 40.7 respectively, the remaining species being of minor importance. Within the seep complex, a total of 140 vascular plant species representing 110 genera and 57 families were documented. During the present study many more species were found than were reported in an earlier study of the site conducted in 1912.

INTRODUCTION

Seep communities occur in areas with saturated soil caused by groundwater reaching the surface in a diffuse flow (White and Madany 1978). These seeps, which rarely exceed 0.5 ha, are common along the lower slopes of glacial moraines, in ravines, and on stream terraces. Ground water of seeps usually flows through sand and gravel deposits above an impervious soil layer to the outlet area where it forms a distinct seep line. The resulting seeps are permanently wet, marshy areas. Seeps may have some localized areas of concentrated flow (springs), but these areas are not obvious. It is common, however, that some of the seep waters flow from the site in shallow runs.

Seeps are relatively common throughout Illinois, but most are small, and these communities and the associated plant species seldom have been studied in detail. Most seeps discussed in the literature, were studied because they contained an unusual assemblage of plant species or because a few endangered or threatened species were present. The first study describing seep community vegetation in Illinois was by Gates (1912) in his analysis of a "bog" community in Mason County, Illinois. He was interested in this site because "it is so far south of the usual southern limits of peat-bog plants as outlined by

Transeau" (1903). More recently Phipps and Speer (1958) and later Parker and Ebinger (1971) studied the vascular plant species of a hillside marsh in Coles County, east-central Illinois. Later Ebinger (1978) examined the flora of seven seeps in east-central Illinois, while Henry and Scott (1984) studied the vegetation of four seeps in McDonough County in northwestern Illinois. In southern Illinois Voigt and Mohlenbrock (1964) described a few seeps from the Shawnee Hills Natural Division, while Schwegman (1969) examined a series of seep springs in the Cretaceous Hills Section of the Coastal Plain Natural Division (Schwegman 1973).

The present study was undertaken to determine the composition and structure of the vegetation of this series of seeps at White Oak Creek Natural Area in Mason County, and compare the result to those observed by Gates (1912).

DESCRIPTION OF THE STUDY AREA

The seep complex studied is located along White Oak Creek about 6 km south of Havana, Mason County, Illinois (NW1/4 S23 T21N R9W). At this site numerous small seeps are located along both sides of White Oak Creek on a sandy terrace about 400 m east of the Illinois River. The largest seep is nearly 125 m long and varies in width from 1 to 8 m. This seep is in an open area with nearly continual sunlight throughout the day (sunny seep). The remaining seeps are smaller with the largest approximately 100 m long by about 10 m wide, and shaded nearly the entire day (shaded seep). The seeps are in a narrow valley surrounded by steep slopes 3 to 5 m high. The upland forest surrounding the seeps is dominated by *Quercus velutina* (black oak) and *Q. alba* (white oak). The soils are excessively drained Plainfield sand (Calsyn 1995), part of the dune and swale topography known as the Parkland Formation (Willman and Frye 1970), which occurs in the Illinois River Section of the Illinois River and Mississippi River Sand Areas Natural Division (Schwegman 1973).

The timbered land north of White Oak Creek, was designated "grade B" dry to dry-mesic sand forest by the Illinois Natural Areas Inventory (White 1978). The larger white oak trees were selectively logged north of White Oak Creek in 1980, resulting in that area being designated "grade C" forest (Lerczak 2000). Registered as an Illinois Natural Heritage Landmark since 1983, it is now designated as the Speckman-Stelter Woods Land and Water Reserve by the Illinois Nature Preserves Commission (Lerczak 2000).

METHODS

The seep complex was visited seven times each year throughout the growing seasons of 2004 and 2005. Voucher specimens of plant species listed in Appendix I were collected, identified, and deposited in the Stover-Ebinger Herbarium of Eastern Illinois University, Charleston, Illinois (EIU), or the herbarium of the Illinois Natural History Survey, Champaign, Illinois (ILLS). Nomenclature follows Mohlenbrock (2002).

In late July of 2005, a transect 90m long was located along the centerline of the sunny seep. At 3 m intervals along this transect m^2 plots were located randomly 0 to 2 m from the transect line, even number plots to the right, odd to the left ($n=30$). In the shaded seep two transects 45 m long were randomly located and the same procedure followed ($n=30$).

Species cover was determined using the Daubenmire (1959) cover class system as modified by Bailey and Poulton (1968). The modified Daubenmire cover scale is as follows: class 1 = 0 to 1%; class 2 = 1 to 5%; class 3 = 5 to 25%; class 4 = 25 to 50%; class 5 = 50 to 75%; class 6 = 75 to 95%; class 7 = 95 to 100%. Mean cover was then calculated by using the mid-point of the cover classes. Importance value (IV) for each species was determined by summing relative cover and relative frequency.

The Sorensen Index of Similarity (ISs) was used to determine the degree of vegetation similarity between the two seep communities studied (Mueller-Dombois and Ellenberg 1974). In this index $[ISs = 2C/A+B \times 100]$, A equals the number of species in the first community, B equals the number of species in the second community, and C equals the number of species common between the two communities.

RESULTS

Within the seep complex, a total of 140 vascular plant species representing 110 genera and 57 families were documented (Appendix I). Of the species listed in Appendix I, four were ferns and fern-allies, 27 were monocots in 22 genera and nine families, while 109 were dicots in 85 genera and 45 families. Although Gates (1912) reported the occurrence of the state endangered *Mimulus glabratus* (yellow monkey flower), and the presently state threatened *Veronica scutellata* (marsh speedwell), neither of these two species nor any other state threatened or endangered species were encountered during the present study (Herkert and Ebinger 2002).

The sunny seep community had 23 species recorded in the plots. The perennial vine, *Apios americana* (groundnut) and the annual, *Impatiens capensis* (spotted touch-me-not) were the dominant species with mean cover values of 33.88% and 26.78% and IV's of 31.5 and 30.3, respectively (Table 1). In many parts of the seep, *Apios americana* overtopped and covered the other vegetation. *Leersia oryzoides* (rice cut grass), *Decodon verticillatus* (swamp loosestrife), and *Saururus cernuus* (lizard's-tail) all had IV's greater than 15, and mean covers that ranged from 8.35% to 15.57%. The only non-native species encountered was *Lysimachia nummularia* (moneywort), with an IV of 4.4. This species formed scattered, cushion-like patches beneath the much taller vegetation.

Of the 19 species in the plots of the shaded seep, *Symplocarpus foetidus* (skunk cabbage) was dominant with a mean cover of 39.75% and an IV of 70.2. *Impatiens capensis* and *Saururus cernuus* were second and third, with IV's of 41.7 and 40.7 respectively (Table 1). The remaining 16 species encountered had much lower mean covers and IV's. The non-native *Alliaria petiolata* (garlic mustard), a pervasive adventive species of many Illinois sand deposits, was occasionally found in the shaded seep plots (IV of 2.5) and was commonly observed in the forests surrounding the seeps.

The mean cover of the sunny seep was 153.12%, nearly twice the mean cover of the shaded seep (80.61%). Consistent with this, the average mean cover for bare ground and litter was nearly eight times greater in the shaded seep (39.43%) than in the sunny seep (4.50%). Twelve species encountered in the plots were present in both of the seep communities resulting in a Sorensen Index of Similarity (ISs) of 57.1. *Impatiens capensis* was second in IV in both seep communities, and *Saururus cernuus* was fifth in IV in the

sunny seep (IV of 15.4) and third in the shaded seep (IV of 40.7). Three of the top five species encountered in the sunny seep (*Apios americana*, *Leersia oryzoides*, *Decodon verticillatus*) were not observed in the shaded seep. *Symplocarpus foetidus*, the dominant species of the shaded seep (IV of 70.2), was occasionally found beneath the taller vegetation in the sunny seep (IV of 4.9). Of the species restricted to the shaded seep, *Fraxinus nigra* (black ash) seedlings were the most common (IV of 7.2), followed by the non-native *Alliaria petiolata*, and five other species with low IVs that were rarely encountered (Table 1).

Fraxinus nigra was common in many parts of the terrace, being particularly abundant in and at the edges of the shaded seeps. Seedlings and a few saplings of *F. nigra* were common in the shaded seep along with a few trees that rarely exceeded 25 cm dbh. In the sunny seep, *Salix discolor* (pussy willow) and *S. interior* (sandbar willow) was observed throughout, mostly being less than 3m tall. The slightly woody *Decodon verticillatus* was the dominant species in parts of the seep, while the shrubs *Cephalanthus occidentalis* (buttonbush), *Ribes americanum* (Missouri gooseberry), and *Rosa palustris* (swamp rose) were occasionally observed. Most of the remaining tree and shrub species listed in Appendix I were found at the edges of the seeps and along White Oak Creek.

DISCUSSION

In addition to the endangered and threatened plant species listed by Gates (1912), 17 other species, cited by Gates (1912), were not found during the present study. A few are very common species, while some are relatively uncommon [*Amsonia tabernaemontana* (blue star), *Cicuta bulbifera* (bulblet water hemlock), *Oxypolis rigidior* (cowbane), *Ranunculus pensylvanicus* (bristly crowfoot), *Sparganium eurycarpum* bur-reed)]. The reason for these losses is not known, but is probably related to changes in water flow and water levels in the seeps, down cutting and erosion by White Oak Creek, and the loss of habitat resulting from human disturbances since 1912. Additionally, Gates (1912) mentioned springs along the bluff and listed many species, which could not be located during the current study, as occurring in these spring communities. Sand bluffs resulting from undercutting by White Oak Creek were found near the seep communities, but no springs were present at the base. Also, *Cornus amomum* (swamp dogwood) and *Ulmus thomasi* (rock elm) probably represent misidentifications by Gates (1912) as they are generally not found in this part of Illinois.

The soils of this seep and most seeps in Illinois have a deep, peaty, soil with water that is usually neutral to slightly alkaline. Ebinger and Bacone (1980) found the waters to be slightly alkaline for two seeps at Turkey Run State Park, Parke County, Indiana. In their examination of four seeps in McDonough County, Illinois, Henry and Scott (1984) found the pH of seep water in three seeps to be neutral to slightly alkaline (pH of 7.0-7.6), while water of the fourth seep was very acidic (pH of 3.5). This acid seep, referred to as a coal seep, was dominated by *Sphagnum* and was heavily shaded by dense mesic woods.

Many species found in the present study were listed for other Illinois seeps. Only a few species, however, have consistently been found in nearly all seeps examined, including *Agrostis gigantea* (red top), *Aster lateriflorus* (side-flowering aster), *Carex lurida* (lurid sedge), *Equisetum arvense* (common horsetail), *Eupatorium perfoliatum* (perfoliate bone-

set), *Glyceria striata* (fowl manna grass), *Impatiens capensis*, *Leersia virginica* (white grass), *Mimulus ringens* (sessile monkey flower), *Lobelia siphilitica* (great blue lobelia), and *Pilea pumila* (clearweed). Two of these species consistently found with relatively high IV's are *Impatiens capensis* and *Pilea pumila*. The remainder, however, usually have low IV's, and are widely scattered or grow in localized clumps.

ACKNOWLEDGMENTS

The authors thank the Illinois Department of Natural Resources for access to the natural area inventory data for the seep; Tom Lerczak, Illinois Nature Preserves Commission, for his help and advice, the land owner for permission to enter the property, and the two anonymous reviewers for their helpful comments.

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Table 1. Average cover and importance value of ground layer species encountered during the summer of 2006 in a sunny seep and a shaded seep at White Oak Creek Woods Natural Area, Mason County, Illinois.

Species	Sunny seep			Shaded seep		
	Freq. %	Mean Cover	I.V.	Freq. %	Mean Cover	I.V.
<i>Apios americana</i>	63	33.88	31.5	--	--	--
<i>Impatiens capensis</i>	87	26.78	30.3	73	19.80	41.7
<i>Leersia oryzoides</i>	73	15.57	21.0	--	--	--
<i>Decodon verticillatus</i>	47	17.12	18.1	--	--	--
<i>Saururus cernuus</i>	67	8.35	15.4	97	14.65	40.7
<i>Pilea pumila</i>	63	6.12	13.4	20	0.75	5.6
<i>Rosa palustris</i>	23	9.27	9.5	--	--	--
<i>Carex spp.</i>	43	4.05	9.0	3	0.10	0.9
<i>Peltandra virginica</i>	23	8.08	8.7	--	--	--
<i>Aster lanceolatus</i>	37	3.42	7.6	6	0.20	1.8
<i>Boehmeria cylindrica</i>	30	2.02	5.7	17	0.82	4.9
<i>Cicuta maculata</i>	27	2.67	5.6	--	--	--
<i>Symplocarpus foetidus</i>	17	3.60	4.9	90	39.75	70.2
<i>Lysimachia nummularia</i>	10	4.67	4.4	--	--	--
<i>Ribes americanum</i>	13	3.50	4.3	3	0.02	0.8
<i>Parthenocissus quinquefolia</i>	13	1.38	2.9	43	2.65	13.4
<i>Leersia virginica</i>	13	1.12	2.7	10	0.22	2.5
<i>Iris shrevei</i>	7	0.52	1.3	--	--	--
<i>Stachys tenuifolia</i>	7	0.20	1.1	--	--	--
<i>Vitis vulpina</i>	3	0.50	0.8	3	0.50	1.4
<i>Acer saccharinum</i>	3	0.10	0.6	--	--	--
<i>Cinna arundinacea</i>	3	0.10	0.6	3	0.10	0.9
<i>Eupatoriadelphus maculatus</i>	3	0.10	0.6	--	--	--
<i>Fraxinus nigra</i>	--	--	--	30	0.15	7.2
<i>Alliaria petiolata</i>	--	--	--	10	0.22	2.5
<i>Smilax tamnoides</i>	--	--	--	6	0.12	1.7
<i>Antenoron virginianum</i>	--	--	--	3	0.50	1.4
<i>Acer negundo</i>	--	--	--	3	0.02	0.8
<i>Thelypteris palustris</i>	--	--	--	3	0.02	0.8
<i>Celastrus scandens</i>	--	--	--	3	0.02	0.8
Totals		153.12	200.0		80.61	200.0
Average bare ground/litter		4.50			39.43	

APPENDIX I.

Vascular plant species encountered in a seep community at White Oak Creek Woods Natural Area, Mason County, Illinois, are listed alphabetically by family under major plant groups. Collecting numbers preceded by an E represent specimens collected by John E. Ebinger and are deposited in the Stover-Ebinger Herbarium, Eastern Illinois University, Charleston, Illinois (EIU). Collecting numbers preceded by a P represent specimens collected by Loy R. Phillippe and are deposited in the Illinois Natural History Survey Herbarium, Champaign, Illinois (ILLS). The species reported by Gates (1912) are preceded by asterisks. A few Gates specimens were located at the University of Illinois Herbarium (ILL), but vouchers for most are missing.

FERNS AND FERN-ALLIES

Equisetaceae

Equisetum arvense L.: E31982*Equisetum laevigatum* A. Br.: E31983

Onocleaceae

Onoclea sensibilis L.: P37204

Thelypteridaceae

Thelypteris palustris* Schott: P37227MONOCOTS**

Alismataceae

Alisma subcordatum Raf.: P37294**Sagittaria latifolia* Willd.: P37285

Araceae

**Peltandra virginica* (L.) Schott:

P37223

**Symplocarpus foetidus* (L.) Nutt.:

E31818

Cyperaceae

Bolboschoenus fluviatilis (Torr.) Sojak:

P37295

Carex alopecoidea Tuckerm.: E31985*Carex blanda* Dewey: E31984*Carex cristatella* Britt.: P37221**Carex lurida* Wahl: P37212*Cyperus strigosus* L.: P37213*Scirpus atrovirens* Willd.: P37205

Dioscoreaceae

Dioscorea villosa L.: E31986

Iridaceae

**Iris shrevei* Small: E31987

Lemnaceae

Lemna minor L.: E31994

Poaceae

**Agrostis gigantea* Roth*Agrostis perennans* (Walt.) Tuckerm.:

P37274

**Cinna arundinacea* L.: P37185*Dichanthelium clandestinum* (L.) Gould:

P37273

Elymus virginicus L.: P37296*Festuca subverticillata* (Pers.) E.B.

Alexeev.: E31988

Glyceria striata (Lam.) Hitchc.: E31989*Leersia oryzoides* (L.) Swartz: E32059**Leersia virginica* Willd.: P37194*Muhlenbergia frondosa* (Poir.) Fern.:

P37220

**Poa sylvestris* Gray: E31990

Smilacaceae

Smilax tamnoides L.: E32110

Sparganiaceae

Sparganium eurycarpum* Engelm.DICOTS**

Aceraceae

Acer negundo L.: E31972**Acer saccharinum* L.: E32060

Anacardiaceae

Toxicodendron radicans (L.) Kuntze:

P37198

Annonaceae

Asimina triloba (L.) Dunal: E31973

Apiaceae

Berula erecta* (Huds.) Coville: E32122Cicuta bulbifera* L.**Cicuta maculata* L.: P37217*Osmorhiza longistylis* (Torr.) DC.:

E31974

- **Oxypolis rigidior* (L.) Raf.
Sanicula canadensis L.: P37206
Sium suave Walt.: E32061
- Apocynaceae
 **Amsonia tabernaemontana* Walt.
- Asclepiadaceae
 **Asclepias incarnata* L.
- Asteraceae
Ageratina altissima (L.) R.M. King & H. Rob.: E32062
Arnoglossum atriplicifolium (L.) H. Rob.: E31992
Aster lanceolatus Willd.: E32111
Aster lateriflorus (L.) Britt.: E32112
Aster ontarionis Wieg.: P37292
Bidens cernua L.: P37281
 **Bidens comosa* (Gray) Wieg.: E32063
Bidens frondosa L.: E32064
Erigeron philadelphicus L.: E31975
Eupatoriadelphus maculatus (L.) R.M. King & H. Rob.: P37193
Eupatoriadelphus purpureus (L.) R.M. King & H. Rob.: E32065
 **Eupatorium perfoliatum* L.: P37210
Eupatorium serotinum Michx.: P37209
Lactuca floridana (L.) Gaertn.: P37203
Solidago gigantea Ait.: E32066
Solidago ulmifolia Muhl.: E32113
Vernonia gigantea (Walt.) Trel.: P37287
Xanthium strumarium L.: P37283
- Balsaminaceae
 **Impatiens capensis* Meerb.: P37189
- Betulaceae
 **Betula nigra* L.: E32067
- Bignoniaceae
 **Campsis radicans* (L.) Seem.
- Boraginaceae
Hackelia virginiana (L.) I.M. Johnston: P37201
- Brassicaceae
Cardamine bulbosa (Muhl.) BSP.: E32124
Nasturtium officinale R. Br.: E31976
- Caesalpiniaceae
 **Gleditsia triacanthos* L.: E32068
Gymnocladus dioicus (L.) K. Koch: P37224
- Campanulaceae
Campanulastrum americanum (L.) Small: P37228
Lobelia cardinalis L.: P37219
Lobelia siphilitica L.: E32069
- Caprifoliaceae
 **Sambucus canadensis* L.: P39163
Viburnum lentago L.: P37197
- Cornaceae
 **Cornus amomum* Mill.
Cornus drummondii C.A. Mey.: P37207
Cornus sericea L.: P37230
- Corylaceae
Carpinus caroliniana Walt.: P39164
- Cucurbitaceae
Sicyos angulatus L.: P37284
- Cuscutaceae
Cuscuta gronovii Willd.: P37226
- Ebenaceae
 **Diospyros virginiana* L.: E32070
- Euphorbiaceae
Actalypha rhomboidea Raf.: P37275
- Fabaceae
Amorpha fruticosa L.: P37225
 **Apios americana* Medic.: P37216
Desmodium paniculatum (L.) DC.: E32071
- Gentianaceae
Gentiana andrewsii Griseb.: E32114
- Grossulariaceae
Ribes americanum Mill.: E31820
- Juglandaceae
 **Juglans nigra* L.: E32072
- Lamiaceae
Lycopus americanus Muhl.: P37214
Lycopus virginicus L.: P37290
 **Mentha arvensis* L.: P37202
Physostegia speciosa (Sweet) Sweet: P37229
 **Scutellaria lateriflora* L.: P37199
Stachys tenuifolia Willd.: P37188
- Lythraceae
 **Decodon verticillatus* (L.) Ell.: P37215

Menispermaceae

Menispermum canadense L.: P39165

Moraceae

Morus rubra L.: E32073

Oleaceae

**Fraxinus lanceolata* Borkh.: E32074

**Fraxinus nigra* Marsh.: E31821

Ligustrum vulgare L.: E32115

Oxalidaceae

Oxalis stricta L.: E31977

Platanaceae

**Platanus occidentalis* L.

Polygonaceae

Antenoron virginianum (L.) Roberty & Vautier: P37190

Persicaria pensylvanica (L.) Small: P37282

Persicaria punctata (Ell.) Small: P37222

**Rumex orbiculatus* Gray

Primulaceae

**Lysimachia ciliata* L.

Lysimachia nummularia L.: E32075

Ranunculaceae

Anemone canadensis L.: E31978

**Ranunculus abortivus* L.: E32123

**Ranunculus pensylvanicus* L.f.

Ranunculus recurvatus Poir.: E31979

Rosaceae

Geum canadense Jacq.: E32116

**Rosa palustris* Marsh.: P37187

Rubiaceae

**Cephalanthus occidentalis* L.: P37218

Galium aparine L.: E31981

**Galium trifidum* L.

Galium triflorum Michx.: E32117

Salicaceae

**Salix discolor* Muhl.: E32077

**Salix interior* Rowlee: E32076

Saururaceae

**Saururus cernuus* L.: P37196

Scrophulariaceae

**Chelone glabra* L.: P37291

**Mimulus glabratus* HBK.

Mimulus ringens L.: P37208

**Veronica scutellata* L.

Tiliaceae

**Tilia americana* L.

Ulmaceae

**Celtis occidentalis* L.: E32118

**Ulmus americana* L.: E32078

Ulmus rubra Muhl.: E31980

**Ulmus thomasii* Sarg.

Urticaceae

**Boehmeria cylindrica* (L.) Sw.: P37191

**Laportea canadensis* (L.) Wedd.:

E32079

**Pilea pumila* (L.) Gray: P37195

Urtica gracilis Ait.: P37211

Verbenaceae

**Phyla lanceolata* (Michx.) Greene

**Verbena hastata* L.

Vitaceae

Ampelopsis cordata Michx.: P37280

Parthenocissus quinquefolia (L.)

Planch.: E32121

Vitis vulpina L.: E31993