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Floristic Assessment of Foley Sand Prairie Nature Preserve, Lee County, Illinois

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ABSTRACT

Foley Sand Prairie Nature Preserve, Lee County, Illinois, was studied during the growing seasons of 2001 and 2002. Located in the Green River lowlands of northwestern Illinois, this area was dominated by marshes and sand prairies before European settlement. The native prairie grasses with the highest importance values were *Schizachyrium scoparium* (Michx.) Nash (little bluestem) and *Sporobolus heterolepis* (Gray) Gray (prairie dropseed). Important forbs included *Euphorbia corollata* L. (flowering spurge), *Aster ericoides* L. (heath aster), *Echinacea pallida* Nutt. (pale coneflower), and *Coreopsis palmata* Nutt. (prairie coreopsis). A total of 180 vascular plant species were found on the site, 132 species of dicots, 46 monocots, and two fern-allies. Twenty non-native species were found, comprising about 12% of the flora. The dry sand prairie community had a Floristic Quality Index of 52.98.

INTRODUCTION

At the time of European settlement prairie vegetation covered about 60% of Illinois (Iverson et al. 1991). Most was tall-grass, black soil prairie that occurred in the prairie peninsula in the northeastern part of the state (Schwegman 1973, Ebinger and McClain 1991). Other prairie communities were also common, such as loess hill prairies, glacial till prairies, sand prairies, and gravel prairies, depending on soil and topography (Schwegman 1973). Of these prairie communities, sand prairies were relatively common in the northern half of Illinois. Most occurred on outwash plains that resulted from erosional events associated with Wisconsin glaciation (Willman and Frye 1970, King 1981). The most extensive are the Kankakee Sand Area Section of the Grand Prairie Natural Division in northeastern Illinois and the Illinois River Sand Area Section of the Illinois River and Mississippi River Sand Area Natural Division in the central part of the state (Schwegman 1973).

Numerous smaller sand deposits also occur in Illinois, including the glacial outwash sands along the upper Mississippi River valley and its tributaries and the Green River Lowlands of Lee and Henry counties in northwestern Illinois. Gleason (1910) refers to these sand areas in his extensive studies of the inland sand deposits of Illinois. Until Handel et al. (2003) Gleason's work was the only study of the flora of the Green River sand deposits. This sand area contains numerous small dunes, but few still retain native flora, having been degraded or destroyed by grazing, agriculture, or development. The present study was undertaken to determine vascular plant species composition, vegetation structure, and floristic quality of a small dry sand prairie community located in the Green River Lowlands on a dune ridge and slope at Foley Sand Prairie Nature Preserve (FSPNP).

STUDY SITE

FSPNP is located in the extreme western part of Lee County, about 25 km southwest of Dixon, Illinois, and about 7 km northwest of the terminal moraine of Wisconsin glaciation (Killey 1998). Extensive amounts of sand and gravel were deposited in the Green River Lowlands during intermittent warm periods of the Wisconsin Episode. These sands were reworked by wind creating numerous small sand dunes throughout the lowlands (Killey 1998). The soils of the dune at FSPNP are excessively drained Sparta loamy sands, while Orio loamy sand occurs in the poorly drained depression at the base of the dune (Zwicker 1985). The vegetation varies from dry sand prairie to sedge meadow, depending upon availability and persistence of moisture (White and Madany 1978, Robertson 1998).

The small prairie community in the FSPNP is about 2.8 ha in size and nearly covers the entire ridge and slopes of the dune (SW1/4 S7 T20N R8E). Formerly called County Line Prairie, this dune has been grazed in the past, but not plowed. Since being dedicated in 1988, the only management has been occasional burns. A lowland depression adjacent to the dune, and a small field make up the remainder of FSPNP. This area was plowed once, the year before being purchased by the Illinois Department of Natural Resources, and comprises about 3.4 ha of the 6.2 ha FSPNP. Many prairie as well as non-native species now occur in this area.

Climate at FSPNP is continental with warm summers and cold winters. Based on weather data from Dixon, 25 km northeast of FSPNP, the mean annual precipitation is 94.7 cm, with June having the highest rainfall (12.4 cm). Mean annual temperature is 8.5°C with the hottest month being July (average of 22.3°C), and the coldest January (average of -7.9°C). Average number of frost free days is 161 (Midwestern Regional Climate Center 2002, Angel and Armstrong 1998).

METHODS

FSPNP was visited throughout the growing seasons of 2001 and 2002. Voucher specimens of each plant species were collected, identified, and deposited in the Stover-Ebinger Herbarium of Eastern Illinois University, Charleston, Illinois (EIU). Criteria for designating non-native species followed Mohlenbrock (1986) and Gleason and Cronquist (1991).

In August of 2002 four 25 m transects were located randomly in an east-west orientation within the study area to determine plant community composition. Along each transect, 1 m^2 quadrats were located at 1 m intervals (n=25/transect). Quadrats located at odd numbered intervals were on the north side of the transect line; quadrats located at even numbered intervals were on the south side of the transect line. A random numbers table was used to determine the number of meters (0 to 9) the quadrat was located from the transect line. Species cover was determined using the Daubenmire cover class system (Daubenmire 1959) as modified by Bailey and Poulton (1968). Only ground layer species rooted within the quadrat frame were recorded. 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%. Importance value (IV) was determined by summing relative cover and relative frequency.

The Floristic Quality Index (FQI) was determined using the coefficient of conservatism (CC) assigned each species by Taft, et al. (1997). The CC for each taxon in the Illinois flora was determined by assigning each an integer from 0 to 10 based on the species tolerance to disturbance and its fidelity to habitat integrity based on observation made by many observers over years of study. Therefore, as used here the FQI is a weighted index of species richness (N = number of species present on a site), and is the arithmetic product of the average coefficient of conservatism (C-Value = the average of all species CC's) multiplied by the square root of the species richness ($\sqrt{N}$) of an inventory site: FQI = C-Value ($\sqrt{N}$).

For relatively small areas that are intensively studied, the FQI gives a rapid means of comparison and an indication of the floristic integrity of the site. As used here, the floristic integrity of the site is related to its species diversity, and the degree to which self-correcting properties are exhibited when the site is exposed to disturbance. Using the FQI along with other floristic measures, such as quadrat-based sampling methods, provides a way to making qualitative comparisons among sites. Prairies with an FQI of 35 or higher are considered good quality natural areas (Taft et al. 1997).

RESULTS AND DISCUSSION

A total of 180 species within 127 genera and 43 families were documented (Appendix I). Fern and fern-allies were represented by only two species. Of the remainder, 46 were monocots in 6 families and 31 genera and 132 were dicots in 36 families and 95 genera. Twenty non-native species were encountered, and 11 species of trees and shrubs were collected. The predominant plant families were the Asteraceae with 39 species, the Poaceae with 25 species, and the Cyperaceae with 13 species.

Of the species encountered, 42 were present in the quadrats. Of these taxa *Schizachyrium scoparium* (Michx.) Nash (little bluestem) was most important, having a frequency of 80%, a relative cover of 16.1, and an IV of 23.5 (Table 1). A close second was *Euphorbia corollata* L. (flowering spurge) with an IV of 22.9, followed by *Aster ericoides* L. (heath aster), *Sporopolus heterolepis* (Gray) Gray (prairie dropseed), and *Echinacea pallida* Nutt. (pale coneflower). Overall, ten native prairie species, that are typical components of dry sand prairies, had IV's greater than 10. All would be expected in good quality dry

sand prairie communities in northwestern Illinois. The FQI for this site was 52.98, with a mean C-Value of 3.96.

Of the other species encountered in the plots, two were non-native, *Poa pratensis* L. (Kentucky bluegrass) and *Achillea millefolium* L. (common yarrow). Kentucky bluegrass was relatively common with a frequency of 49%, but was not a very obvious component of the flora due to its low relative cover (0.3). Common yarrow, in contrast, had a frequency of only 14% and was mostly represented by scattered basal leaves.

Of the three woody species encountered in the plots, *Amorpha canescens* Pursh. (leadplant) was common, having an IV of 11.6 and a frequency of 54%; being scattered throughout the prairies, particularly along the ridge and upper dune slopes. *Salix humilis* Marsh. (prairie willow), in contrast, had a frequency of only 2% and was restricted to a few large clumps toward the middle and base of the slopes (Table 1). *Rosa carolina* L. (pasture rose) was found in one quadrat.

Though 20 non-native, adventive species were encountered, most were restricted to the roadside on the south edge of the FSPNP. Some were present in the depression adjacent to the dune, or in the disturbed field at the southwest corner of the preserve. The depressions contained remnants of a sedge meadow community. Also, the disturbed field contained the remaining woody species, most of which were exotics or invasive native species.

The only other dry sand prairie studied in the Green River Lowlands is one located on a shallow ridge that is surrounded by wetter sand prairies and sedge meadows. This prairie is in the Richardson Wildlife Foundation in the central part of Lee County 35 km east of FSPNP (Handel et al. 2003). Here *Sorghastrum nutans* Nash (Indian grass) and little bluestem dominate, while the important forbs included *Euthamia graminifolia* (L.) Salisb. (grass-leaved goldenrod), *Solidago nemoralis* Ait. (gray goldenrod), and *Liatris aspera* (rough blazing-star). A few species were common to both prairies, but many species at the Richardson Wildlife Foundation were commonly associated with mesic conditions. Differences in hydrology probably accounted for the different species composition.

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Table 1. Frequency (%), average cover, relative frequency, relative cover, and importance value of ground layer species at Foley Sand Prairie Nature Preserve, Lee County, Illinois (* = exotic species).

Species	Freq. %	Average Cover	Rel. Freq.	Rel. Cover	I. V.
Schizachyrium scoparium	80	14.76	7.4	16.1	23.5
Euphorbia corollata	90	13.38	8.4	14.5	22.9
Aster ericoides	86	9.91	8.0	10.7	18.7
Sporobolus heterolepis	55	10.94	5.1	11.9	17.0
Echinacea pallida	81	6.59	7.5	7.1	14.6
Coreopsis palmate	50	6.38	4.7	6.9	11.6
Amorpha canescens	54	6.12	5.0	6.6	11.6
Ambrosia psilostachya	64	4.41	6.0	4.8	10.8
Cyperus filiculmis	97	1.64	9.0	1.8	10.8
Comandra umbellate	70	3.70	6.5	4.0	10.5
Stipa spartea	49	2.20	4.6	2.4	7.0
**Poa pratensis*	49	0.30	4.6	0.3	4.9
Tephrosia virginiana	16	2.61	1.5	2.8	4.3
Solidago speciosa	19	1.96	1.8	2.1	3.9
Koeleria macrantha	22	1.09	2.0	1.2	3.2
Dichanthelium villosissimum	29	0.47	2.7	0.5	3.2
Liatris aspera	26	0.72	2.4	0.8	3.2
Dichanthelium oligosanthes	24	0.25	2.2	0.3	2.5
Helianthus rigidus	16	0.67	1.5	0.7	2.2
**Achillea millefolium*	14	0.10	1.3	0.1	1.4
Eragrostis spectabilis	13	0.14	1.2	0.2	1.4
Euthamia gymnospermoides	6	0.78	0.5	0.8	1.3
Salix humilis	2	1.00	0.2	1.1	1.3
Solidago nemoralis	10	0.30	0.9	0.3	1.2
Aster sericeus	6	0.52	0.5	0.6	1.1
Sorghastrum nutans	7	0.23	0.7	0.2	0.9
Heterotheca camporum	6	0.16	0.5	0.2	0.7
Leptoloma cognatum	6	0.08	0.5	0.1	0.6
Phlox pilosa	5	0.10	0.5	0.1	0.6
Antennaria plantaginifolia	3	0.21	0.3	0.2	0.5
Helianthus occidentalis	2	0.30	0.2	0.3	0.5
Andropogon gerardii	2	0.06	0.2	0.1	0.3
Asclepias verticillata	3	0.02	0.3	--	0.3
Gentiana puberulenta	2	0.06	0.2	0.1	0.3
Panicum virgatum	2	0.06	0.2	0.1	0.3
Lespedeza capitata	2	0.04	0.2	--	0.2
Oxalis dillenii	2	0.01	0.2	--	0.2
Artemisia campestris	1	0.03	0.1	--	0.1
Dalea purpurea	1	0.03	0.1	--	0.1
Equisetum arvense	1	0.01	0.1	--	0.1
Lithospermum caroliniense	1	0.03	0.1	--	0.1
Rosa carolina	1	0.03	0.1	--	0.1
Totals		92.40	100.0	100.0	200.0
Average bare ground and litter		14.83			

APPENDIX I

Vascular plant species encountered at Foley Sand Prairie Nature Preserve, Lee County, Illinois, are listed alphabetically by family under major plant groups. Non-native (exotic) species are indicated by an asterisk (*). For each species the author's collection number (JEE) is given.

FERN AND FERN ALLIES

Equisetaceae
Equisetum arvense L. not collected
Equisteum laevigatum R. Br. 30930

MONOCOTS

Commelinaceae
Tradescantia ohiensis Raf. 30683

Cyperaceae
Carex bicknelii Britt. 30686
Carex brevior (Dewey) Mack. 31036
Carex lanuginosa Michx. 30685
Carex meadii Dewey 31347
Carex muhlenbergii Willd. 30684
Carex pensylvanica Lam. 31301
Carex stricta Lam. 30687
Carex umbellata Schk. 31346
Carex vesicaria L. 31349
Cyperus esculentus L. 31037
Cyperus filiculmis Vahl. 31038
Cyperus schweinitzii Torr. 31147
Scleria triglomerata Michx. 31039

Juncaceae
Juncus greenei Oakes & Tuckerm. 31040
Juncus interior Wieg. 30931

Iridaceae
Iris shrevei Small 30932
Sisyrinchium campestre Bickn. 30688

Liliaceae
Hypoxis hirsuta (L.) Coville 31303
Polygonatum commutatum (Schult.) A. Dietr. 31041
Smilacina stellata (L.) Desf. 31302

Poaceae
**Agropyron repens* (L.) Beauv. 30933
Agrostis hyemalis (Walt.) BSP. 30934
Andropogon gerardii Vitman 31042
**Bromus inermis* Leyss. 30690
**Bromus tectorum* L. 30689
Calamagrostis canadensis (Michx.) Beauv. 31152
**Dactylis glomerata* L. 30691
Dichanthelium linearifolium (Scribn.) Gould 31345
Dichanthelium oligosanthes (Schult.) Gould 31043
Dichanthelium villosissimum (Nash) Freckm. 30693
Elymus canadensis L. 31153
Eragrostis spectabilis (Pursh) Steud. 31148
Koeleria macrantha (Ledeb.) Spreng. 30692
Leptoloma cognatum (Schult.) Chase 30935
Panicum virgatum L. 30936
Phalaris arundinacea L. 30937
**Phleum pratense* L. 30938
**Poa compressa* L. 30695
**Poa pratensis* L. 30694
Schizachyrium scoparium (Michx.) Nash 31044
**Setaria faberi* Herrm. 31154
Spartina pectinata Link 30939
Sporobolus heterolepis (Gray) Gray 31151
Sorghastrum nutans (L.) Nash 31150
Stipa spartea Trin. 30696

DICOTS

Apiaceae
Eryngium yuccifolium Michx. 30940
Polytaenia nuttallii DC. 30697
Sanicula canadensis L. 30941
Thaspium trifoliatum (L.) Gray 30592
Zizia aptera (Gray) Fern. 31155

Apocynaceae
Apocynum cannabinum L. 30942

Asclepiadaceae
Asclepias syriaca L. 30957
Asclepias verticillata L. 30958

Asteraceae
**Achillea millefolium* L. 20698
Ambrosia artemisiifolia L. 31045
Ambrosia psilostachya DC. 31046
Ambrosia trifida L. 31156
Antennaria neglecta Greene 31304
Antennaria plantaginifolia (L.) Richards. 30699
Artemisia campestris L. 30943
Aster ericoides L. 31139

Aster laevis L. 31138
Aster pilosus Willd. 31158
Aster praealtus Poir. 31157
Aster sericeus Vent. 31140
Boltonia asteroides (L.) L'Her. 31159
Cirsium discolor (Muhl.) Spreng. 31160
Conyza canadensis (L.) Cronq. 31047
Coreopsis palmata Nutt. 30944
Echinacea pallida Nutt. 30945
Erigeron strigosus Muhl. 30700
Eupatorium altissimum L. 31048
Euthamia gymnospermoides Greene 31049
Helianthus grosseserratus Martens 30946
Helianthus occidentalis Riddell 30947
Helianthus rigidus (Cass) Desf. 31051
Heterotheca camporum (Greene) Shinners 30701
Hieracium longipilum Torr. 31050
Lactuca canadensis L. 30948
Liatris aspera Michx. 31141
Liatris pycnostachya Michx. 30949
Parthenium integrifolium L. 30950
Ratibida pinnata (Vent.) Barnh. 30951
Rudbeckia subtomentosa Pursh 30952
Senecio plattensis Nutt. 30702
Silphium integrifolium Michx. 30953
Solidago missouriensis Nutt. 30954
Solidago nemoralis Ait. 31142
Solidago rigida L. 31161
Solidago speciosa Nutt. 31052
**Tragopogon pratensis* L. 30703
Vernonia fasciculata Michx. 30956

Boraginaceae
Lithospermum canescens (Michx.) Lehm. 30593
Lithospermum caroliniense (J.F. Gmel.) MacM. 30704

Brassicaceae
Descurainia pinnata (Walt.) Britt. 31306
**Lepidium densiflorum* Schrad. 30705

Campanulaceae
Campanula aparinoides Pursh 31053
Lobelia spicata Lam. 30706

Caryophyllaceae
**Lychnis alba* Mill. 30707
Silene antirrhina L. 31342
Silene stellata (L.) Ait.f. 30959

Chenopodiaceae
**Chenopodium album* L. 30960
Chenopodium desiccatum A. Nels. 31054

Convolvulaceae
Calystegia sepium (L.) R. Br. 30961

Cornaceae
Cornus obliqua Raf. 30962

Cuscutaceae
Cuscuta gronovii Willd. 30963

Euphorbiaceae
Euphorbia corollata L. 30964

Fabaceae
Amorpha canescens Pursh 30965
Baptisia lactea (Raf.) Thieret 30966
Baptisia leucophaea Nutt. 30594
Dalea candida (Michx.) Willd. 30967
Dalea purpurea Vent. 30968
Desmodium canadense (L.) DC. 31162
Desmodium illinoense Gray 30969
Lespedeza capitata Michx. 31143
**Medicago lupulina* L. 30708
**Melilotus alba* Medic. 31055
Tephrosia virginiana (L.) Pers. 30970
**Trifoloium pratense* L. 30709

Gentianaceae
Gentiana andrewsii Griesb. 31163
Gentiana puberulenta A. Davids. 31144

Lamiaceae
Lycopus americanus Muhl. 30971
Lycopus virginicus L. 31056
Monarda fistulosa L. 30972
**Nepeta cataria* L. 30973
Pycnanthemum virginianum (L.) Dur. & Jacks. 30974
Scutellaria leonardii Epling 31343
Stachys palustris L. 30975
Teucrium canadense L. 31164

Nyctaginaceae
**Mirabilis nyctaginea* (Michx.) MacM. 30976

Onagraceae
Oenothera biennis L. 30977
Oenothera rhombipetala Nutt. 31145

Oxalidaceae
Oxalis dillenii Jacq. 31057
Oxalis violacea L. 30595

Polemoniaceae
Phlox bifida Beck 31307
Phlox pilosa L. 31146

Polygonaceae
Polygonum amphibium L. 31165
Polygonum pensylvanicum L. 31058
Rumex altissimus Wood. 30978

Primulaceae
Lysimachia lanceolata Walt. 31059

Ranunculaceae
Anemone canadensis L. 30710
Anemone cylindrica Gray 30980
Thalictrum revolutum DC. 30711

Rhamnaceae
Ceanothus americanus L. 30979

Rosaceae
Fragaria virginiana Duchesne 31344
Potentilla arguta Pursh 30981
**Potentilla norvegica* L. 31060
Potentilla simplex Michx. 30712
Prunus serotina L. 31061
Prunus virginiana L. 31062
Rosa carolina L. 30713
Rubus allegheniensis Porter 30715
Rubus occidentalis L. 30714
Spiraea alba DuRoi 30982

Rubiaceae
Galium aparine L. 30716
Galium obtusum Bigel. 30983

Salicaceae
Populus deltoides Marsh. 31166
Salix humilis Marsh. 30984

Santalaceae
Comandra umbellata (L.) Nutt. 30596

Saxifragaceae
Heuchera richardsonii R. Br. 30717

Scrophulariaceae
Pedicularis canadensis L. 30597
Penstemon pallidus Small 30718
Veronicastrum virginicum (L.) Farw. 30985
**Verbascum thapsus* L. 30986

Solanaceae
Physalis heterophylla Nees 30988
Physalis subglabrata Mack. & Bush 30987
Solanum carolinense L. 30989

Ulmaceae
**Ulmus pumula* L. 31064

Urticaceae
Parietaria pensylvanica Muhl. 31063

Verbenaceae
Verbena bracteata Lag. & Rodr. 30990
Verbena hastata L. 30992
Verbena stricta Vent. 30991

Violaceae
Viola lanceolata L. 31308
Viola pedatifida G. Don 30598
Viola sagittata Ait. 31065

Vitaceae
Parthenocissus quinquefolia (L.) Planch. 31066
Vitis vulpina L. 30719