

## Natural Barrens and Post Oak Flatwoods in Posey and Spencer Counties, Indiana

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### Introduction

Post oak flatwoods are xeric forested communities that are dominated by *Quercus stellata* with a relatively open canopy that allows a great deal of dispersed light to reach the forest floor. This forested community lacks the typical shrub-layer found in more mesic forested communities and appears "savanna-like". Characteristically, post oak flatwoods in Indiana are found on poorly drained nearly level soils of alluvial lacustrine terraces of the Ohio River and other major streams in the unglaciated region of the Wabash Lowland Physiographic Province (12). The understory is dominated by sedges and the content of organic matter in the soil appears to be very low. The barrens described herein are relatively small natural openings surrounded by post oak flatwoods where a fragipan is at or very near the surface. The vegetation in these barrens is not dominated by prairie grasses and forbs, but is closely related to the vegetation of sandstone glades described for Illinois (21) and Missouri (18).

Contemporary southern "flatwoods" of the Illinois Tillplain dominated by sweetgum (*Liquidambar styraciflua*), beech (*Fagus grandifolia*) and red maple (*Acer rubrum*) in southwestern Ohio (4) and southeastern Indiana have been described in detail (9,13,15,17). Indiana "barrens" dominated by prairie forbs and grasses (7) have been discovered recently and discussed (3,10). Flatwoods dominated by post oak have received limited attention in Illinois (16) where they have been referred to as "southern flatwoods" (21) and very little has been written about the Indiana post oak flatwoods. The barrens associated with post oak flatwoods have not been previously described for Indiana (8) or to our knowledge, elsewhere. The best remaining examples of these types of natural communities in Indiana are of state, and possibly regional, significance and have an interesting flora that includes many species that are considered rare, threatened or endangered (1,2). A species list is presented for the post oak flatwoods and barrens communities with some additional information regarding some very rare floristic elements, including two native vascular plant species, *Isoetes melanopoda* and *Trichostema setaceum*, that are new to the Indiana flora.

### Methods

A systematic search for post oak flatwoods and associated barrens of high natural quality was made in Spencer and Posey Counties from April to October, 1983. Some preliminary field work was conducted from 1980 to 1982. Initially, aerial photo base maps for Spencer (22) and Posey (14) Counties were examined in conjunction with 7.5' United States Geological Survey topographic quadrangle maps and 1940 aerial photos to identify potential post oak flatwoods and barrens. These areas were then flown in a helicopter at an altitude of 300 to 1000 feet, and the potential sites were examined to determine the presence of barrens and/or extensive stands of post oak, as well as obvious signs of disturbance.

Subsequently, sites were field checked to evaluate their natural quality. Those that were determined to have high enough natural quality to warrant preservation efforts were visited every six to eight weeks to compile vascular plant species lists. Common and easily identified species were recorded but not collected, whereas species that are

rare in Indiana or that were difficult to identify were collected to document their occurrence. Voucher specimens of these will be deposited in the Deam Herbarium of Indiana University—Bloomington. The nomenclature follows Gleason and Cronquist (5) except where noted otherwise.

### Plant Communities

With some exceptions, Spencer County consisted mostly of dry to dry mesic upland forest before it was settled by European man (6). In the Bloomfield (Grass)-Chrisney-Gentryville areas near Little Pigeon Creek shrubby black-jack oak thickets and small brushy barrens were present (19). In the early 1800's, land surveyors made many references to "barrens" and "flats" in sections within T6S R6W. Some noteworthy examples include: "briery, brushy flats with black-jack oak" in section 1, "hazel thickets-no timber" between sections 12 and 13, and one-half of the area traversed between sections 10 and 11 and sections 1 and 2 were described as "barrens" or "brushy barrens". Also in section 24 T5S R6W a surveyor noted, "briery, brushy, barrens" and "¼ post . . . in burnt land-no live timber for bearings." In sections thirty-two and thirty-three, which includes our study areas, no mention of post oak was made by the surveyors. Either they referred to it as "scrub-oak" or mistook it for some other species.

Some of this area became Classified Forest Land in the late 1920's and was visited by Indiana botanist Charles C. Deam, the State Forester at the time. From plant collection label data on herbarium sheets it is possible to discern that many early well known Indiana botanists visited the flats north of Grass. In 1929, Deam first collected rush-foil (*Crotonopsis elliptica*—84428 IND) in a "low flat post oak—pin oak woods" and Ray C. Friesner (s.n. BUT) and John Potzger (240472 ND) collected the same species here on September 3, 1937. Deam revisited the area on September 4, 1939, collected *Hypericum denticulatum* (81515 IND), and apparently was accompanied by Ralph Kriebel (*C. elliptica* 12255 PUL), Scott McCoy (*C. elliptica*) and Rolland and P. Tryon (*C. elliptica* 54052 DPU). Unfortunately, none of these botanists provided a detailed written description of the flora or plant communities of this unique area.

Presently, the two areas that are considered to be of State significance in Spencer County are within three miles north of Bloomfield, Grass Township. Only one of these sites has barrens. It is approximately 200 acres in area and has three barrens within it ranging from one-half to five acres. The other site is approximately 150 acres in area. All of the Spencer County post oak flatwoods and barrens, both disturbed and undisturbed, are associated with the McGary silt loam soil type, which has a fragipan.

The overstory in the Spencer County post oak flatwoods are composed of almost pure stands of similar sized post oak (*Quercus stellata* four to fourteen inches dbh and approximately 30 feet high. These are relatively widely spaced and form an open canopy. White oak (*Q. alba*) and shellbark hickory (*Carya laciniosa* and *C. ovata*) are seen occasionally, but none larger than 18 inches dbh was observed. Pin oak (*Q. palustris*) is not encountered in the pure post oak stands but is found in a couple of shallow intermittently ponded sites one to three acres in area where it is abundant; this is where sweetgum (*Liquidambar styraciflua*) is also seen. Cherry-bark oak (*Q. falcata* var. *pagodaefolia*) is rarely encountered and only one black-jack oak (*Q. marilandica*) was ever seen. Shingle oak (*Q. imbricaria*) occurs throughout the flatwoods but seldom reaches 15 feet in height.

The flatwoods characteristically lack a distinct shrub-layer, although some shrubs are present. The most frequently seen shrubs are winged elm (*Ulmus alata*), shining sumac (*Rhus copallina*) and shrubby St. John's wort (*Hypericum prolificum*), which

never gets more than five feet high. Although red cedar (*Juniperus virginiana*) was very conspicuous, fewer than 15 individuals were seen.

The herbaceous layer is sparse and usually lacks a thick leaf litter. Three species of sedges (*Carex caroliniana*, *Eleocharis verrucosa* and *Luzula acuminata* var. *mesochorea*) are characteristic of the herb layer in the flatwoods. Characteristic forbs include *Gillenia stipulacea*, *Phlox maculata* and *Pycnanthemum flexuosum* and the most common grasses are *Cinna arundinacea* and *Uniola latifolia*. In areas where the wind-swept post oak leaves accumulate, which is mostly around fallen trees and small clumps of shrubs, the slowly decaying leaf litter is thick with little or no herbaceous growth.

False aloe (*Agave virginica*) was very rare in the flatwoods and did not occur at all in the barrens. *Carex bushii*, a state endangered sedge, occurred infrequently throughout the flatwoods and was associated with *C. caroliniana*. The state threatened spiderlily (*Hymenocallis occidentalis*) occurred just beyond, and in terms of elevation—just below, the pure stands of post oak in shallow drainageways.

The barrens are floristic areas that exemplify some unusual characteristics for an Indiana plant community. In spring, some of the barrens have shallow, ombrotrophic (rain fed) vernal pools that persist long enough to have an assemblage of characteristic plants (Figure 1). The elevation gently decreases as one enters the surrounding flatwoods from the barrens. Although the barrens occupy the highest elevational point they are covered with ponded water in late winter and early spring and in fact, one of the barrens is depicted as a "pond" on the Chrisney topographic quadrangle map. In early spring, a moss (*Dichranium scoparium*) grows in dense lush mats around the perimeter of the barrens and may somehow account for the ponding of the water.



FIGURE 1. Oblique aerial photo of a Spencer County barren covered with water in April, 1983. The surrounding open forest consists of pure stands of post oak (*Quercus stellata*).

By May, a 12 inch high spike rush (*Eleocharis verrucosa*) forms extensive almost pure stands in the barrens. *Carex annectens* is also a characteristic species at this time. In one barren in a slightly shallower basin 10 to 20 square yards in area where the water was 3 to 6 inches deep, three state endangered species were discovered. They are *Eleocharis wolfii*, which was common to abundant, the small crowfoot (*Ranunculus pusillus*), which was common, and at least 50 individuals of the quillwort (*Isoetes melanopoda*), previously unreported for Indiana. All three of these rare species were growing together in association with *C. annectens* and *Ludwigia palustris*.

By July, most of the above plants have completely withered and poverty grass (*Danthonia spicata*) and little bluestem (*Andropogon scoparius*) are the characteristic graminoid plants (Figure 2). Small annuals, that are often found on sandstone glades



FIGURE 2. *Spencer County barren dominated by poverty grass (Danthonia spicata) in July, 1983.*

in southern Illinois and Missouri, such as *Diodea teres*, *Hypericum drummondii*, *H. gentianoides*, and the state endangered rushfoil (*Crotonopsis elliptica*) are abundant. These species persist throughout the remainder of the summer and early fall. By early October the species composition has not changed much, although at this time a three awn grass (*Aristida ramosissima*) was first mature enough to identify; as was the small bluecurls (*Trichostema setaceum*) which previously has not been reported for Indiana. At least 100 individuals of the state endangered St. John's wort (*Hypericum denticulatum*) were seen along the perimeter of the barrens immediately adjacent to the post oak flatwoods.

Although post oak flatwoods in Posey County were not identified as such by the land surveyors in the early 1800's (19), their description of the local landscape as generally "thin soil, flatland, oak and hickory" might indicate the presence of the community. In the 1920's Charles Deam collected plants from the area in a habitat described as "low, open post oak flats . . .". Presently post oak flatwoods are restricted



FIGURE 3. *Oblique arboreal photo taken in August, 1983 depicting the open spacing of the trees in a Posey County post oak flatwoods.*

in Posey County to Point Township, where three significant sites are known. They are almost exclusively associated with Weinbach silt loam, an acid alluvium on old terraces of the Wabash and Ohio Rivers (14). The communities consist of small, level areas (5 to 10 acres) dominated by *Quercus stellata* and an herbaceous flora characterized by a number of prairie species. These communities are noticeably different from surrounding ones not on Weinbach soils, for their open and relatively sunny environment (Figure 3) contrasts with adjacent sites that are densely vegetated with shrubs, vines, and an assortment of tree species. The absence of lower and mid-canopy woody species and the thick, widely spaced branches of the post oak contribute to the open nature of the community. The post oak are not large, averaging fifteen inches dbh. One tree ten inches dbh was cored and determined to be approximately sixty-five years old.

Although the sites rarely flood from overflow of streams, they do collect one to three inches of standing water in winter and spring, due primarily to the presence of a fragipan and the lack of drainage. The almost pure stands of post oak are found on slightly elevated land above the standing water. On the wetter sites, *Quercus falcata* var. *pagodaefolia*, *Q. bicolor*, *Q. palustris*, and *Carya laciniosa* are more important.

The communities are floristically unique in Indiana. This is due primarily to the occurrence of prairie species growing with southern bottomland species. Some of the characteristic prairie and dry woodland plants found include *Carex caroliniana*, *C. Bushii*, *Baptisia leucantha*, *Psoralea psoralioides*, *Solidago rigida*, *Coreopsis tripteris*, *Helianthus mollis*, *Liatris spicata*, *Phlox pilosa*, *Euphorbia corollata*, *Eryngium yuccifolium*, *Physostegia virginiana*, *Agave virginica*, and *Gillenia stipulata*. In the scattered wet depressions additional species are found, including *Carex muskingumensis*, *C. squarrosa*, *C. Buxbaumii*, *C. socialis*, *Cinna arundinacea*, *Hymenocallis occidentalis*, *Amorpha fruticosa*, *Ilex decidua*, *Boltonia asteroides*, *Platanthera peromoena*, *Isoetes melanopoda*, *Spermacoce glabra*, and *Spigelia marilandica*.

### Results and Discussion

A total of 22 potentially significant post oak flatwoods and barrens were field checked and evaluated. The five most significant sites were selected for intensive field surveys. A total of 146 taxa representing 57 families were identified (Table 1). Of particular note are the eleven rare, threatened or endangered species that were discovered; two of which are new to the Indiana flora. The number of non-native species, which included *Achillea millefolium* and *Lonicera japonica*, was low. These aliens were rarely encountered, but since they are not a part of the native flora in these natural communities, they should be exterminated.

Many of the flatwoods that we checked had been intensively timbered and a number of others have been cleared within the past 10 to 20 years for agriculture. Most notably, these include the Halfmoon Pond Woods discussed by Lindsey et al. (11), Grabert's Woods which was a collection site of Deam's and the famous Scuffle Pond (Nolta Irwin Woods). The Irwin Woods was unfortunately destroyed in 1979. It was visited by botanists attending the 1939 Indiana Academy of Sciences Spring Meeting at New Harmony (20) and contained many rare plants.

The use of the term "barrens" to describe the natural openings surrounded by post oak flatwoods in Spencer County appears to be the best word to describe this community. Both the early land surveyors and former Indiana botanists applied this term to these forest openings. Also in light of Hutchison's (7) excellent, well documented review of the past and present use and meaning of "barrens", it is appropriately used here. It still must be emphasized that the Spencer County barrens vegetation is distinct from the barrens described elsewhere that are dominated by prairie vegetation.

It does appear that fire did play a role, and perhaps still should, in the maintenance of these communities. Both the early land surveyors and Deam in his May 1, 1927 "Woodland Inspection Report" of a tract within S32 T5S R6W made reference to burnt over flats and barrens. Only a few trees with fire scars were noted during this study. The suppression of fires may account for the apparent disappearance of buffalo clover. The absence of fires may also account for the low density of some prairie plants that were seen in Posey County. Since very few "typical" prairie species were found in Spencer County it is difficult to speculate what impact fire cessation has had here.

A few intriguing rare, or otherwise noteworthy, plants were reported historically by Deam in the immediate vicinity of the areas we studied but were not rediscovered by us. *Lesquerella globosa* was found in 1941 at its only "natural" site outside of the Nashville Basin. Although *Hypericum denticulatum* was rediscovered in Spencer County it was not found in Posey County. *Perideridia americana* was found in 1929, as a single plant, in the Spencer County flats north of Grass. In 1939, in the same area, *Baptisia leucantha* and *Prenanthes aspera* were found associated with *Liatris aspera* and *Hypericum denticulatum*. These latter two species were rediscovered in one of the Spencer County barrens north of Bloomfield. It is difficult to believe that we overlooked the conspicuous *B. leucantha* and *P. aspera*, so perhaps they have become locally extirpated. Unfortunately, it also appears that buffalo clover (*Trifolium reflexum* var. *glabrum*) may be extirpated in Indiana. Although it is presently listed as threatened, it has not been reported in the past 50 years. Historically, this species was collected in post oak flatwoods in Posey and Spencer Counties, but we were unsuccessful in our specific attempts to rediscover it. Its disappearance is baffling, particularly since its habitat and historic collection site is still extant and relatively undisturbed. Apparently this species has not fared well throughout most of its range. It is extirpated in Ohio

TABLE 1. *Vascular Flora of Post Oak Flatwoods and Barrens*

Taxa	Spencer County	Posey County
Amaryllidaceae		
<i>Hymenocallis occidentalis</i>	x	x
<i>Hypoxis hirsuta</i>		x
Anacardiaceae		
<i>Rhus copallina</i>	x	
<i>Rhus radicans</i>	x	x
Apocynaceae		
<i>Amsonia tabernaemontana</i>		x
Aquifoliaceae		
<i>Ilex decidua</i>		x
Asclepiadaceae		
<i>Asclepias purpurea</i>		x
Asteraceae		
<i>Achillea millefolium</i>	x	
<i>Antennaria plantaginifolia</i>		x
<i>Bidens</i> sp.	x	
<i>Boltonia asteroides</i>		x
<i>Coreopsis tripteris</i>		x
<i>Cryptotaenia canadensis</i>	x	
<i>Eupatorium perfoliatum</i>	x	
<i>Eupatorium purpureum</i>	x	
<i>Helianthus divaricatus</i>	x	x
<i>Helianthus mollis</i>		x
<i>Hieracium gronovii</i>	x	x
<i>Krigia biflora</i>	x	x
<i>Liatris aspera</i>	x	
<i>Liatris spicata</i>		x
<i>Polymnia canadensis</i>		x
<i>Silphium integrifolium</i>	x	
<i>Solidago nemoralis</i>	x	
<i>Solidago rigida</i>		x
<i>Verbesina helianthoides</i>		x
Araceae		
<i>Arisaema dracontium</i>	x	x
Balsaminaceae		
<i>Impatiens biflora</i>		x
Bignoniaceae		
<i>Campsis radicans</i>	x	x
<i>Catalpa speciosa</i>		x
Boraginaceae		
<i>Cynoglossum virginianum</i>		x
Campanulaceae		
<i>Lobelia inflata</i>		x
Caprifoliaceae		
<i>Lonicera japonica</i>	x	x
<i>Symphoricarpos orbiculatus</i>	x	x
<i>Viburnum dentatum</i>		x
<i>Viburnum prunifolium</i>		x
Celastraceae		
<i>Euonymus atropurpureus</i>		x
Cistaceae		
<i>Lechea tenuifolia</i>	x	
Cornaceae		
<i>Cornus florida</i>	x	
<i>Nyssa sylvatica</i>		x
Commelinaceae		
<i>Tradescantia subaspera</i>		x

TABLE 1.—Continued

Taxa	Spencer County	Posey County
Cupressaceae		
<i>Juniperus virginianus</i>	x	
Cyperaceae		
<i>Carex annectens</i>	x	x
<i>Carex bushii</i>	x	x
<i>Carex buxbaumii</i>		x
<i>Carex caroliniana</i>	x	x
<i>Carex cephalophora</i>		x
<i>Carex davisii</i>		x
<i>Carex festucacea</i>		x
<i>Carex glaucophylla</i>	x	
<i>Carex grayii</i>		x
<i>Carex lanuginosa</i>		x
<i>Carex molesta</i>		x
<i>Carex muskingumensis</i>		x
<i>Carex squarrosa</i>	x	x
<i>Eleocharis verrucosa</i>	x	x
<i>Eleocharis wolfii</i>	x	
<i>Luzula echinata</i> var. <i>mesochorea</i>	x	x
Ebenaceae		
<i>Diospyros virginiana</i>	x	x
Euphorbiaceae		
<i>Crotonopsis elliptica</i>	x	
<i>Euphorbia corollata</i>	x	x
Fabaceae		
<i>Amorpha fruticosa</i>		x
<i>Apios americana</i>	x	x
<i>Baptisia leucantha</i>		x
<i>Cassia fasciculata</i>		x
<i>Cercis canadensis</i>		x
<i>Desmodium</i> sp.	x	x
<i>Psoralea psoraliooides</i>		x
<i>Stylosanthes biflora</i>	x	
Fagaceae		
<i>Quercus alba</i>	x	
<i>Quercus bicolor</i>		x
<i>Quercus falcata</i> var. <i>pagodaefolia</i>	x	x
<i>Quercus imbricaria</i>	x	x
<i>Quercus marilandica</i>	x	
<i>Quercus palustris</i>	x	x
<i>Quercus stellata</i>	x	x
Gentianaceae		
<i>Swertia caroliniensis</i>	x	
Gramineae		
<i>Andropogon scoparius</i>	x	
<i>Andropogon virginicus</i>	x	
<i>Aristida ramosissima</i>	x	
<i>Cinna arundinacea</i>	x	x
<i>Danthonia spicata</i>	x	
<i>Hystrix patula</i>		x
<i>Panicum depauperatum</i>	x	x
<i>Sorghastrum nutans</i>		x
<i>Uniola latifolia</i>	x	x
Hamamelidaceae		
<i>Liquidambar styraciflua</i>	x	x
Hypericaceae		
<i>Hypericum denticulatum</i>	x	
<i>Hypericum drummondii</i>	x	
<i>Hypericum gentianoides</i>	x	

TABLE 1.—Continued

Taxa	Spencer County	Posey County
<i>Hypericum prolificum</i>	x	
Iridaceae		
<i>Iris virginica</i>		x
Isoetaceae		
<i>Isoetes melanopoda</i>	x	x
Juglandaceae		
<i>Carya laciniosa</i>	x	x
<i>Carya ovata</i>	x	x
Juncaceae		
<i>Juncus tenuis</i>	x	x
Labiatae		
<i>Physostegia virginiana</i>		x
<i>Prunella vulgaris</i>	x	
<i>Pycnanthemum flexosum</i>	x	x
<i>Scutellaria leonardi</i>	x	x
<i>Scutellaria parvula</i>		x
<i>Trichostema setaceum</i> Houtt.	x	
Lauraceae		
<i>Sassafras albidum</i>		x
Liliaceae		
<i>Allium canadense</i>		x
<i>Polygonatum canaliculatum</i>	x	x
Linaceae		
<i>Linum medium</i> var. <i>texanum</i>	x	
Loganiaceae		
<i>Spigelia marilandica</i>		x
Moraceae		
<i>Maclura pomifera</i>	x	
Oleaceae		
<i>Fraxinus pennsylvanica</i>		x
Onagraceae		
<i>Circaea quadrisulcata</i>		x
<i>Ludwigia alternifolia</i>		x
<i>Ludwigia palustris</i>	x	
<i>Oenothera tetragona</i>	x	x
Orchidaceae		
<i>Platanthera peramoena</i>		x
Oxalidaceae		
<i>Oxalis stricta</i>	x	
Polemoniaceae		
<i>Phlox glaberrima</i>	x	x
<i>Phlox maculata</i>	x	x
<i>Phlox pilosa</i>		x
Polygalaceae		
<i>Polygala sanguinea</i>	x	
Primulaceae		
<i>Lysimachia lanceolata</i>	x	x
<i>Lysimachia nummularia</i>		x
Ranunculaceae		
<i>Ranunculus pusillus</i>	x	
Rhamnaceae		
<i>Ceanothus americanus</i>		x
Rosaceae		
<i>Amelanchier</i> sp.	x	
<i>Crataegus</i> sp.	x	x
<i>Potentilla simplex</i>	x	x
<i>Prunus serotina</i>	x	
<i>Rosa caroliniana</i>	x	x

TABLE 1.—Continued

Taxa	Spencer County	Posey County
<i>Rubus</i> sp.	x	x
Rubiaceae		
<i>Spermacoce glabra</i>		x
Saxifragaceae		
<i>Heuchera americana</i>	x	
Scrophulariaceae		
<i>Gerardia</i> sp.	x	
<i>Gratiola neglecta</i>	x	x
<i>Penstemon digitalis</i>	x	x
Ulmaceae		
<i>Ulmus alata</i>	x	
<i>Ulmus americana</i>		x
Umbelliferae		
<i>Cryptotaenia canadensis</i>		x
<i>Eryngium yuccifolium</i>		x
<i>Thaspium trifoliatum</i>		x
Rubiaceae		
<i>Cynoglossum virginianum</i>	x	
<i>Galium concinnum</i>		x
<i>Houstonia purpurea</i>		x
Vitaceae		
<i>Parthenocissus quinquefolia</i>	x	x
<i>Vitis</i> sp.	x	x
Violaceae		
<i>Viola sagittata</i>	x	x
<i>Viola triloba</i>		x
Urticaceae		
<i>Boehmeria cylindrica</i>		x

and New York and probably Kentucky, Iowa, and South Dakota. Only one extant site is known from Illinois where historically it occurred in 19 counties.

None of the post oak flatwoods and barrens are presently protected as state natural areas. However, efforts towards their protection are being taken through direct acquisition from willing sellers by the Department of Natural Resources' Division of Nature Preserves and The Nature Conservancy. Some owners have also agreed to protect their post oak flatwoods voluntarily through the Indiana Natural Areas Registry. Continued efforts to protect these unique elements of Indiana's natural heritage should be supported by the public and private sectors to insure their existence in perpetuity.

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