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Vegetation of Denby Prairie Nature Preserve, Macoupin County, Illinois

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ABSTRACT

Denby Prairie Nature Preserve, 3 km southwest of Carlinville, Macoupin County, Illinois, is dominated by mesic prairie vegetation characteristic of the Carlinville Section of the Western Forest-Prairie Natural Division. Disturbance is indicated by the native annual *Chamaecrista fasciculata* as first in Importance Value (I.V. of 31.3; 200 possible) followed by the weedy native perennial *Solidago canadensis* (I.V. of 22.4). *Sorghastrum nutans* was the dominant native grass and ranked third (I.V. of 19.2), followed by sixth ranked *Andropogon gerardii* (I.V. of 13.8). Other dominant forbs observed among the top eight species included *Helianthus mollis* (I.V. of 18.4), *Pycnanthemum tenuifolium* (I.V. of 16.5), and *Lespedeza capitata* (I.V. of 10.0). A total of 32 species were recorded in the survey plots with *Poa pratensis* as the only exotic species. Overall, 156 species representing 46 families were found in this one ha (2.5 acres) mesic prairie. No endangered or threatened species were encountered while 18 exotic species were located.

Key Words: central Illinois, disturbance, importance value, mesic prairie

INTRODUCTION

Mesic prairie was relatively common in the Carlinville Section of the Western Forest-Prairie Natural Division in early settlement times (Schwegman 1973). This west-central Illinois natural division is a strongly dissected glacial till plain of mostly Illinoian age that has been subjected to extensive erosion for more than 100,000 years. Forests dominated at the time of European settlement accounting for more than 80% of the vegetative cover. Forests associated with valleys slopes and narrow ridges consisted of an oak-hickory association, while floodplains were dominated by maples, elms and ashes.

Prairie originally accounted for about 12% of the total land surface of the Carlinville section (Schwegman 1973). Some prairies were relatively extensive on the flat to gently rolling uplands, and were similar in floristic composition to "black soil" mesic prairies of the Grand Prairie Natural Division to the east. Presently, very little original prairie exists in the Carlinville Section except for a few small remnants along railroads, roadsides, and fence rows. The one ha Denby Prairie Nature Preserve is a surviving remnant (McFall and Karnes (1995). The present study was undertaken to determine vascular plant species composition, vegetation structure, and floristic quality of this preserve that has been subjected to extensive degradation and infrequent prescribed fires.

DESCRIPTION OF THE STUDY AREA

Denby Prairie Nature Preserve is located in central Macoupin County about 3 km southwest of Carlinville between a railroad and the Shipman Blacktop (NE1/4 NE1/4 NE1/4 S12 T9N R8W; N39.24201, W89.92601; elevation 223m). The preserve, which is owned by the Illinois Department of Natural Resources, was dedicated in 1987, and contains poor to average quality mesic prairie (McFall and Karnes 1995). Some small prairie remnants also occur between the railroad and road northeast of the preserve. Parts of the preserve, plus the small remnants, have been extensively degraded by past herbicide treatments, underground cable installation in 1988 and 2013, and the lack of consistent fire management that has allowed woody encroachment and considerable thatch accumulation. Since dedication as a nature preserve, prescribed burns have been conducted during the late fall to early spring, the last one in 2011.

The Pennsylvanian and Mississippi aged bedrocks underlying the preserve are covered by Illinoian glacial till which is overlain by extensive loess deposits, usually more than 1 m thick. The Keomah silt loam soils derived from the loess are somewhat poorly drained and relatively high in organic material (Tegeler 2004). The climate is continental with warm summers and cold winters. Mean annual precipitation is 98.01 cm with the highest rainfall (10.80 cm) in May. Mean annual temperature is 11.9°C with July as the hottest month (average of 30.7°C), and the coldest, January (average of -8.1°C). Frost-free days range from 137 to 205 with the average of 182 days per year (Midwestern Regional Climate Center 2013; Carlinville, Illinois).

METHODS

Floristic Composition

The preserve was visited an average of six times per year throughout the growing seasons of 2010 to 2012 plus a few visits in 2013. Voucher specimens were collected and deposited in the Stover/Ebinger Herbarium at Eastern Illinois University, Charleston, Illinois (EIU). The designation of exotic species follows Mohlenbrock (2002) and Taft et al. (1997) while nomenclature follows Mohlenbrock (2002). Illinois endangered and threatened species were based on species indicated by the Illinois Endangered Species Protection Board (2005).

Ground Layer Sampling

In September of 2012, two transects were located randomly along cardinal compass directions within the prairie. Along each transect, 1m^2 quadrats were located alternately to the right then left along each transect (n = 50 plots). A random numbers table was used to determine the distance (0 to 9 m) a quadrat was located from the transect line. 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 determined for each taxon using the mid-point values for each cover class, while Importance Value (I.V.) was calculated by summing relative cover and relative frequency.

RESULTS

Floristic Composition

This small preserve supports a total of 156 vascular plant taxa representing 46 families (Appendix I). No ferns or fern-allies were represented. Of the remaining taxa, 45 were monocots in seven families, and 111 were dicots in 39 families. Non-native (exotic) species accounted for 18 taxa (12% of the species recorded). Predominant plant families were Asteraceae (36 species), Poaceae (22), and Cyperaceae (12). No Illinois threatened or endangered species were encountered.

Mesic Prairie

Mesic prairie occurs throughout the preserve along with a patch-work of degraded and fairly good quality prairie. This patchwork is the result of past disturbance and is mostly associated with underground cable installation and railway maintenance. Only 32 species of plants were found in plots during the ground layer survey (Table 1). The native annual *Chamaecrista fasciculata* (partridge pea) occurred in 72% of the plots and was the most importance species with an I.V. of 31.3, and a mean cover of 18.18. The native weedy perennial *Solidago canadensis* (Canada goldenrod) occurred in 60% of the plots, was second in importance with an I.V. of 22.4, and a mean cover of 12.00. The dominant grasses were *Sorghastrum nutans* (Indian grass) with an I.V. of 19.2 followed by *Andropogon gerardii* (big bluestem) with an I.V. of 13.8, ranking third and sixth in I.V., respectively (Table 1). Other prairie grasses that were rarely encountered included *Sporobolus heterolepis* (prairie dropseed), *Elymus virginicus* (Virginia wild rye), *Elymus canadensis* (nodding wild rye), *Muhlenbergia frondosa* (Satin grass), and *Panicum virgatum* (switch grass). Dominant forbs included *Helianthus mollis* (downy sunflower), *Pycnanthemum tenuifolium* (slender mountain mint), and *Lespedeza capitata* (roundheaded-bush clover), all with an I.V. of 10 or greater. The shrub *Rubus pensilvanica* (blackberry) was the only woody species found in plots while *Poa pratensis* (Kentucky blue grass) was the only exotic species encountered (Table 1). Overall, the species found were common prairie species associated with mesic "black soil" prairie.

Table 1. Frequency (%), mean cover (% of total cover), relative frequency, relative cover, and importance value (I.V.) of ground layer species encountered at the Denby Prairie Nature Preserve, Macoupin County, Illinois (*exotic species).

Species	Freq %	Mean Cover	Rel. Freq.	Rel. Cover	I.V.
Chamaecrista fasciculata	72	18.18	9.8	21.5	31.3
Solidago canadensis	60	12.00	8.2	14.2	22.4
Sorghastrum nutans	74	7.71	10.1	9.1	19.2
Helianthus mollis	46	10.28	6.3	12.1	18.4
Pycnantheum tenuifolium	58	7.31	7.9	8.6	16.5
Andropogon gerardii	56	5.25	7.6	6.2	13.8
Rubus pensilvanicus	48	6.18	6.5	7.3	13.8
Lespedeza capitata	48	2.99	6.5	3.5	10.0
Silphium integrifolium	28	3.00	3.8	3.5	7.3
Eryngium yuccifolium	32	2.11	4.4	2.5	6.9
Veronicastrum virginicum	32	1.43	4.4	1.7	6.1
Vernonia missourica	26	1.69	3.5	2.0	5.5
Carex (sterile)	30	0.65	4.1	0.8	4.9
Desmodium glabellum	12	1.32	1.6	1.6	3.2
Aster ericoides	16	0.62	2.2	0.7	2.9
Coreopsis tripteris	14	0.85	1.9	1.0	2.9
Euphorbia corollata	18	0.34	2.5	0.4	2.9
Sporobolus heterolepis	6	1.06	0.8	1.3	2.1
Helianthus divaricatus	6	0.90	0.8	1.1	1.9
**Poa pratensis*	12	0.11	1.6	0.1	1.7
Euthamia graminifolia	8	0.14	1.1	0.2	1.3
Heuchera americana	6	0.08	0.8	0.1	0.9
Eupatorium altissimum	4	0.12	0.5	0.1	0.6
Elymus virginicus	4	0.02	0.5	--	0.5
Linum medium	4	0.02	0.5	--	0.5
Apocynum cannabinum	2	0.06	0.3	0.1	0.4
Baptisia alba	2	0.06	0.3	0.1	0.4
Elymus canadensis	2	0.06	0.3	0.1	0.4
Fragaria virginiana	2	0.06	0.3	0.1	0.4
Muhlenbergia frondosa	2	0.01	0.3	--	0.3
Oxalis violacea	2	0.01	0.3	--	0.3
Panicum virgatum	2	0.01	0.3	--	0.3
Totals		84.63	100.0	100.0	200.0
Bare ground and litter		30.74			

DISCUSSION

In early settlement times mesic "black soil" prairie was the most extensive and characteristic plant community of Illinois. Large expanses of mesic prairies are now uncommon in Illinois, and it has been estimated that less than one tenth of one percent of the original "black soil" prairie is still present in the state, and many of these small remnants are highly degraded. This early settlement community, as described by White and Madany (1978), was dominated mostly by tall grasses, particularly *Andropogon gerardii*, *Sorghastrum nutans*, along with the shorter *Sporobolus heterolepis*. These clump grasses commonly exceeded 2 m in height, depending on moisture, while the associated forbs were extremely diverse, the species composition dependent on many variables.

The small remnant mesic prairie at Denby Prairie Nature Preserve has been extensively degraded since the railroad was established through Carlinville in 1852 (McClain and Ebinger 2013). In the twentieth century the use of herbicides by the railroad, the general lack of fire to prevent woody encroachment, and most recently, trenching and soil removal caused by the installation of underground cables and railway maintenance has decreased species diversity and changed the vegetation structure of this prairie. Domination by *Chamaecrista fasciculata* and *Solidago canadensis* is an indication of disturbance, as is the decrease in

dominance of common prairie grasses.

Since the original survey of this site by the Illinois Natural Areas Inventory (White 1978), and at the time of dedication, unvouchered species lists were prepared for Denby Prairie Nature Preserve. These early lists indicate a loss of species diversity on the preserve. Prairie species once present but not found during the present survey include *Amorpha canescens* Pursh, *Brickellia eupatorioides* (L.) Shinners, *Camassia scilloides* (Raf.) Cory, *Ceanothus americanus* L., *Dalea purpurea* Vent., *Dichanthelium oligosanthes* (Schult.) Gould, *Eupatorium serotinum* Michx., *Helianthus strumosus* L., *Heliopsis helianthoides* (L.) Sweet, *Hieracium longipilum* Torr., *Lilium michiganense* Farw., *Platanthera lacera* (Michx.) G. Don, *Silphium perfoliatum* L., *Silphium terebinthinaceum* Jacq., *Solidago speciosa* Nutt., and *Triosteum perfoliatum* L. A fire regime of every other year, and the hand removal of some of the larger woody species will be required to return this small remnant into a quality mesic prairie. Also, some of the "lost" species should be reintroduced.

Prairie was still fairly abundant around Carlinville in the late 1800s and early 1900s. This vegetation and the associated pollinating insects were studied by Dr. Charles Robertson of Blackburn College of Carlinville (Robertson 1925, 1926). Dr. Robertson was born in 12 June 1858, taught at Blackburn College from 1880-1886 and 1898-1910, and studied and collected plants and insects around Carlinville from 1886 to 1931. His collections are preserved at the Illinois Natural History Survey (Jones and Fuller 1955). One of the plant specimens is the uncommon *Erythronium mesochoreum* (prairie trout-lily) which was collected by Dr. Robertson in 1880 and 1883 (ILLS 9355 and 9356), but misidentified as *E. albidum* Nutt. until recently (McClain et al. 1999).

Erythronium meochoreum was initially listed as endangered in Illinois, later reclassified as threatened (Herkert 1991), and now removed from the list because it is more common in Illinois than previously thought (Nÿboer and Ebinger 2004). Presently, a remnant population of this species, consisting of only a few individuals, exists on the preserve. Only 15 individuals were found in the early spring of 2013 compared to over 3,000 individuals in 1998 (McClain et al 1999, McClain 2013). A more active fire regime will probably be necessary to help restore the population of this plant. These fires should be conducted in late fall as this species normally flowers during the time of spring burns in March and early April.

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APPENDIX I. Vascular plant species encountered at the Denby Prairie Nature Preserve, Macoupin County, Illinois are listed alphabetical by family under the major plant groups. Collecting numbers are preceded by the initial of the collector (E = John E. Ebinger; M = William E. McClain). Specimens are deposited in the Stover/Ebinger Herbarium of Eastern Illinois University (EIU), Charleston, Illinois. (*exotic species).

MONOCOTS

Amaryllidaceae
Hypoxis hirsuta (L.) Coville: M2776

Commelinaceae
Tradescantia ohiensis Raf.: E32647
Tradescantia virginiana L.: M2790

Cyperaceae
Carex aggregate Mach.: M2855
Carex blanda Dewey: M2785
Carex bushii Mack.: M2854
Carex gravida L.H. Bailey: M2861
Carex muhlenbergii Schk.: M2854
Carex pellita Willd.: M2861
Carex prasina Wahl.: M2780
Carex sparganioides Muhl. ex Willd.: M2852
Carex vulpinoidea Michx.: M2852
Cyperus esculentus L.: E32725
Cyperus strigosus L.: E32495
Eleocharis verrucosa (Svenson) Harms: M2775
Scirpus atrovirens Willd.: E32726

Iridaceae
Sisyrinchium albidum Raf.: M2781

Juncaceae
Juncus biflorus Ell.: E32648
Juncus interior Wieg.: M2833
Juncus torreyi Coville: M2831

Lilliaceae
Asparagus officinalis L.: E32727
Erythronium albidum Nutt.: M2774
Erythronium mesochoreum Knerr.:E16167

Poaceae
Agrostis hyemalis (Walt.) BSP.: M3841
Andropogon gerardii Vitman: E32503
Dichanthelium acuminatum (Sw.) Gould & Clark: M2838
**Digitaris ischaemum* (Schreb.) Schreb.: E32649
**Digitaria sanguinalis* (L.) Scop.: E32650
**Echinochloa crusgalli* (L.) P. Beauv.: E32496
**Eleusina indica* (L.) Gaertn.: E32497
Elymus canadensis L.: E32651
Elymus virginicus L.: M2848
Eragrostis spectabilis (Pursh) Steud.: E32652
**Eriochloa contracta* Hitchc.: E32653
Glyceria striata (Lam.) Hitchc.: M2843
Muhlenbergia frondosa (Poir.) Fern.: E32654
Panicum capillare L.: E32498
Panicum virgatum L. (found in plots)
Paspalum laeve Michx.: E32655
**Phleum pratense* L.: M2885
**Poa compressa* L.: M2856
**Poa pratensis* L. (found in plots)
Schizachyrium scoparium (Michx.) Nash: E32656
**Setaria faberi* F. Herrm.: E32499
Sorghastrum nutans (L.) Nash: E32500
Sporobolus heterolepis (Gray) Gray: E32501
Tridens flavus (L.) Hitchc.: E32502

DICOTS

Acanthaceae
Ruellia humilis Nutt.: M2899

Aceraceae
Acer saccharinum Marsh.: M2875

Anacardiaceae
Rhus glabra L.:E32472

Apiaceae
Eryngium yuccifolium Michx.: E32473
**Pastinaca sativa* L.: M2882
Sanicula canadensis L.: M2847
Zizia aurea (L.) Koch: M2787

Apocynaceae
Apocynum cannabinum L.: M2849

Asclepiadaceae
Asclepias hirtella (Pennell) Woodson: E32474
Asclepias purpurascens L.: M2998
Asclepias syriaca L.: E32657
Asclepias tuberosa L.: M2830
Asclepias verticillata L.: M2857

Asteraceae
**Achillea millefolium* L.: M2863
Ageratina altissima (L.) King & Robins.: E32658
Ambroia artemisiifolia L.: E32660
Ambrosia trifida L.: E32459
Antennaria neglecta Greene: M2769
Antennaria plantaginifolia (L.) Hook.: M2782
Arnoglossum atriplicifolia (L.) H. Robins.: E32720
Aster ericoides L.: E32728
Aster lanceolatus Willd.: E32718
Aster novaeangliae L.: E32719
Aster pilosus Willd.: E32729
Aster turbinellus Lindl.: E32717
Bidens coronata (L.) Britt.: M2994
Bidens polyepis Blake: E32460
**Cichorium intybus* L.: E32461
Cirsium discolor (Muhl.) Spreng.: E32462
Conyza canadensis (L.) Cronq.: E32463
Coreopsis palmata Nutt.: M2835
Coreopsis tripteris L.: E32464
Erechtites hieracifolia (L.) Raf.: E32465
Erigeron annuus (L.) Pers.: M2860
Eupatorium altissimum L.: E32662
Euthamia graminifolia (L.) Nutt.: E32659
Helianthus divaricatus L.: M2999
Helianthus grosseserratus Martens: E32663
Helianthus mollis Lam.: E32466
Lactuca canadensis L.: E32467
Liatris pycnostachya Michx.: E32468
Oligoneuron rigidum (L.) Small: E32661
Prenanthes aspera Michx.: M2996
Ratibida pinnata (Vent.) Barnh.: M2876
Rudbeckia hirta L.: M2851
Silphium integrifolium Michx.: E32469
Solidago canadensis L.: E32664
Solidago missouriensis Nutt.: E32470
Vernonia missurica Raf.: E32471

Berberidaceae
Podophyllum peltatum L.: M2779

Boraginaceae
Lithospermum canescens (Michx.) Lehm.: M2792

Brassicaceae
Barbarea vulgaris R. Br.: M2771
Thlaspi arvense L.: M2789

Caesalpiniaceae
Chamaecrista fasciculata (Michx.) Greene: E32475

Campanulaceae
Lobelia spicata Lam.: M2894

Cannabinaceae
Humulus lupulus L.: E32721

Caprifoliaceae
**Lonicera maackii* (Rupr.) Maxim.: E32669

Convolvulaceae
Calystegia sepium (L.) R. Br.: M2846

Corylaceae
Corylus americana Walt.: E32722

Euphorbiaceae
Acalypha virginica L.: E32476
Chamaesyce nutans (Lag.) Small: E32477
Euphorbia corollata L.: E32478

Fabaceae
Baptisia alba (L.) Vent.: E32666
Desmodium glabellum (Michx.) DC.: E32667
Lespedeza capitata Michx.: E32480
**Medicago lupulina* L.: E32668
**Melilotus albus* Medic.: M2886
**Melilotus officinalis* (L.) Pers.: M2898
**Securigera varia* (L.) Lasson: E32479
**Trifolium pratense* L.: E32481

Fagaceae
Quercus stellata Wangh.: E32482

Hypericaceae
Hypericum punctatum Lam.:E32483

Juglandaceae
Carya ovata (Wangenb.) Sarg.: M2893

Lamiaceae
Lycopus americanus Muhl.: E32484
Monarda fistulosa L.: E32485
Pycnanthemum tenuifolium Schrad.: E32670
Teucrium canadense L.: E32486

Lauraceae
Sassafras albidum (Nutt.) Nees: M2895

Linaceae
Linum medium (Planch.) Britt.: M2834
Linum sulcatum Riddell: E32487

Lythraceae
Ammannia coccinea Rottb.: E32723

Onagraceae
Ludwigia alternifolia L.: E32488
Oenothera biennis L.: E32489

Oxalidaceae
Oxalis violacea L.: M2783

Polemoniaceae
Phlox pilosa L.: M2784

Polygonaceae
Fallopia scandens (L.) Holub: E32490
**Rumex crispus* L.: M2862

Primulaceae
Dodecatheon media L.: M2793

Ranunculaceae
Anemone virginiana L.: M2850
Delphinium tricorne Michx.: M2788

Rosaceae
Fragaria virginiana Duchesne: M2772
Geum canadense Jacq.: M2840
Potentilla simplex Michx.: M2791
Prunus serotina Ehrh.: M2887
Rosa carolina L.: E32491
Rubus pensilvanicus Poir.: M2839

Salicaceae
Salix humilis Marsh.: E32492

Saxifragaceae
Heuchera americana L.: M2842

Scrophulariaceae
Penstemon digitalis Nutt.: M2845
Veronicastrum virginicum (L.) Farw.: M2873

Ulmaceae
Celtis occidentalis L.: M2880
Ulmus rubra Muhl.: M2881

Verbenaceae
Phyla lanceolata (Michx.) Greene: E32493
Verbena urticifolia L.: E32494

Violaceae
Viola pratincola Greene: M2777
Viola sororia Willd.: M2770

Vitaceae
Vitis vulpina L.: M2878