

Full Tally Inventory of 4⁺ cm Woody Individuals in Bendix Woods Nature Preserve, an Old Growth Beech-Maple Forest

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Introduction

Bendix Woods County Park is located about 19 km west of South Bend, Indiana in western St. Joseph County. The Bendix Woods Nature Preserve is in the southwestern portion of the park and lies in the south half of section 11, T. 37 N., R. 3 E. (86° 29' 16". Longitude and 41° 39' 11" N. Latitude). The land containing the present park and preserve was homesteaded in 1860 by Jacob and Emily Hooton. In 1926, the portion of the land that includes the park was sold to the Studebaker Corporation and they constructed an automobile testing area that included several miles of roads. Later the Bendix Corporation purchased the testing grounds from Studebaker and in 1966, deeded 175 acres to the newly created St. Joseph County Parks and Recreation Board. During the last five decades, the preserve area has not been disturbed.

The park area is in the Kame facies of the Lagro Formation of the Wisconsin glacial period (4). The elevation within the preserve ranges from 274 m to 242 m above sea level with slopes ranging from 2 to 22 percent. The soils are coarse textured (sandy loam), well drained members of the Hillsdale series (1). However, finer textured lenses do occur and several seasonal springs occur in the eastern third of the preserve which includes some moderately well to somewhat poorly drained soils.

The presettlement vegetation of the north one half of this township, as recorded by the surveyors in 1829, was dominated by sugar maple and beech with basswood, elm and white oak being major associates. The trees recorded for the 37 points in the north half were 28 percent sugar maple (avg. diameter, 54.8 cm) and 25 percent beech (avg. diameter, 44.5 cm). The largest beech and sugar maple recorded were 102 cm in diameter and the largest tree recorded was a 152 cm diameter walnut.

On July 5 and 9, 1980, straight line winds reaching velocities of more than 96 km per hr caused extensive damage in SW Michigan and northern Indiana. In the Nature Preserve, the wind impacted about 2.4 hectares or almost 25 percent of the preserve area. The present study was initiated in the spring of 1981 to assess the damage by the windstorm, to inventory the living woody individuals and to establish permanent quadrats to study forest regeneration. Tree, shrub and herbaceous level studies were initiated, but only the tree inventory has been completed and this should serve as baseline data for future studies.

Methods

A 50 X 50 meter grid was established for the preserve area using the SW corner of the preserve (corner post of chainlink fence) as the initial point. The

intersections of the 50 m interval, north-south and east-west lines were marked by driving 1.9 cm diameter by 61 cm long galvanized pipe into the ground. These corners of the permanent quadrats were established by measuring the sides and diagonals using 50 m and 100 m tapes. Elevation changes were measured and surface measurements corrected to establish a horizontal grid.

All woody stems within the inventory area (Figure 1) were tallied by subdividing the 0.25 ha permanent quadrats into 10 m X 10 m plots. The data recorded for each plot included the plot number, plot size and shape, date and the species, dbh and vegetation level for each woody stem, 4 cm or more in diameter. The plot number consists of the column and row numbers for the grid (Figure 1) plus the column and row of plot within quadrat. Shape and size of plot were recorded since the irregular boundaries of the preserve resulted in some rectangular and triangular plots. The field data were transcribed to a computer data bank for storage and analysis.

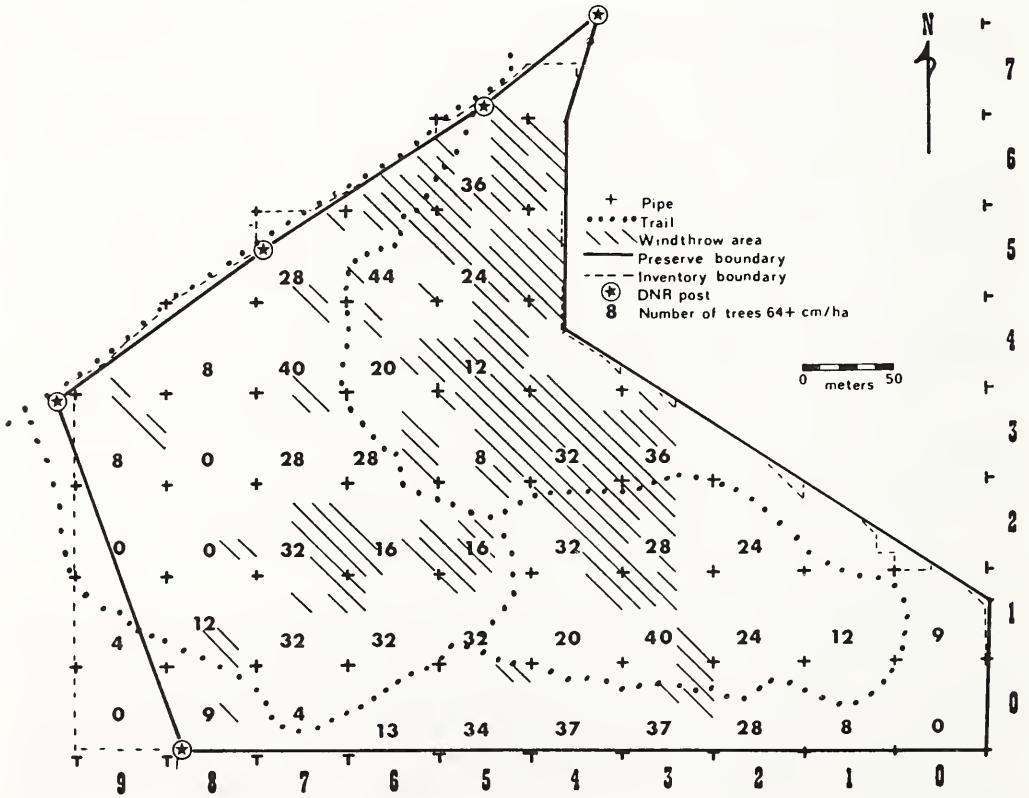


FIGURE 1. Bendix Woods Nature Preserve and area included in full tally inventory of 11.6 ha in 1981 and 1982. Preserve is located in southeastern portion of Bendix Woods County Park.

Results and Discussion

The summary statistics for the 11.6 ha inventoried are presented in tables 1 and 2. The inventory required more than one growing season to complete and the major windthrow area was the last to be inventoried. Therefore, a number of individuals may have entered the lower size class during the inventory period. The smallest size class is dominated by maple (*Acer saccharum* and *A. nigrum*), 73 percent of all individuals, and maple probably gained the most individuals through growth during the interval from windthrow to completion of inventory.

This dominance by maple in the lower size class skews the density and relative density values in table 1 and inflates the maple importance value.

TABLE 1. Vegetation attributes for full tally inventory of woody individuals 4 cm or more dbh in Bendix Woods Nature Preserve, St. Joseph County, Indiana.

Species (1)	Vegetation attributes (2)				IV
	D1	D2	B1	B2	
<i>Acer saccharum</i>	358.7	56.4	7.2	27.1	42
<i>Fagus grandifolia</i>	56.6	8.4	7.8	29.3	19
<i>Ulmus rubra</i>	56.7	8.9	3.7	13.9	11
<i>Tilia americana</i>	25.9	4.1	2.1	7.9	6
<i>Liriodendron tulipifera</i>	8.6	1.4	1.6	6.0	4
<i>Ulmus americana</i>	28.7	4.5	0.9	3.2	4
<i>Celtis occidentalis</i>	26.0	4.1	0.7	2.7	3.5
<i>Carya cordiformis</i>	21.1	3.3	0.7	2.7	3
Others	54.1	8.9	1.9	7.2	
TOTALS	636.4		26.7		

1. *Acer saccharum* includes *A. nigrum*. Other species in the 11.6 hectares inventoried area: *Asimina triloba*, *Carpinus caroliniana*, *Crataegus* sp., *Fraxinus americana*, *F. quadrangulata*, *F. pennsylvanica*, *Gymnocladus dioica*, *Juglans cinerea*, *J. nigra*, *Ostrya virginiana*, *Platanus occidentalis*, *Populus deltoides*, *Prunus serotina*, *P. virginiana*, *Pyrus malus*, *Quercus rubra*, and *Sassafras albidum*.

2. Vegetation attributes are: D1, density in number per ha; D2, relative density in percent; B1, basal area in square meters per ha; B2, relative basal area in percent; IV, importance value, $(D2 + B2)/2$.

If the two species of maple (*A.saccharum* and *A.nigrum*) are separated, their importance values would be about the same as beech (*Fagus grandifolia*). If only canopy individuals were considered, the separate maple importance values would be less than beech and only slightly higher than slippery elm (*Ulmus rubra*). The forest would be classified as a beech-sugar maple-black maple community using the Indiana Heritage Program classification (2). The data for the two maple species are combined in this report since many individuals appear to be hybrids and no species distinction was made for about 80 individuals recorded in late fall and very early spring.

Most species in Table 1 have a similar rank for both the density and basal area values. Tuliptree (*Liriodendron tulipifera*) is a notable exception since it has a relatively low density value compared to its basal area value. Tuliptree has relatively few individuals in the smaller diameter classes and a relatively large number in the 40 to 60 cm classes (Table 2). A similar situation occurs in the frequency distributions of black cherry (*Prunus serotina*) and black walnut (*Juglans nigra*). Basswood (*Tilia americana*) has two secondary peaks in the larger size classes, beech has one and maple has a distinct plateau in the 40 to 70 cm classes.

We believe past disturbances, particularly windthrow, have been important in shaping the observed frequency distributions. During the inventory, we noted much evidence of earlier windthrows throughout the preserve although none as massive as the present. The eastern and western two columns of quadrats (Figure 1) are much younger (smaller diameters) and probably reflect past cropping or logging of these areas. Black cherry is more common in the eastern and western portions of the preserve and tuliptree is more abundant in the western end. The eastern end is the lowest and wettest area of the preserve and contains the most massive of old windthrows. This end of the preserve also contains most of the young *Ulmus americana*. The heterogeneity of the preserve area explains some of the frequency variation in table 2. We hope to gain additional information on past disturbances through analysis of the growth rings of windthrown trees.

TABLE 2. *Frequency analysis of full tally data for Bendix Woods Nature Preserve, St. Joseph County, Indiana.*

Species (1)	Diameter classes (cm)									
	4 to	10 to	20 to	30 to	40 to	50 to	60 to	70 to	80 to	+
Acesp	3110	693	121	45	56	54	56	26	5	
Carco	69	87	56	24	6	1	2	0	0	
Celoc	160	91	30	7	3	4	1	4	2	
Faggr	194	52	44	43	80	84	68	45	13	
Frasp	49	55	44	22	10	0	0	0	0	
Jugni	0	3	5	3	1	3	3	0	2	
Lirtu	6	9	13	8	22	19	13	6	4	
Pruse	2	16	11	23	14	0	2	0	0	
Queru	1	4	7	7	0	1	2	0	2	
Tilam	113	79	23	16	23	9	24	12	2	
Ulmam	113	133	53	21	7	5	0	0	1	
Ulmru	90	159	209	118	47	16	12	6	2	
TOTAL	4246	1400	620	324	270	197	184	99	33	
% <i>Acer</i>	73	50	20	13	21	27	30	26	15	

1. Acesp, *Acer nigrum* and *A. saccharum*; Carco, *Carya cordiformis*; Celoc, *Celtis occidentalis*; Faggr, *Fagus grandifolia*; Frasp, *Fraxinus americana* and *F. pennsylvanica*; Jugni, *Juglans nigra*; Lirtu, *Liriodendron tulipifera*; Pruse, *Prunus serotina*; Queru, *Quercus rubra*; Tilam, *Tilia americana*; Ulman, *Ulmus americana*; Ulmru, *Ulmus rubra*. TOTAL includes all species in inventoried area, 11.6 ha.

In 1969, Lindsey et al. (3) reported a full tally inventory of individuals 10 cm or more dbh in 4.3 ha of Bendix Woods Nature Preserve. Although we are not sure of the exact location of the early survey, we think it was within the area defined by columns 4 through 7 and rows 1 through 5 in Figure 1. Table 3 is a comparison of the values for this 4.8 ha area and the data from Lindsey et al. The basal area values for the present inventory are slightly lower than Lindsey's data for beech, slippery elm and basswood. Since this area includes a portion of the major windthrow damage and these three species are represented by windthrown individuals, we believe the decrease in basal area reflects the amount of windthrow damage from the 1980 storms. In Figure 1, the windthrow damaged quadrats have fewer large trees and much lower basal area values than

TABLE 3. *Vegetation attributes for 1981 and 1969 inventories of 10+ cm trees in central old growth section of Bendix Woods Nature Preserve.*

Species (2)	Vegetation attributes (1)				
	D1	D2	B1	B2	IV
Faggr	57.4 (69.7)	36 (38)	12.8 (13.9)	50 (49)	43 (43)
Acesp	51.5 (44.8)	32 (25)	5.0 (5.0)	19 (17)	26 (21)
Ulmru	21.8 (27.4)	14 (15)	2.7 (3.2)	10 (12)	12 (13)
Tilam	10.7 (13.7)	7 (7)	2.6 (3.0)	10 (10)	8 (9)
Celoc	9.0 (9.4)	6 (5)	0.8 (0.8)	3 (3)	4 (4)
Ulman	3.2 (5.0)	2 (3)	0.3 (0.5)	1 (2)	2 (2)
Lirtu	1.7 (3.0)	1 (2)	0.6 (0.6)	2 (2)	2 (2)
Carco	1.9	1	0.3	1	1
TOTAL	161.1 (182.3)		25.7 (28.4)		

1. Vegetation attributes are: D1, density in number per ha; D2, relative density in percent; B1, basal area in square meters per ha; B2, relative basal area in percent; IV, importance value, $(D2 + B2)/2$. Data in parentheses are from Lindsey et al (3) for 4.3 ha. The other data are for 4.8 ha.

2. See table 2 for species codes.

the surrounding undisturbed quadrats. An inventory of the windthrown trees has not been completed so exact figures for loss of basal area are not available.

The basal area of the old growth portion of the preserve is comparable to that reported for other beech-maple forests in Indiana e.g. Hoot Woods, 25.2 m²/ha, Officers Woods, 25.7 m²/ha, Potzger Woods, 26.8 m²/ha and Meltzer Woods, 28.8 m²/ha (3). However, the 25.7 m²/ha for the old growth portion is considerably less than the 39.6 m²/ha reported for Warren Woods in Berrien County, Michigan (5). The largest tree in the Nature Preserve is a 105 cm beech. Warren Woods has several trees in this and larger size classes (5).

Although the beech and maple basal areas in Bendix Woods are similar to that of other Indiana beech-maple forests, none of the other forests had *Ulmus rubra* and *Tilia americana* as the major canopy associates. White ash (*Fraxinus americana*) and tuliptree are more important in the other forests than they are in Bendix Woods.

Summary

The central area of Bendix Woods Nature Preserve is a good example of an old growth beech-sugar maple-black maple forest with slippery elm and basswood as strong associates. The July 1980 windstorm damaged a large portion of the preserve and probably reduced the average basal area per hectare by 10 percent or more.

The establishment of permanent quadrats and the completion of a full tally inventory of the total preserve area provide the reference points and baseline data necessary to study the recovery from the 1980 windthrow and to assess future disturbances.

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Literature Cited

1. BENTON, HEZEKIAH JR. 1977. Soil Survey of St. Joseph County, Indiana. U. S. Department of Agriculture, Washington. 101 p. + maps.
2. JACKSON, M. T. 1980. A classification of Indiana plant communities. Ind. Acad. Sci. Proc. 89:159-172
3. LINDSEY, A. A., D. V. SCHMELZ and S. A. NICHOLS. 1969. Natural Areas in Indiana and Their Preservation. (Reprint ed.) American Midland Naturalist, Notre Dame. 594 p.
4. SCHNEIDER, A.F. and S.J. KELLER. 1970. Geologic map of the 1°X 2° Chicago quadrangle, Indiana, Illinois and Michigan, showing bedrock and unconsolidated deposits. Regional Geol. Map No. 4, Indiana Geological survey, Bloomington.
5. WOODS, K. D. 1979. Reciprocal replacement and the maintenance of codominance in a beech-maple forest. Oikos 33:31-39.

