Gravel Hill Prairies of Indiana

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Introduction

Gravel hill prairies are native grasslands occurring on gravel deposits. They are termed hill prairies because they occur on relatively steep south, southwest, or west facing slopes (9). This xeric community is previously undescribed in studies of Indiana's plant communities (12) and contain a flora quite different from the characteristic "tall grass prairie" of northwest Indiana (5, 12). In this paper we discuss gravel hill prairies recently located in Tippecanoe County and the methods used to locate and describe them. We also compare them with hill prairies in other states. A preliminary species list is presented, including information concerning some very rare floristic elements (2).

Methods

A systematic search for remaining gravel hill prairies was made in 1979 and 1980. Past evidence of the existence of this type of prairie included early plant collection records (8) and a report by Betz (5). The methods used were similar to those used to find glades in Harrison County, Indiana (1). The 1971 aerial photographs were examined at the Agriculture Stabilization and Conservation Service office, in conjunction with the 7.5 minute United States Geological Survey topographic quadrangle map, and the soil survey of Tippecanoe County (20). Openings along the gravel bluffs of the Wabash River and tributaries, primarily Wea Creek, were examined in an effort to locate natural communities. Eight sites were found to have potential. These sites were then checked during an aerial survey in a high-winged aircraft, from an elevation of 1000 feet.

During the ground survey three significant prairie remnants were identified. Several other more disturbed sites, containing some prairie vegetation, were also located. The three prairie remnants were visited throughout the past several growing seasons. A species list was compiled for each site, and rare species were located and mapped. Nomenclature follows Gleason and Cronquist (11).

The Study Area

All three remaining gravel hill prairies are located in central Tippecanoe County. Historically this area was a mix of oak woods and prairies as recorded by the early land surveyors (22). Gravel hill prairies in presettlement times covered a small percentage of the total land area of Tippecanoe County, while 35% of the county was covered by tall grass prairie typically found on silt loam soils in west-central Indiana. Today it is difficult to find any prairie in this region, as the area has been intensively altered by agricultural and industrial uses.

Topographic and edaphic conditions form a narrow continuum from dry to dry mesic in the 3 sites which are located on a steep south or west facing bluff between an elevation of 570 to 600 feet. The soil type under each prairie is a Rodman gravelly loam (20). This soil is found on steep slopes of gravel terraces, kames and eskers, usually along the Wabash and Tippecanoe Rivers and a few of their major tributary streams in Carroll, Tippecanoe, Fountain, Parke and Vermillion Counties (4, 15, 18, 20, 21). Characteristics of this soil types are a dark brown gravelly loam, underlain

by stratified calcareous sand and gravel, mildly alkaline to alkaline in pH with high permeability, rapid runoff and excessive drainage.

All three prairies are found within a mile of each other on the bluffs overlooking Wea Creek. Names given to each site are Lookout Point, Wabash Breaks, and Wea Creek respectively. Wea Creek is the largest of the three although each hill prairie exists today as a small (less than one hectare) opening in a forest composed of *Quercus macrocarpa, Q. imbricaria, Carya ovata, Prunus serotina*, and *Cercis canadensis*. It is likely that each was larger in the past but has shrunk in size due to a number of disturbances. These disturbances include horses causing erosion, brush invasion due to lack of fire (5) and mining of the gravel resulting in the outright destruction of part of the Wea Creek prairie.

Results and Discussion

These gravel hill prairies still exist today in Indiana due to soil and topography. Environmental conditions are more xeric in hill prairies than in surrounding forests due to higher light intensities, higher wind velocity, higher soil temperatures, higher daily air temperatures and higher evaporation rates (9, 14). No hill prairies or potential hill prairies have been found on north or east facing slopes probably due to more mesic conditions.

As a result of xeric conditions a unique assemblage of plants occurs in these gravel hill prairies (8). This assemblage is a combination of typical prairie plants found in Indiana and prairie plants considered rare in Indiana but common in mid-grass prairies farther west. Prairie plants found on these sites but rarely found elsewhere in Indiana include: *Androsace occidentalis, Arenaria patula, Aster oblongifolius, Besseya bullii, Erysimum asperum, Lithospermum incisum,* and *Muhlenbergia cuspidata. Astragalus tennesseenis, Psoralea tenuiflora, Onosmodium molle* var. *hispidissimum*, and *Linum sulcatum* occurred in the Wea Creek vicinity historically. The *Astragalus* and *Psoralea* are now considered extirpated in the state and the others endangered and threatened (2).

To date, 154 vascular plant species representing 54 families have been identified at the three prairies. At Lookout Point 80 taxa including one rare species and 5 state endangered species were identified. At Wabash Breaks 101 taxa were found including one rare species and three state endangered species. At Wea Creek 86 taxa were found to occur including one rare species and seven state endangered species (Table 1).

The visual aspect is that of mid-grass prairie, i.e. vegetation height typically 2 feet high. The common grasses found on Indiana's gravel hill prairies are *Bouteloua curtipendula, Andropogon scoparius,* and *Stipa spartea.* Other associates included *Allium cernuum, Amorpha canescens, Aster oblongifolius, Petalostemum purpurem, Erysimum asperum* and *Kuhnia eupatorioides* (Table 1). These species, in conjunction with the dominance of little bluestem and side-oats grama grass, are more typical of mid-grass prairies.

The Illinois Natural Areas Inventory recognized both gravel hill prairie and loess hill prairie (23). There is a close similarity in species composition between Indiana and Illinois gravel hill prairies (9, 23). Species in common include *Bouteloua curtipendula, Andropogon scoparious, A. gerardi, Sporobulus heterolepis, Sorghastrum nutans, Androsace occidentalis, Aster oblongifolius, Besseya bullii* and *Lithospermum incisum.* In a more recent Illinois study, 51% of the species including *Lithospermum incisum, Muhlenbergia cuspidata, Onosmodium hispidissimum* and *Besseya bullii* reported from the Tazewell Gravel Terrace Prairie (23) occur on Indiana gravel hill prairies. Another of Indiana's gravel hill prairie components, *Astragalus tennesseensis* also occurs at this Illinois site.

The Illinois loess hill prairies were found to occur on upper slopes of southwest

TABLE 1. Vascular Flora of Three Tippecanoe County Gravel Hill Prairies

Taxa	Lookout Point	Wabash Breaks	Wea Creek
# Achillea millefolium			X
# Alliaria officinalis		X	X
Allium cernuum	X	X	X
# Amaranthus sp.		X	
Ambrosia artemisiifolia	X	X	X
Ambrosia trifida	X	X	
Amelanchier arborea	X		
Amorpha canescens	X	X	X
Andropogon gerardi	X	X	X
Andropogon scoparius	X	X	X
* Androsace occidentalis			X
Anemone cylindrica	X	X	
Anemone quinquefolia		X	
Antennaria plantaginifolia	X		
Apocynum androsaemifolium		X	
Aquilegia canadensis			X
* Arenaria patula	X	X	X
# Artemisia sp.		X	
Asclepias syriaca			X
Asclepias tuberosa			X
Asclepias verticillata		X	X
Asclepias viridiflora	X	X	X
Aster ericoides	X	X	X
* Aster oblongifolius	X	X	X
# Avena fatus	X		X
* Besseya bullii			X
Bidens sp.		X	
Bouteloua curtipendula	X	X	X
# Bromus inermis		X	
Carex pensylvanica	X	X	
Carya ovata	X	X	
Cassia fasciculata	X		
# Catalpa speciosa			X
Celastrus scandens	X	X	
Celtis occidentalis	X	X	
Cercis canadensis	X	X	
Claytonia virginica			X
Comandra umbellata	X	X	X
Convolvulus sepium		X	
Coreopsis palmata	X		
Coreopsis tripteris		X	
Cornus racemosa	X	X	X
Crataegus sp.	X	X	
Cyperus sp.			X
# Daucus carota			X
Dodecatheon meadia	X		
# Draba verna	X		X
Elymus canadensis	X	X	X
Equisetum arvense		X	
Erigeron sp.		X	X
* Erysimum asperum	X	X	X
Euonymus atropurpureus	X		
Eupatorium altissimum	X	X	X
Eupatorium rugosum		X	
Eupatorium serotinum			X
Euphorbia corollata	X	X	X
# Euphorbia sp.	X	X	
Fragaria virginiana		X	X
Fraxinus americana		X	X
Galium aparine		X	

TABLE 1.—Continued

Taxa	Lookout Point	Wabash Breaks	Wea Creek
Galium circaezans	X	X	X
Helianthus divaricatus	X	X	X
Helianthus grosseserratus	X	X	
Helianthus occidentalis		X	
Heuchera richardsonii			X
Hypericum sphaerocarpum	X	X	
Hypericum spp.	X		
Hypoxis hirsuta	X		
Hystrix patula		X	
Kuhnia eupatorioides	X	X	X
Lactuca sp.		X	
# Lepidium sp.			X
Lespedeza capitata	X		X
Lithospermum canescens	X	X	
* Lithospermum incisum	X		X
Lonicera sp.	X		X
# Medicago sativa	X		
# Melilotus alba	X	X	X
Mirabilis nyctaginea		X	
Monarda fistulosa			X
# Morus alba			X
* Muhlenbergia cuspidata	X	X	X
Muhlenbergia racemosa	X		
Oenothera biennis			X
Opuntia humifusa	X	X	X
Osmorhiza longistylis		X	
Oxalis sp.			X
Panicum virgatum	X	X	
Panicum sp.	X	X	X
Parthenocissus quinquefolia		X	
Penstemon hirsuta	X		X
Petalostemum purpureum	X	X	X
Phlox bifida	X	X	X
Physalis sp.	X		X
Physostegia virginiana		X	
Phytolaca americana		X	
# Plantago aristata	X		
Platanus occidentalis			X
# Poa pratensis	X	X	X
Polanisia graveolens			X
Polygonatum biflorum			X
# Potentilla recta			X
Prunus serotina		X	X
Prunus virginiana			X
Ptelea trifoliata	X	X	X
Pycnanthemum sp.		X	
Quercus imbricaria	X	X	
Quercus macrocarpa	X	X	
Quercus muhlenbergia		X	
Quercus velutina		X	
Ratibida pinnata		X	X
Rhus aromatica	X	X	X
Rhus glabra	X	X	X
Rhus radicans	X	X	
Ribes sp.		X	
# Robinia pseudoacacia	X	X	X
Rosa carolina	X	X	X
Rubus flagellaris		X	X
Rubus occidentalis		X	X

TABLE 1.—Continued

Taxa	Lookout Point	Wabash Breaks	Wea Creek
Rudbeckia hirta		X	
Ruellia humilis		X	
Ruellia strepens	X	X	X
Sanguinaria canadensis	X	X	
# Saponaria officinalis	X	X	X
Scutelaria elliptica	X		
Scutelaria parvula	X		
# Setaria sp.	X		
Silphium integrifolium		X	X
Silphium terebinthinaceum		X	
Smilax sp.	X		
# Solanum sp.			X
Solidago altissima		X	
Solidago nemoralis			X
Solidago rigida		X	
Solidago ulmifolia	X	X	X
Sorghastrum nutans	X	X	X
Specularia perfoliata		X	
Sporobolus clandestinus	X		
Sporobolus heterolepis	X	X	
Sporobolus vaginiflorus			X
Taenidia integerrima	X		
# Taraxacum officinale		X	
Tilia americana		X	
Tradescantia ohiensis	X	X	X
Tradescantia virginiana	X	X	
# Tragopogon pratensis		X	X
* Trichostema dichotomum		X	X
# Tridens flava	X	X	
# Trifolium repens	X		X
Ulmus americana			X
# Verbascum thapsus	X		X
Veronica sp.			X
Verbena stricta		X	X
Vitis riparia	X	X	X

* = on *"Preliminary list of endangered and threatened vascular plants of Indiana"* (2)
\# = Non-native Species

and west facing bluffs along major Illinois streams particularly along the Mississippi River (9). The major difference between these prairies and the Indiana gravel hill prairies is their soil, which is composed of loess, a windblown accumulation of silt with subordinate clay and minor amounts of fine sand. However, the vegetation of these prairies appears to be similar to the Indiana gravel hill prairies. Characteristic species of Illinois loess hill prairies are *Bouteloua curtipendula, Psoralea tenuiflora, Petalostemum candidum, Linum sulcatum* and *Lithospermum incisum*. Common species included: *Andropogon scoparius, A. geradri, Aster oblongifolius, Cassia fasciculata, Erigeron strigosus, Euphorbia corollata, Eupatorium altissimum, Lespedesza capitata, Linum sulcatum, Lithospermum incisum, Petalostemum purpureum, Psoralea tenuiflora, Ruellia humilis* and *Sorghastrum nutans* (9). All of the aforementioned species with the exception of *Psoralea tenuiflora, Petalostemum candidum,* and *Linum sulcatum* are found on Indiana gravel hill prairies.

In Wisconsin, a similar type of hill prairie occurs on steep southwest facing slopes on thin soil over limestock bedrock (7). A number of prairie species reported from

these areas also occur on the Indiana gravel hill prairies, including: *Amorpha canescens, Andropogon gerardi, A. scoparius, Aster oblongifolius, Bouteloua curtipendula, Comandra umbellata, Coreopsis palmata, Euphorbia corollata, Kuhnia eupatorioides, Lithospermum incisum, Muhlenbergia cuspidata, Sporobulus* sp., and *Stipa spartea.* Curtis lists 47 prevalent species of dry prairie, 33% of which also occur on Indiana's gravel hill prairies (7).

In Missouri, loess hill prairies, also known as "Till Slope Hill Prairies" (19) have species such as *Muhlenbergia cuspidata, Bouteloua curtipendula,* and *Andropogon scoparius,* and typical prairie forbs such as *Lespedeza capitata, Lithospermum canescens, L. incisum,* and *Monarda fistulosa.*

Two types of hill prairie are reported from Iowa (16). One is a hill prairie on steep southwest facing slope with limestone ledges and rubble present. Dominant grasses are *Bouteloua curtipendula, Sorghastrum nutans,* and *Andropogon scoparius.* Forbs include *Aster oblongifolius, Anemone patens, Castilleja sessiliflora, Lithospermum incisum, Coreopsis palmata, Liatris aspera,* and *Amorpha canescens.* The other prairie type is the loess hill type in extreme western Iowa that is apparently similar to the Missouri loess hill prairie.

Summary

The gravel hill prairies in Indiana provide habitat for prairie species typical of tall grass prairie such as big bluestem, Indian grass, tall coreopsis (*Coreopsis tripteris*), bush clover, (*Lespedeza capitata*), switchgrass (*Panicum virgatum*), and flowering spurge (*Euphorbia corollata*). More noteworthy though is the occurrence of a number of rare species of plants at or very near the limit of their eastern range that are more typical of prairie further west. Upon examining the general distribution of these plants one discovers they are very rare in Indiana (2), and become common to abundant in Illinois (13, 17), Missouri (6) and farther west (3).

The Tippecanoe County gravel hill prairies and their associated rare flora represent a unique part of Indiana's natural heritage. One of the remaining gravel hill prairies is a dedicated State Nature Preserve, one is owned by The Nature Conservancy and negotiations are underway to protect the third prairie. Plans are also being drawn up to monitor the rare plant species and determine how to best manage these areas. To date, encroaching brush has been cut back and studies have started on several plant species. Future plans call for prescribed burns to stimulate growth of prairie species and to control woody brush encroachment.

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