An Ecological Inventory of Bryan Nature Preserve

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Abstract

Bryan Nature Preserve, one of the natural areas protected under the Indiana Nature Preserve Act, is a 29-acre, old-growth, oak-hickory, beech-maple forest located in Clinton County. The habitat is variable, ranging from wet to dry sites and from old-growth forest to old field.

Flora and fauna of the preserve are quite diverse including 200 species of plants, 74 species of birds during spring and fall migrations with 22 species present year-round, 5 species of amphibians, 4 species of reptiles, and 17 species of mammals.

The dominant overstory species are *Quercus alba*, *Q. rubra* and *Carya ovata*. However, the sapling-sized understory is dominated by *Acer saccharum* and moderate numbers of *Fagus grandifolia*. In the absence of disturbance these two species will probably replace the present overstory dominants.

Introduction

Bryan Nature Preserve is a 29-acre, relatively undisturbed, old-growth, deciduous forest located 8 miles northwest of Frankfort, Indiana, in Clinton County. Twenty-seven of the 29 acres are forested, with the remainder in early successional old fields. A few remaining stumps are evidence of past selective logging conducted more than 30 years ago.

Bryan Nature Preserve occurs on the Tipton Till Plain or Central Drift Plain formed during the Wisconsin Glacial Era 10,000 to 12,000 years ago (6). The till plain is composed of approximately 100 to 130 feet of glacial till over sandstone and shale bedrock in Clinton County. Wet depressional areas are common throughout the relatively level (<10 feet elevation change) plain. Surface drainage is poorly developed on the Tipton Till Plain and none occurs from Bryan Nature Preserve.

The two soil types present in Bryan Nature Preserve are Ragsdale silty clay loam and Fincastle silt loam. The Fincastle is a somewhat poorly-drained soil developed from loess (wind-blown silt) over glacial till and comprises the upland, better-drained soil in the forest. The Ragsdale is a very poorly-drained soil developed from loess and frequently supports a suspended water table.

Previous studies of Bryan Nature Preserve have been limited to small sample areas (1, 3). The greater importance of oak and hickory tree species compared to beech and maple was pointed out in these studies. Fifty-nine forb species were recorded as present by Jones (3). Other flora and fauna species have not been studied.

The main objective of our study of Bryan Nature Preserve was to obtain baseline data of plant species composition (herbaceous and woody understory and overstory) and animal species of the area. These data will be used as a means of comparison for studying man's

effect on the area over time, as well as background information for future research in the preserve.

Methods

The forest was divided into 0.1-hectare (0.246-acre) quadrats (100 x 107 feet) and permanently marked with steel pipe and aluminum tags. Quadrats were numbered consecutively, starting in the northwest corner of the preserve.

Boundaries and total acreage of standing water in the three large depressional areas were determined for each season during 1972. Delineation of the different soil types was provided by the Soil Conservation Service, United States Department of Agriculture.

Composition of woody vegetation in Bryan was determined by a total inventory of the mature trees (>4.9 inches diameter breast high) and a partial sampling of shrubs and saplings (>4.5 feet in height but <4.9 inches dbh). Data for each mature tree were recorded on Fortran coding paper as follows: Date, quadrat, tree number, species, dbh (diameter breast high—determined by diameter tape), crown condition, and presence of forks, vines, and dens. Dominant, codominant, suppressed, and understory comprised the crown classes. The presence of forks and dens was recorded as either above or below breast height (4.5 feet), and vines were divided into above 1-inch diameter and below 1-inch diameter classes. The presence of dead trees and cut stumps in each quadrat was also recorded.

These data were used to compute basal area and density by species for each quadrat and for the entire forested area (4). The sum of relative basal area and relative density divided by 2 gave an importance value by species. The density of shrub and tree saplings was determined using strip quadrats of 3.28 feet (1 m) by 100 feet (30.4 m) located on the west boundary of each large quadrat.

Specimens of herbaceous plant species were collected at the time of flowering and recorded by community type. Gray's Manual of Botany was used in identification of the plants (2).

Throughout the study (January 1972-September 1972), general observations were made of the forest fauna. Visits were made to the woods at least once a week and usually more often. Mammals sighted and mammal signs were recorded each time, thus giving a reasonable indication of those mammals present during the year. Bird species were observed throughout the period with special attention given to the year-round resident birds, migrating spring and fall birds, summer residents, and the raptors seen flying over the woods. Birds were identified through actual sightings as well as by song. Amphibians and reptiles observed were also identified and recorded.

Results

Standing Water

The area inundated during February 1972, was 1.1 acres (Fig. 1). This area increased to 3.3 acres by April due to snowmelt and spring

rains. Numerous other very small depressional areas were inundated but are not included in the above estimates. The two depressional areas located in the northwestern and southwestern corners of the preserve were dry by mid-July. The large depressional area was dry by August 25 but remained so only until September 7.

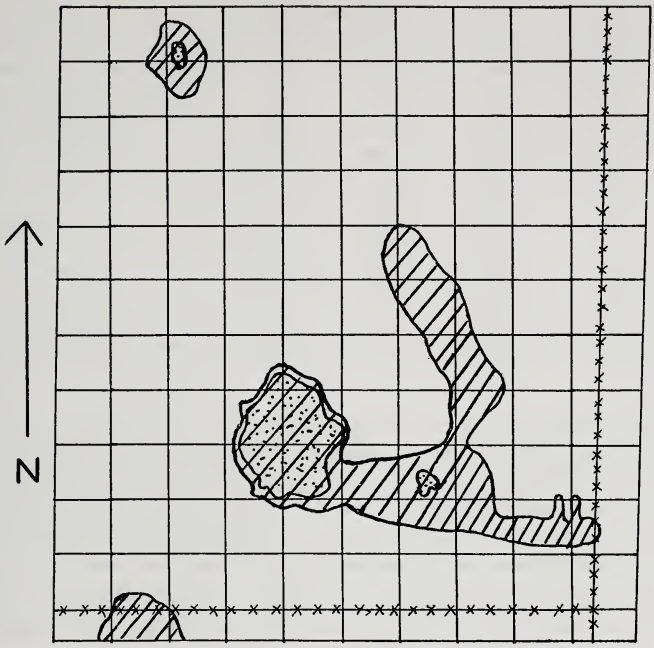

FIGURE 1. *Standing water in Bryan Nature Preserve during February (stippled) and April (hatched) of 1972. One grid square represents 1/10 hectare except for the odd-sized ones along the fence line (x-marked) and along the west boundary.*

Distributional patterns of plant species correspond very closely to the area inundated during April. This probably indicates that the area inundated in the spring of 1972 is approximately the maximum that occurs during any given year.

Plant Communities

There are three major plant community types in the preserve (Table 1). These correspond to edaphic factors or to past disturbance. The forest mesic and forest wet communities correspond to the areas free of inundation and the areas inundated during part of the year, respectively (Fig. 1). The open field community type corresponds to a recently cultivated area located along the eastern edge from the fence to the east boundary.

Other less extensive community types also occur. The wet depressional area in the southwestern corner is more open and more recently disturbed than the other wet areas. It is characterized by water-plantain

(*Alisma triviale*) and common cattail (*Typha latifolia*). The western part of the east central wet area is surrounded by wet-site tree species such as pin oak (*Quercus palustris*) and swamp-white oak (*Quercus bicolor*). However, the deeper portion contains water much of the year and is dominated by the high shrub, buttonbush (*Cephalanthus occidentalis*).

TABLE 1. *Number of plant species and families identified according to habitat type.*

Vegetation Type	Number of Species		
	Forest Mesic	Forest Wet	Old-field
Herbs	76	20	68
Shrubs	14	2	?[1]
Vines	6	0	1
Trees	25	9	?[1]
Total Species	121	31	69
Total Families	55	18	25

[1] Intensive sampling of old-field communities has not been made for tree and shrub seedlings.

The greatest number of species occurs in the forest mesic community type (Table 1). Total number of species identified is four times greater in this type than in the wet community type and about twice as large as the open field type. The mesic community type, however, includes the transitional areas along the forest edge and along the water boundaries and therefore includes species from the other two types.

The number of species will probably increase as more intensive studies are made. For example, the open field has not been sampled for tree and shrub seedlings which are known to occur.

A complete listing of plant species by community type can be obtained from the Department of Forestry and Conservation, Purdue University.

Trees

White oak (*Quercus alba*) is the most important tree species found on the area (Table 2). This is due to both its abundance and large size. It is the fourth most abundant tree, with 158 stems, 68% of which are $\geqslant$20 inches dbh. White ash (*Fraxinus americana*) has the second highest importance value primarily because it is the most abundant with 366 stems. Sixty-two per cent of these are $\leqslant$10 inches dbh. Only 12 stems are $\geqslant$20 inches dbh. A large number of individuals for this species occurs along the forest edge.

Sugar maple (*Acer saccharum*) and American beech (*Fagus grandifolia*) are relatively unimportant in the overstory. However, American beech is more important than sugar maple both in total stem number and in size of stems. Sugar maple had a total of 38 stems, 10 of which are $\geqslant$20 inches dbh. American beech had a total of 78 stems with 41 $\geqslant$20 inches dbh.

TABLE 2. *Vegetational attributes[1] of Bryan Nature Preserve based on complete tally of all stems greater than 4.9 inches diameter breast high and ranked in order of decreasing importance value.*

Species	B_2	B_3	D_2	D_3	V_3
Quercus alba	31.22	24.90	6.08	7.58	16.24
Fraxinus americana	8.31	6.63	14.08	17.55	12.09
Quercus rubra	19.06	15.20	5.19	6.47	10.84
Carya ovata	11.59	9.24	10.81	13.46	11.35
Tilia americana	6.30	5.03	9.81	12.23	8.63
Quercus bicolor	9.53	7.60	2.81	3.50	5.55
Quercus palustris	9.22	7.35	1.96	2.44	4.90
Fagus grandifolia	7.01	5.59	3.00	3.74	4.67
Juglans nigra	4.41	3.52	3.00	3.74	3.63
Ulmus americana	1.57	1.25	3.96	4.94	3.10
Carya glabra	2.43	1.94	2.81	3.50	2.72
Acer rubrum	3.03	2.42	1.81	2.26	2.34
Ostrya virginiana	0.70	0.56	3.31	4.13	2.34
Carya cordiformis	1.39	1.11	1.81	2.26	1.69
Acer saccharum	1.76	1.40	1.46	1.82	1.61
Prunus serotina	0.85	0.68	2.04	2.54	1.61
Quercus macrocarpa	2.78	2.22	0.77	0.96	1.59
Remaining 16 sp.[2]	4.21	3.36	5.52	6.88	5.10
Total	125.37	100.00	80.23	100.00	100.00

[1] Total acreage covered=26.8 acres. B_2 is basal area (ft^2 per acre), B_3 is relative basal area (%), D_2 is density (stems per acre), D_3 is relative density (%) and V_3 is the importance value, or the average of B_3 and D_3 for each species.

[2] Other species in decreasing order of V_3 are as follows: *Celtis occidentalis, Liriodendron tulipifera, Sassafras albidum, Quercus velutina, Quercus muehlenbergii, Plantanus occidentalis, Ulmus rubra, Cornus florida, Quercus shumardii, Fraxinus nigra, Carpinus caroliniana, Fraxinus pennsylvanica, Gleditsia triacanthos, Gymnocladus dioicus, Acer saccharinum, Nyssa sylvatica.*

The total basal area for all species is 125.4 square feet per acre, a value which is high for Indiana forests. Total density for all species on the area is 80.2 stems per acre.

Tree Saplings

Sugar maple and white ash are the two most abundant species in the sapling size class (>4.5 feet in height and <4.9 inches dbh). The first averaged 238 stems per acre over the entire forest while the latter averaged 172 stems per acre. Sugar maple saplings were well-distributed throughout the interior, better-drained portion of the forest. White ash saplings were found largely along the forest edge. Several of the white ash saplings found in the interior were dead or dying.

American beech saplings averaged 32 stems per acre for the entire forest. These were highly clumped around large individuals and most are believed to be root sprouts.

White oak, the most important overstory tree, appears to be reproducing very poorly in this forest. This species averaged 1 sapling per acre for the whole forest, and most of its saplings were found along the edge between old field and forest.

Fauna

Five amphibian, 4 reptile and 17 mammal species have been identified in the area. These numbers are only a first approximation, however, since intensive studies have not been conducted. One unusual find was a pregnant Keen's myotis bat (*Myotis keenii*), the first to be recorded in Indiana.

At least 22 bird species reside in the preserve year-round, but a more likely estimate would be 38. A total of 74 species have been observed during spring migration. The uncommon veery (*Hylocichla fuscescens*) was sighted during spring migration and the Black-throated green warbler (*Dendroica virens*) was sighted in June, a rare occurrence this far south during the summer months.

Lists of faunal species can be obtained upon request.

Discussion

The secondary successional pattern for mesic forests of west-central Indiana is believed to proceed from oak-hickory to oak-maple to maple-oak to maple-beech to beech-maple and finally to a beech-dominated mixed-mesophytic forest (5). The high number of sugar maple saplings and moderate number of American beech saplings compared to other species indicate that, barring large-scale disturbance, the mesic community type of Bryan Nature Preserve will follow this pattern. Future change in species composition of wet sites is more difficult to predict. However, red maple is a species likely to become more abundant as pin oak and swamp white oak trees die, due to its prolific seed production and fast growth.

Acknowledgments

We would like to express our gratitude to Dr. R. E. Mumford, Dr. David A. Easterla, and Mrs. Rastrigan, Purdue University, for their help in species identification or for provision of other information which enabled us to fulfill the objectives of this study.

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