A Biotic Inventory of the Dobbs Park Natural Area

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Abstract

Dobbs Park is a 105-acre (42-hectare) tract, located at the east edge of Terre Haute, Indiana. Community types range from grass-forb to a 14-acre old-growth deciduous forest.

The old-growth is largely upland depressional, much of which is subject to periodic ponding. Dominants among the 34 tree species present are elms (*Ulmus americana, rubra,* and *thomasii*) and ashes (*Fraxinus americana* and *pennsylvanica*) at a combined importance of 33 per cent. A mesic ridge supports beech and sugar maple plus upland oaks and hickories. Total density above 4 inches dbh is 340 stems per hectare (138 per acre); total basal area is 27.5 square meters per hectare (120 square feet per acre); mean stem diameter is 26.7 centimeters (10.5 inches).

The present vascular plant list totals 263 species. The vertebrate fauna includes 16 mammal, 73 bird, 10 reptile, 8 amphibian and 7 bony fish species.

Introduction

The purpose of this study was to complete a biotic inventory of the Dobbs Park natural area. Our data will be used by the Terre Haute Board of Parks and Recreation as a guide in developing Dobbs Park into an environmental education center. Special attention was given to the ecological attributes and distribution patterns of tree species within the old-growth forest. Information obtained for the old-growth community will serve as a data base in a long-term study. Specific objectives follow:

1) Inventories of the vascular flora, vertebrate fauna, and vegetation types of the entire park
2) Full census of the old-growth forest, plus construction of a 1:33 scale map of exact tree locations.

Study Site

Dobbs Park is located on the east edge of Terre Haute in Vigo County, Indiana, at the junction of Poplar Street and State Road 46, Township 12 N, Range 8 W. The "L"-shaped tract contains 42 ha (105 acres). It is bordered on the south and east by highways and on the north and west by subdivisions and crop fields (Fig. 1).

In 1944, the land was donated to the City of Terre Haute, in the name of John G. Dobbs Memorial Grove, with the stipulation that it be used primarily as a natural area park. In 1975, the old-growth tract and adjacent forested areas totalling about 10 ha (25 acres) was designated as a State Nature Preserve.

The area was formerly a farm with parcels of land left to natural succession at various times in the past, thereby resulting in most upland seral stages. During the middle and late 1940's, the city added a 1-ha lake (2.5 acres) and several pine and a few hard-

wood plantings totalling about 12.5 ha (32 acres). Only the areas surrounding the park entrance, lake and picnic grounds are mowed (Fig. 1).

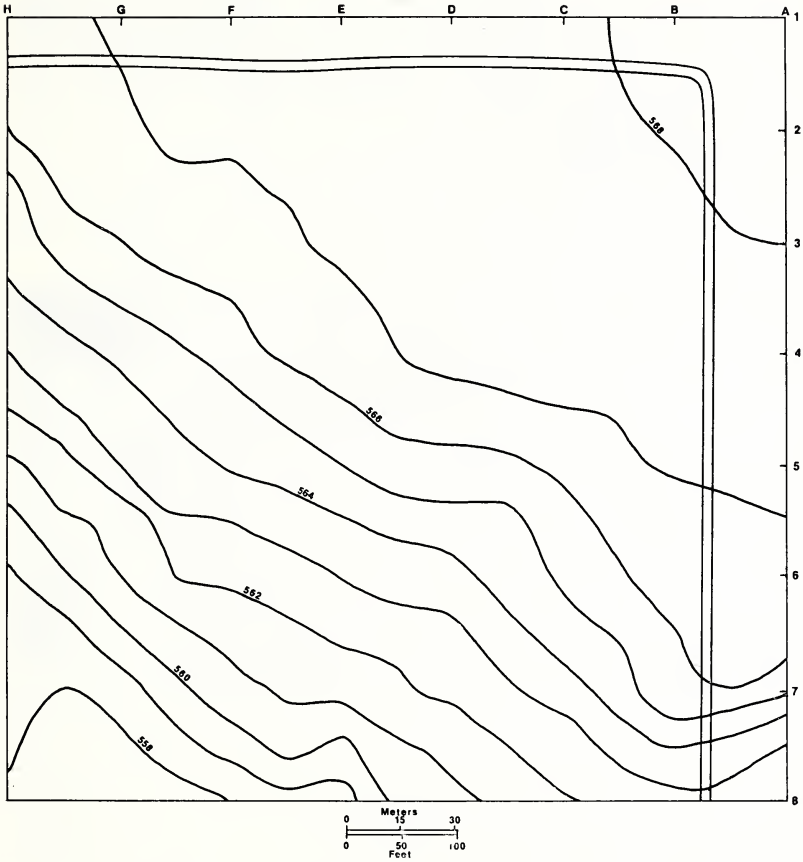

FIGURE 1. *Community types map of the Dobbs Park natural area.*

The north end of the park contains a 5.6 ha (14-acre) stand of original forest (Figs. 1 and 2). Any cutting has been minimal and a long time ago. Canopy openings were created by recent elm mortality and occasional wind-thrown trees. The only human disturbance of consequence is an abandoned bridle trail which parallels three sides of the area in about 20-30 m from the perimeter (Fig. 2). Since the trail was discontinued in 1971, tree seedlings and herbs have rapidly colonized the trail borders.

Soil parent material is Wisconsinan age loess over Illinoian age glacial till, which in turn, overlays Pennsylvanian age sandstone and shale.

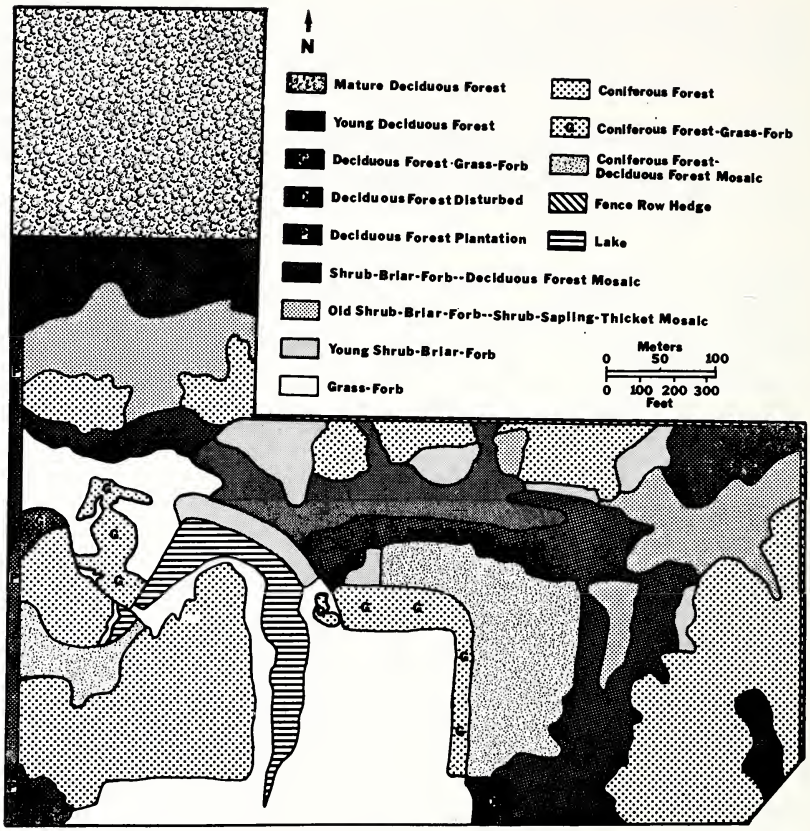

FIGURE 2. *Plot layout and relief map of the old-growth section of Dobbs Park natural area. (The shaded strip is an old bridle trail.)*

The old-growth section ranges from nearly flat to gently sloping, with a total of about 10 feet of relief (Fig. 2). Poorly-drained Reeseville silt loam (I Profile) predominates. Most of the flatter areas are seasonally ponded, sometimes for 2-3 months.

Successional areas (Fig. 1) have greater relief and more rapid drainage, although overflow and ponding occur locally. Soil types range from Wakeland (II Profile) in the poorly-drained bottom lands to Muren (III), Alford (IV), and Cincinnati (IV) on better-drained upland sites.

Methods

A vegetation map was constructed by delimiting community boundaries on a 1:600 scale aerial photograph flown in 1967. Extensive field reconnaissance and vegetation sampling was required to adjust community boundaries which had changed since 1967. Mapping units were based on physiographic separation, physiognomy of vegetation, floristic composition and seral development. Although the successional

stages blend and approach a continuum, units which differ sufficiently in composition from other such units to be recognized consistently were mapped as separate vegetation types.

Vegetation composition of seral communities was evaluated by the stratum rank method of Lindsey *et al.* (5). Floral collections were made at 3-week intervals or more often. Species new to Vigo County were listed by Jackson *et al.* (4). A faunal list was compiled by sightings or presence definitely established by sign. Fish species within the lake were determined from catches by fishermen during the summers of 1974 and 1975.

Species nomenclature follows Fernald (3) for non-arborescent vascular plants; Little (8) for trees; Lyon (9) for mammals; Peterson (10) for birds; Conant (1) for reptiles and amphibians; and Eddy (2) for bony fishes.

Analysis of the old-growth forest involved the least disturbed section (largely inside of the old bridle trail) totalling 3.6 ha (9 acres) (Fig. 2). Mapping of tree locations was facilitated by gridding the area into 36 0.1-ha plots, each 31.6 m^2; these, in turn, were divided east-west into half plots. A 50-meter tape along the south or north side of each half plot served as the base line, from which the distance to each tree was measured by a 15-m retractible loggers tape. A Suunto sighting compass served to establish perpendicular distances from the base line to the trees being plotted. Locations of all trees over 10 cm dbh (diameter breast height) were mapped; seedling positions of American beech (*Fagus grandifolia* Ehrh.) and sugar maple (*Acer saccharum* Marsh.) were also plotted.

Construction of the 1:33 scale map was accomplished by an IBM Model 180 computer. Field data entered into the program was computer plotted within scaled study plot circles corresponding to the scaled dbh at coordinates entered for each tree. For tree identification, the plotter over-printed within each circle the tree species and true dbh. Copies of the computer program are available upon request from the authors.

Results

Plant Communities

Eighteen community types were mapped as 40 mapping units. Figure 1 depicts the major types, but not all individual mapping units.

Four major community types, totalling 25.6 ha (65 acres), have closed or nearly-closed canopies: mature deciduous forest, young deciduous forest, coniferous forest plantations and deciduous forest plantations. The seven units of young deciduous forest total approximately 6.5 ha (16 acres) and contain mostly species that are found within the mature deciduous forest, thereby acting as second growth extensions of the old-growth.

Twelve units of coniferous forest plantations total 12.5 ha (32 acres). These 30-year-old plantings contain varying combinations of red (*Pinus resinosa*), white (*P. strobus*), Scotch (*P. sylvestris*), and Virginia (*P. virginiana*) pines. Many of the plantations contain dead

or dying conifers being shaded out by taller deciduous species, but some natural reproduction also occurs.

Two small deciduous plantations totalling about 1 ha (2.5 acres) contain pure stands of tulip tree (*Liriodendron tulipifera*).

Non-canopied areas of low grass-forb, old field (shrub-briar-forb), and shrub-sapling thicket collectively comprise about 12 ha (30 acres). The grass-forb community is a mixture of short grasses and herbs, held in an early successional stage by mowing. Old field vegetation is a mixture of herbaceous perennials with young shrubs, briars, and tree seedlings. Old field becomes shrub-sapling thicket as development time increases and shrubs and saplings reach 60 per cent or more of the total ground cover.

Table 1 summarizes the stratum rank data of the primary community types. Comprehensive stratum rank data by species for each unit of each community type are available from the authors upon request.

Floral and Faunal Surveys

To date, the floral inventory totals 263 species of vascular plants representing 169 genera and 78 families. This high number of species is a product of great habitat diversity and wide variations in available soil moisture. Active field collection in the future, plus verification of some present collections, should bring the floristic list to over 300 species.

The vertebrate fauna stands at 114 species, including 16 mammals, 73 birds, 10 reptiles, 8 amphibians, and 7 bony fishes. Whitetail deer (*Odocoileus virginiana*) and red and gray foxes (*Vulpes fulva* and *Urocyon cinereoargenteus*) reside within the park and are seen occasionally. The large number of bird records during the 2-year study reflects the excellent mix of vegetation types and abundant nesting sites for resident species. Many migratory species visit the park as they move along the Wabash River migration corridor. Bird records of particular interest or rarity are the red crossbill (*Loxia curvirostra*), pileated woodpecker (*Hylotomus pileatus*) and the great blue heron (*Ardea herodias*). Green herons (*Butorides virescens*) nest within the park. Complete flora and fauna lists are available upon request.

TABLE 1. *Species richness by stratum within the major vegetation units at Dobb's Park (Grass-forb units (Fig. 1) were not stratum ranked because of disturbance due to mowing).*

	Stratum[1]			
Community Type	Canopy	Subcanopy	Shrub	Herbaceous
Mature deciduous forest	17	21	30	66
Young deciduous forest	20	31	41	69
Coniferous plantation	18	18	24	58
Deciduous plantation	1	1	13	24
Shrub-sapling thicket	—	7	24	41
Old field	—	4	14	52

[1] Canopy: >25 cm in diam and >10 m tall; subcanopy: >5 cm in diam and <10 m tall; shrub: >0.5 m tall and <5 cm in diam; herbaceous: <0.5 m tall.

Old-Growth Analysis

The old-growth is dominated by elms (*Ulmus americana, rubra* and *thomasii*) and ashes (*Fraxinus americana* and *pennsylvanica*) at collective importance percentages of 18.5 and 14.4, respectively. These co-dominants have relatively high stem densities (97.5 per ha for elm and 56.9 for ash) of medium-sized trees, plus high frequencies (Table 2).

The third species is white oak (*Quercus alba*) at 7.9 per cent importance. A low density of 12 per ha is offset by a large average stem diameter of 66.7 cm. (Table 2).

Total density is 340 stems per ha (138 stems per acre); total basal area is 27.5 m^2 per ha (120 ft^2 per acre). The presence of 34 tree species reflects the heterogeneity in soil moisture conditions even though relief varies only 10 feet (Figure 2).

Mean stem diameter is 26.7 cm (10.5 inches), with twelve species containing 52 individuals in or above the 75-cm (30-inch) size class. The ten largest trees (>95 cm or 36-inch) are oaks: Shumard's red (*Quercus shumardii*), northern red (*Q. rubra*), white (*Q. alba*), and chinkapin (*Q. muehlenbergii*) reach maximum diameters of 50.1, 42.2, 41.3 36.0, respectively.

Beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*) are the seventh and eighth most important species. A well-drained ridge best suited for the growth of mesic species runs roughly from the northwest to the southeast corners of the old-growth. This mesic band contains all the large beech and most large sugar maples.

Discussion

From observations of species distribution patterns, it is apparent that the flat northeast corner of the old-growth has been wet for quite some time (Figure 2). Alteration of natural drainage patterns when the subdivision was built on the north has increased the level and duration of ponding in recent times. With drainage blocked, water stands at varying levels from March through May. Plant distribution patterns correspond very closely to the areas ponded and the moisture tolerances of particular species, as extremes are the factors which control vegetation. Only species of high flood tolerance, such as red maple (*Acer rubrum*) and green ash (*Fraxinus pennsylvanica*) are capable of reproducing within the maximum ponded areas. Differences in soil moisture levels in late summer were not significant, reflecting that it is excessive moisture in the spring, rather than soil drying in the fall, that influences tree species success within mature forests.

Although Dobbs Park is located in the northern part of the Wabash lowland physiographic region, the old-growth is topographically similar to Tipton Tillplain stands, such as Meltzer Woods (7), Beckville Woods (7) and Bryan Nature Preserve (5).

In comparison with these stands, Dobbs Park has about average stand basal area, and a slightly above average stem density (Table 3). The higher stem density at Dobbs is a product of disturbance by wind throw and elm mortality. The light gaps are quickly filled by seedlings of wind-dispersed species, such as sugar maple and American elm.

TABLE 2. *Stand attributes for tree species within the mature deciduous forest community of Dobb's Park, Terre Haute, Indiana based on a full census of 3.60 hectares. Frequencies are based on 36 0.1 - ha square plots.*

Species	Density Per Hectare	Relative Density	Frequency	Relative Frequency	Basal Area per Hectare in M^2	Relative Basal Area	Percent Importance	Mean Diameter in cm
Ulmus americana	67	20	36	8.7	1.2	4.5	11	16.1
Fraxinus americana	44	13	35	8.4	3.1	11	11	27.4
Quercus alba	12	3.5	17	4.1	4.4	16	7.9	66.7
Carya cordiformis	28	8.2	23	5.5	2.2	8.0	7.2	27.2
Liriodendron tulipifera	16	4.6	22	5.3	1.9	7.0	5.6	35.2
Ulmus rubra	22	6.4	27	6.5	.73	2.6	5.2	19.7
Fagus grandifolia	12	3.5	22	5.3	1.5	5.5	4.8	35.5
Acer saccharum	25	7.4	20	4.8	.43	1.6	4.6	16.0
Quercus rubra	8.6	2.5	16	3.9	2.0	7.3	4.6	47.3
Quercus shumardii	5.0	1.5	9	2.2	2.2	8.0	3.9	72.7
Fraxinus pennsylvanica	13	3.8	16	3.9	.69	2.5	3.3	24.2
Tilia americana	13	3.8	15	3.6	.39	1.4	2.8	19.2
Acer rubrum	7.8	2.3	10	2.4	1.1	4.0	2.9	36.4
Quercus muehlenbergii	4.2	1.2	13	3.1	1.1	4.0	2.8	53.7
Sassafras albidum	11	3.3	13	3.1	.32	1.2	2.5	18.0
Prunus serotina	7.5	2.2	18	4.3	.23	.84	2.5	18.7
Ulums thomasii	8.9	2.6	16	3.9	.14	.51	2.3	15.6
Carya laciniosa	3.9	1.1	12	2.9	.52	1.9	2.0	37.1
Carya cordiformis	5.6	1.6	10	2.4	.51	1.9	2.0	32.5
Juglans nigra	4.7	1.4	9	2.2	.42	1.5	1.7	35.0
Quercus macrocarpa	2.8	.82	5	1.2	.76	2.8	1.6	54.0
Nyssa sylvatica	3.9	1.1	7	1.7	.41	1.5	1.4	28.6
Others[1]	16.1	4.7	44	10.6	1.3	4.7	6.7	——
TOTALS	340 (138)		415		27.5 (120)			

[1]Other species in descending order of percent importance are: Quercus palustris, Carpinus caroliniana, Carya glabra, Celtis occidentalis, Acer negundo, Q. bicolor, Platanus occidentalis, Crataegus spp., Fraxinus nigra, Q. imbricaria, Cercis canadensis, Gleditsia triacanthos.

TABLE 3. *Comparison of Dobbs Park old-growth to other Indiana stands on similar topography.*

	Dobbs Park	Bryan	Beckville	Meltzer
Number of Species	34	35	42	27
Species in common	—	28	25	24
Leading Dominants	Ua,Fa,Qa	Qa,Fa,Qr	Ar,Qr,Qa	Qsh,Fg,Fa
Coefficient of Similarity	—	52%	40%	43%
Basal Area	120	125[1]	129	149
Density	138	80[1]	104	122

[1]Lower tree size limit of 5.0 inches dbh lowers values for density (substantially) and basal area (slightly) for Bryan Nature Preserve.

Most stems of these two species are in the 6-inch (15-cm) size class, and account for the increase in stem density.

Shifts in dominants lowers the coefficient of similarity to 40-52% (Table 3), but at least 24 species are common to these stands. Lowland depressional species predominate in all stands, with mesic and xeric species restricted to better-drained low ridges.

A size-class-log density plot (not included) for all species collectively very closely approximated a straight-line relationship, reflecting the excellent representation of all size classes and the general lack of disturbance.

Future work concerning the trends in changing species composition and elm replacement will be studied by revision of the large-scale map at decade intervals. An evaluation of tree distribution patterns is presently in progress.

Acknowledgments

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