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A quadrat study of Meltzer woods, Shelby county, Indiana

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The *Butler University Botanical Studies* journal was published by the Botany Department of Butler University, Indianapolis, Indiana, from 1929 to 1964. The scientific journal featured original papers primarily on plant ecology, taxonomy, and microbiology. The papers contain valuable historical studies, especially floristic surveys that document Indiana's vegetation in past decades. Authors were Butler faculty, current and former master's degree students and undergraduates, and other Indiana botanists. The journal was started by Stanley Cain, noted conservation biologist, and edited through most of its years of production by Ray C. Friesner, Butler's first botanist and founder of the department in 1919. The journal was distributed to learned societies and libraries through exchange.

During the years of the journal's publication, the Butler University Botany Department had an active program of research and student training. 201 bachelor's degrees and 75 master's degrees in Botany were conferred during this period. Thirty-five of these graduates went on to earn doctorates at other institutions.

The Botany Department attracted many notable faculty members and students. Distinguished faculty, in addition to Cain and Friesner , included John E. Potzger, a forest ecologist and palynologist, Willard Nelson Clute, co-founder of the American Fern Society, Marion T. Hall, former director of the Morton Arboretum, C. Mervin Palmer, Rex Webster, and John Pelton. Some of the former undergraduate and master's students who made active contributions to the fields of botany and ecology include Dwight. W. Billings, Fay Kenoyer Daily, William A. Daily, Rexford Daudenmire, Francis Hueber, Frank McCormick, Scott McCoy, Robert Petty, Potzger, Helene Starcs, and Theodore Sperry. Cain, Daubenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

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A QUADRAT STUDY OF MELTZER WOODS, SHELBY COUNTY, INDIANA*

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As one travels eastward on return from a trip through the prairie states, perhaps the most characteristic feature of the landscape which starts him humming the strains of, "Back Home Again in Indiana," are the beautiful woodlands along the highways of our state. These woodlands are remnants of the great Eastern deciduous forest upon which the pioneers gazed with amazement as they penetrated the interior of our continent. The botanist and Nature lover of the present day ofttimes wish they could have had the thrill of looking at the stately array of massive-trunked, majestic giants in that forest primeval. There are no quantitative data available to show just what the sociology of this forest was originally, but judging from the remnants of the ancient towering monuments found in some virgin forest areas by Butler ecologists (3, 11, 24), we may assume that trees from 150-200 feet tall with a girth of 20 feet or more were not uncommon. Early settlers and explorers with no particular botanical or ecological interest were impressed with the grandeur of the forest through which they traveled, as may be seen from their journals and other records. Ovid Butler (2) reports that Pierre Joseph Celoron de Blainville, who traveled down the Allegheny and Ohio rivers in 1749, dined one day with twenty-eight other men in a hollow sycamore somewhere in the Ohio Valley.

There were giants in those days, but, alas, most of them have fallen victim to the touch of Midas and have been converted into gold. Gold, of course, was what many of the early pioneers were seeking, and when they found that the natural resources of the northern part of the New World offered wealth in greater measure than the actual gold found by Cortez and Pizarro in the southern parts, they began to garner this wealth without restraint.

To the farmer, however, the forest presented a problem. Corn and produce could not be grown under the shading canopy of the

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trees, or among their living roots. Clearing the land was a necessary operation if agriculture were to prosper, but the idea that the forests were inexhaustible, and could never be depleted, led to indiscriminate cutting and wasteful burning of timber just for the purpose of getting rid of it. Community log-rollings were quite common at this time, and all too frequently the only thing left from a pile of logs (worth hundreds of dollars today) would be enough ashes to make a batch of soap.

The early lumbermen and loggers also had the idea that this great source of wealth would never diminish. To use the words of Stewart H. Holbrook (6), to the early logger "a tree was something that contained so many thousand feet of boards, or, he might figure it to contain fully one quart of hard liquor. In any case, the tree was to be cut as quickly as possible. 'Let daylight into the swamp.'"

And when there was daylight everywhere in the swamps of Michigan and Wisconsin, when the valuable *Pinus strobus* and other coniferous timber had been practically depleted, then the hardwoods to the south came in for their share of the slaughter. Commercial interests have pillaged our Indiana forests to the extent that only in a few places in the state can one find small areas which have been protected from the axe of the lumbermen by far-sighted individuals who realized that the most rapid acquisition of money is not always the best and surest way to ultimate wealth. Such a man is Brady Meltzer, owner of the woods which we surveyed for this study. Like Joseph Cox, whose woods we studied in 1942 (14), Mr. Meltzer seemed to have a sort of tender affection for his trees. There were certain ones among them to which he pointed with particular pride, the most outstanding of which was a Shumard's red oak, 52 inches DBH., and a swamp white oak, 54 inches DBH. These two monarchs were not within our lines of survey, but their proud owner did not wish them to be overlooked, so taking a recess from his work in the field, he led us down the pasture lane to see "something worth looking at."

"There is some valuable timber in this woods," he said, as we walked back to the road, "and it would make a nice piece of farm land, if cleared, but our country needs forests, so I'm going to leave it alone." It is a rare pleasure to find such conservation-minded men who do not let their interest in getting all they can for themselves overshadow their consideration for our national welfare, and also the welfare of future generations. It is the hope of the writer that

Mr. Meltzer's woods, together with the other stands of virgin timber still left in Indiana, may long remain as a monument to the spirit of conservation; and that students of ecology and forestry in generations to come may have access to these tracts as laboratories for scientific research, where they may find some new facts on successional trends by comparing their findings with those recorded by us of the present generation. The survey for this study was made March 27, 1943.

LOCATION OF THE MELTZER WOODS

The Meltzer woods is located in Shelby County, Indiana, near the eastern boundary of the county, in Liberty Township, T. 12 N., R. 8 E., Section 8. It is about eleven miles west of the village of Milroy, and just north of state road 244. The area of the tract is about forty acres.

GEOLOGY AND PHYSIOGRAPHY

The southeastern two-thirds of Shelby County lies within the Muscatatuck Regional Slope, with altitude ranging from 650 to 920 feet above sea level, giving it a maximum relief of 270 feet.

According to Malott (8), the Muscatatuck Regional Slope is the most notable regional slope in the entire state. It merges rather indistinctly into the low-land area on the west and the glacial plain on the north. Shelby County lies at the northern edge of this region. It is within the boundaries of Illinois and Early Wisconsin glaciation, and is covered with a rather thin layer of glacial drift which rests upon a stratum of New Albany shale, underlain by bedrock of Devonian and Silurian limestones.

CLIMATIC FEATURES

Indiana is near the southern margin of the area having long, severe winters. Visher (16) gives the normal average January temperature as ranging from 33° F. in the southern part of the state to 25° in the north. Shelby county lies midway between these two extremes. It has a growing season of from 160 to 180 days. The average annual precipitation for most of the state is about 40 inches. This is fairly evenly distributed throughout the year. The air is generally moist, with relative humidity averaging about 70% during the day. At night the lower air becomes super-saturated and moderate to heavy dews result.

The average wind velocity for the state is about eight miles per hour, with southwest winds prevailing in summer and northwest winds in winter. Gales and tornadoes are rare, and when they do occur, only small areas are affected.

METHODS

The 100 square meter quadrat was used as a unit of sampling. The quadrats were laid out by means of a stout cord with loops ten meters apart. These loops were slipped over stakes to form the corners of the areas to be tabulated. Two lines of survey were laid out, since the mature part of the woods was not of sufficient depth to include fifty quadrats in a continuous line. It was not originally intended to make a comparative study of the two sectors, since from casual observation the existing differences were not strikingly apparent, but since the tabulations showed rather marked differences, it was decided to present it in this way. A ten-meter skip was left between each unit area, as well as between the two lines. DBH. measurements were taken with wooden calipers. All stems over one inch in diameter were measured and tabulated. All young trees less than one inch DBH., and a meter or more in height, were also counted. It is assumed that these stems give a better idea of the dynamics of reproduction in an area than the smaller seedlings, many of which do not survive their first winter.

OBSERVATIONS

There were 43 different woody species found in this survey. They distributed themselves into the following life forms: 22 tall trees, 7 small trees. 4 large shrubs, 6 small shrubs, and 4 lianas. 37 different species were found in each sector. Some found in one sector were not found in the other and vice versa. *Acer saccharum, Fraxinus americana,* and *Fagus grandifolia* totalled more than half the number of stems above one inch DBH. (table I). Basal area percentages (table II) show that *Fagus grandifolia* is the most prominent species in the stand, constituting 27.33% of the total basal area, while *Acer saccharum* constituted only 3.78%, but in comparing the percentages of total stems below one inch and those one to two inches DBH. (table I), it appears that *Acer saccharum* is gaining in prominence and *Fagus grandifolia* is on the decline. In the one to two-inch size-class we find the following distribution: *Acer saccharum,* 26.59%, and *Fagus grandifolia,* 10.71%. In the size-class below one

inch, *Acer* drops to 7.99% and *Fagus* to .86%. It should be pointed out, however, that in this size-class competition involves species of the shrub stratum, *Lindera benzoin*—42.62%; *Asimina triloba*—8.77%; besides the young of the dominants.

Fraxinus americana shows rather unusual prominence for a woods of this type (table II), represented by the following percentages: stems below one inch, 13.21%; one to two-inch stems, 22.62%; all stems above one inch, 20.39%; and total basal area, 10.57%. The mortality rate of this species here is apparently not so great as it was found to be in the Mauntel woods by Potzger and Friesner (12).

Other species represented by greater basal area percentages than *Acer saccharum* were: *Ulmus americana,* 12.51%; *Carya laciniosa,* 10.12%; *Quercus alba,* 10.08%; *Quercus borealis* var. *maxima,* 6.26%; and *Quercus bicolor,* 6.01%.

Only seven of the species showed a frequency index of more than 50% (table II). They were: *Fraxinus americana,* 98%; *Acer saccharum,* 88%; *Lindera benzoin,* 76%; *Asimina triloba,* 72%; and *Fagus grandifolia,* 70%. This compares favorably with the Cox woods (14) which showed the same number of species with a F. I. of 50% or more. In the Berkey woods, however, Potzger and Friesner (11) found only five species showing so high a rate of frequency.

Because of the large number of species participating in the crown cover, this can hardly be called a beech-maple woods as listed (type 57) by the American Society of Foresters (15). The writer is inclined to consider it in the same class as the Berkey woods (11), and classify it as mixed-mesophytic, the concept proposed by Miss Braun (1).

A striking difference was found in the sociological make-up of the two sectors surveyed. This was particularly apparent in comparing the status of the maples. In the south sector, *Acer saccharum* had a basal area of 1462.41 sq. in., against 368.37 in the north sector (table II). *Acer rubrum* had 3.93 sq. in. in the south sector against 14.14 in the north sector. The total basal area covered in the south sector was 31,061.73 sq. in., while that covered in the north sector was only 17,412.32 sq. in.

DISCUSSION

In an extensive study to determine what is climax in central Indiana, Potzger and Friesner (13) have concluded that the climate in this area favors a modified *Acer-Fagus* climax, and that microclimate,

introduced by topography, causes and maintains the *Quercus-Carya* cover type. They point out that the term *Acer-Fagus* must be made very inclusive of many other species playing a part in the crown cover when forests of this type are considered. Potzger (10), in his Monroe County study, considers the so-called *Acer-Fagus* association as more of a mixed hardwoods type with *Acer* and *Fagus* playing a prominent role. Braun (1) places the true *Acer-Fagus* association into the northern limits of the deciduous forest, and regards the *Acer-Fagus* association in Indiana as a "mixed mesophytic association."

The unusual prominence of *Fraxinus americana* in the Meltzer woods makes it considerably different from other forest areas in which *Fagus* is as prominent as here, but, as the Society of American Foresters Committee on Forest Types (15) suggest, there will always be areas which stand as transitions between existing types, and it cannot be expected that any type list suitable for a region the size of the eastern United States will provide a name for every combination. In this connection, Phillips (9) points out that a climax very rarely, if ever, is wholly uniform floristically and structurally, and that climax associations making up the climax formation show faciations and facies, lociations and locies, climatically determined, and serations edaphically determined. Cain (4) considers the factor of soil in the complexities of the climax, showing that through its physical structure and chemical composition it determines to a greater or less extent the life it bears. And to these factors should be added, also, the soil moisture conditions.

When considering each of the two sets of quadrats in this study separately, and comparing them, one is impressed with the differences caused by microclimatic and edaphic factors. Perhaps the greatest variation was found in the status of *Acer*. In the south sector *Acer saccharum* and *Acer negundo* were almost four times as important as they were in the north sector, while *Acer rubrum* showed the opposite ratio of importance. This observation is based on basal area rather than abundance, in agreement with the view of Cain (4) that dominance should be judged by the area, or space covered by the plants. Another prominent difference found in the two lines of survey was in the greater number of small stems in the north sector, and in the greater total basal area covered by those in the south sector.

Edaphic factors are, without doubt, exerting a decided control on the species participating with *Acer saccharum* and *Fagus grandifolia*

in the crown cover. *Carya laciniosa, Liquidambar styraciflua, Quercus bicolor, Ulmus spp.,* as well as the shrub *Lindera benzoin,* are representative of poorly drained habitats, at least habitats which are wet during the early part of the growing season. This apparently explains the status of *Acer saccharum* in the Meltzer woods. With increased drainage, *Acer saccharum* may replace most of the aforementioned species except *Fagus.* Then a mixed mesophytic forest deprived of strong representation by species typical of the transitional floodplain habitat may develop. Lee (7) shows a number of different stages in the development of the floodplain forest, varying with soil composition, soil moisture, and drainage. Friesner and Ek (5) found two distinctly different forest types within a small area in Shenk's woods, in Howard County. This difference was due primarily to a variation in soil moisture. Further research would be necessary to determine the cause of the variations found in the Meltzer woods, but it may be assumed that a series of soil-moisture studies would give some interesting data.

Inasmuch as the Meltzer Woods is sufficiently unique in character to place it in a class by itself, showing no very close comparison with any particular type, or with any other woods in Indiana that has come to our attention, we might conclude, as suggested in the introduction, that such an area should be set aside as a laboratory of research. Valuable and costly as lumber is at the present time, these trees will be more valuable to the conservation program of the United States in the future if left standing than they will be to commercial interests if they were cut down and sawed into boards.

SUMMARY

1. This paper presents a study of the Meltzer woods, Shelby County, Indiana, based on fifty 100-square-meter quadrats.

2. The study emphasizes the importance of conserving such unusual areas as laboratories for ecological and forest research.

3. Woody species were represented by twenty-two species of tall trees, seven small trees, four large shrubs, six small shrubs, and four lianas.

4. *Acer saccharum, Fraxinus americana,* and *Fagus grandifolia* make up 58% of the stems above one inch DBH. Fagus constitutes 27% of the total basal area.

5. *Acer saccharum* and *Fraxinus americana* have the greatest abundance in the smaller stems (with the exception of shrubby species). *Fagus grandifolia* is poorly represented in the small stem size-class, indicating a decline in rate of reproduction and survival.

6. The Meltzer woods is a somewhat unusual and complex part of the mixed mesophytic forest, representing a transitional stage between wet lowland forest and the ultimate climax in central Indiana under optimum mesophytic habitat conditions.

ACKNOWLEDGMENT

The writer is grateful to Dr. J. E. Potzger, Butler University ecologist, who rendered valuable assistance in making the survey for this study as well as offering many helpful suggestions and criticisms regarding the preparation of the manuscript. He also expresses thanks to Dr. Ray C. Friesner, head of the Botany Department and to Charles Donald Griffin, one of his students, for their aid in laying out the quadrats and in making the tabulations.

LITERATURE CITED

1. Braun, E. Lucy. Deciduous forest climaxes. Ecol. 19: 515-522. 1938.
2. Butler, Ovid. American conservation in picture and story. Amer. Forestry Assn., Washington, D. C. 1935.
3. Cain, Stanley A. Studies on virgin hardwood forest. I. Density and frequency of the woody plants of Donaldson's woods, Lawrence County, Indiana. Indiana Acad. Sci. Proc. 41: 105-122. 1932.
4. ——— ———. The climax and its complexities. Amer. Midl. Nat. 21: 146-181. 1939.
5. Friesner, Ray C., and Charles M. Ek. Correlation of microclimatic factors with species distribution in Shenk's woods, Howard County, Indiana. Butler Univ. Bot. Stud. 6: 87-101. 1944.
6. Holbrook, Stewart H. Holy Old Makinaw. The Macmillan Co., New York, N. Y. 1938.
7. Lee, Mornie B. An ecological study of the flood-plain forest along the White River system in Indiana. Butler Univ. Bot. Stud. 7: 1945.
8. Malott, C. A. The physiography of Indiana. Handbook of Indiana geology. Part II: 66-256. 1922.
9. Phillips, J. Succession, development, the climax, and the complex organism. An analysis of concepts. Jour. Ecol. 22: 554-571; 23: 210-246, 488-508 1934.
10. Potzger, J. E. Topography and forest types in a central Indiana region Amer. Midl. Nat. 15: 212-229. 1935.

11. ——— ——— AND RAY C. FRIESNER. An ecological survey of Berkey woods: A remnant of forest primeval in Kosciusko County, Indiana. Butler Univ. Bot. Stud. 6: 10-16. 1943.
12. ——— ———. Some comparisons between virgin forest and adjacent areas of secondary succession. Butler Univ. Bot. Stud. 3: 85-98. 1934.
13. ——— ———. What is climax in central Indiana? A five mile quadrat study. Butler Univ. Bot. Stud. 4: 181-195. 1940.
14. ——— ——— AND CARL O. KELLER. Phytosociology of Cox woods: A remnant of forest primeval in Orange County, Indiana. Butler Univ. Bot. Stud. 5: 190-221. 1942.
15. Society of American Foresters. Forest cover types of the eastern U. S.; Report of committee on forest types. Journ. Forest. 30: 451-498. 1932.
16. VISHER, STEPHEN S. The geography of Indiana. Handbook of Indiana geology. Part I: 11-58. 1922.

TABLE I

Size—classes of various species in 50 quadrats. a—north sector (25 quadrats). b—south sector (25 quadrats).

Species		Below 1"	1"	2"	3-5"	6-10"	11-15"	16-20"	21-25"	26-30"	31-35"	36-40"	41-45"	46-50"	Total stems above 1"
Acer	a	9	3												3
negundo	b	13	9	2											11
A.	a	4	2		1										3
rubrum	b	3	1	1											2
A.	a	82	36	21	19	1									77
saccharum	b	114	43	34	22	3			1	1					104
Asimina	a	106	7												7
triloba	b	109	7	1											8
Carpinus	a	8	16	10	8										34
caroliniana	b	14	11	5	7	1									24
Carya	a	4	2												2
cordiformis	b	6	1						1						2
C. glabra	a	2													
C.	a	9	2					1	2	2					7
laciniosa	b	17	4	1	3	1	1	1	3	1					15
Celtis	a	2	2	1	1										4
occidentalis	b	7	3	1	3										7
Cercis	a														
canadensis	b		1												1
Cornus	a			2											2
florida	b	3													
Crategus spp.	a	6	2	3	1										6
	b	3	1		3										4
Evonymus	a														
atropurpurea	b	3	1												1
Fagus	a	13	20	15	9	2	4	9	7						66
grandifolia	b	8	11	8	1	1	7	10	7	1					46
Fraxinus	a	155	23	9	15	1					1	1			50
americana	b	169	52	30	17	1	3	1	3	1					108
F.	a														
nigra	b								1						1
Gleditsia	a														
triacanthos	b					1									1
Gymnocladus	a	4	1			1		1							3
dioica	b		1				1								2
Juglans	a	1	1												1
cinerea	b														
J.	a	2													
nigra	b								1						1
Lindera	a	380	20	1											21
benzoin	b	685													
Liquidambar	a	2			2					1					3
styraciflua	b	2				2				1					3

TABLE I—(Continued)

Size—classes of various species in 50 quadrats. a—north sector (25 quadrats). b—south sector (25 quadrats).

Species		Below 1"	1"	2"	3-5"	6-10"	11-15"	16-20"	21-25"	26-30"	31-35"	36-40"	41-45"	46-50"	Total stems above 1"
Liriodendron	a	4	1	1	8	3									13
tulipifera	b	1			2		1		1			1			5
Morus	a	15	4												4
rubra	b	6		4	1										5
Ostrya	a	10	7	1	1										9
virginiana	b	1	1												1
Prunus	a	25	14	3	5		1								23
serotina	b	44	9		4										13
Quercus	a	2								1	1				2
alba	b						1					1		1	3
Q.	a	3					1								1
bicolor	b						1					1	1		3
Q. borealis	a	2	1	2							1				4
var. maxima	b	2	1		1						1		1		4
Rhus	a	202	1												1
toxicodendron	b	42													
Ribes	a	22													
americanum	b														
Rosa	a	4													
palustris	b														
Rubus	a														
allegheniensis	b	1													
R.	a	1													
occidentalis	b														
Sambucus	a														
canadensis	b	1													
Smilax	a	9													
hispida	b	1													
Campsis	a	5													
radicans	b														
Tilia	a	7	1	1			2			1					5
americana	b	13	3	1	3			1							8
Ulmus	a	6	4	1	3	1	2	1			1				13
americana	b	7		1		5	2		2		2	1			13
U.	a	19	3												3
fulva	b	11	3		1	1									5
Viburnum	a	19	2												2
prunifolium	b	17	3												3
Vitis	a	10	3												3
sp.	b	2													
Zanthoxylem	a	10													
americanum	b	4													

TABLE II

Showing percentages of small stems, total stems, basal areas and F. I. a—north sector (25 quadrats) b—south sector (25 quadrats)

Species		Stems below 1" No.	%	Stems 1"—2" No.	%	Total stems No.	%	Basal areas sq. in.	%	F. I.
Acer	a	9	.78	3	1.21	3	.82	2.36	.01	28
negundo	b	13	1.00	11	4.29	11	2.72	13.35	.04	36
A.	a	4	.34	2	.81	3	.81	14.14	.08	12
rubrum	b	3	.23	2	.78	2	.49	3.93	.01	04
A.	a	82	7.05	57	22.98	77	20.81	368.37	2.11	88
saccharum	b	114	8.84	77	30.08	104	25.68	1462.41	4.71	88
Asimina	a	106	9.11	7	2.82	7	1.89	5.50	.03	68
triloba	b	109	8.46	8	3.12	8	1.98	8.64	.02	76
Carpinus	a	8	.69	26	10.48	34	9.19	117.02	.67	52
caroliniana	b	14	1.08	16	6.25	24	5.93	112.31	.36	36
Carya	a	4	.34	2	.81	2	.54	1.57	.01	16
cordiformis	b	6	.47	1	.39	2	.49	491.66	1.60	32
C.	a	2	.17	—	—	—	—	—	—	04
glabra	b	—	—	—	—	—	—	—	—	—
C.	a	9	.77	2	.81	7	1.89	2509.35	14.42	44
laciniosa	b	17	1.32	5	1.95	15	3.71	2394.68	7.71	60
Celtis	a	2	.17	3	1.21	4	1.08	17.28	.10	16
occidentalis	b	7	.54	4	1.56	7	1.73	44.77	.14	32
Cercis	a	—	—	—	—	—	—	—	—	—
canadensis	b	—	—	1	.39	1	.25	.78	—	04
Cornus	a	—	—	2	.81	2	.54	6.28	.04	04
florida	b	3	.23	—	—	—	—	—	—	04

TABLE II—(Continued)

Showing percentages of small stems, total stems, basal areas and F. I. a—north sector (25 quadrats) b—south sector (25 quadrats)

Species		Stems below 1" No.	%	Stems 1"—2" No.	%	Total stems No.	%	Basal areas sq. in.	%	F. I.
Crategus	a	6	.52	5	2.02	6	1.62	30.63	.18	20
spp.	b	3	.23	1	.39	4	.99	32.99	.11	24
Evonymus	a	—	—	—	—	—	—	—	—	—
atropurpurea	b	3	.23	1	.39	1	.25	.78	—	08
Fagus	a	13	1.12	35	14.11	66	17.84	6043.65	37.41	76
grandifolia	b	8	.62	19	7.42	46	11.38	7202.90	23.12	64
Fraxinus	a	155	13.33	32	12.90	50	13.51	2324.00	13.35	96
americana	b	169	13.11	82	32.03	108	26.27	2797.59	9.01	100
F.	a	—	—	—	—	—	—	—	—	—
nigra	b	—	—	—	—	1	.25	527.56	1.89	4
Gleditsia	a	—	—	—	—	—	—	—	—	—
triacanthos	b	—	—	—	—	1	.25	78.54	.25	4
Gymnocladus	a	4	.34	1	.40	3	.81	252.11	1.45	16
dioica	b	—	—	1	.39	2	.49	177.50	.58	4
Juglans	a	—	—	—	—	—	—	—	—	—
cinerea	b	1	.08	1	.39	1	.25	.78	—	8
J.	a	2	.17	—	—	—	—	—	—	4
nigra	b	—	—	—	—	1	.25	314.16	1.00	4
Lindera	a	380	32.67	21	8.46	21	5.66	18.85	.11	80
benzoin	b	665	51.59	—	—	—	—	—	—	72
Liquidambar	a	4	.34	2	.81	3	.81	563.13	3.24	20
styraciflua	b	2	.16	—	—	3	.74	807.39	2.60	12

TABLE II—(Continued)

Showing percentages of small stems, total stems, basal areas and F. I. a—north sector (25 quadrats) b—south sector (25 quadrats)

Species		Stems below 1" No.	%	Stems 1"—2" No.	%	Total stems No.	%	Basal areas sq. in.	%	F. I.
Liriodendron	a	4	.34	2	.81	13	3.51	292.95	1.70	28
tulipifera	b	1	.08	—	—	5	1.23	1135.69	3.66	24
Morus	a	15	1.29	4	1.61	4	1.08	3.14	.02	24
rubra	b	6	.47	4	1.56	5	1.23	19.63	.06	40
Ostrya	a	10	.86	8	3.22	9	2.43	15.71	.09	32
virginiana	b	1	.08	1	.39	—	.25	.78	—	8
Prunus	a	25	2.15	17	6.85	23	6.22	188.49	1.08	40
serotina	b	44	3.41	9	3.52	13	3.21	40.84	.13	40
Quercus	a	2	.17	—	—	2	.54	1614.78	9.21	16
alba	b	—	—	—	—	3	.74	3274.33	10.54	12
Q.	a	3	.26	—	—	1	.27	113.10	.65	8
bicolor	b	—	—	—	—	1	.25	2798.38	9.01	12
Q. borealis	a	2	.17	3	1.21	4	1.08	538.00	3.09	20
var. maxima	b	2	.16	1	.39	4	.99	2496.00	8.04	20
Rhus	a	202	17.37	1	.40	1	.27	.78	—	72
toxicodendron	b	42	3.26	—	—	—	—	—	—	32
Ribes	a	22	1.90	—	—	—	—	—	—	4
americanum	b	—	—	—	—	—	—	—	—	—
Rosa	a	4	.34	—	—	—	—	—	—	4
palustris	b	—	—	—	—	—	—	—	—	—
Rubus alle-	a	—	—	—	—	—	—	—	—	—
gheniensis	b	1	.08	—	—	—	—	—	—	4

TABLE II—(Continued)

Showing percentages of small stems, total stems, basal areas and F. I. a—north sector (25 quadrats) b—south sector (25 quadrats)

Species		Stems below 1" No.	%	Stems 1"—2" No.	%	Total stems No.	%	Basal areas sq. in.	%	F. I.
R.	a	1	.09	—	—	—	—	—	—	4
occidentalis	b	—	—	—	—	—	—	—	—	—
Sambucus	a	—	—	—	—	—	—	—	—	—
canadensis	b	—	.08	—	—	—	—	—	—	4
Smilax	a	9	.77	—	—	—	—	—	—	16
hispida	b	1	.08	—	—	—	—	—	—	4
Campsis	a	5	.43	—	—	—	—	—	—	4
radicans	b	—	—	—	—	—	—	—	—	—
Tilia	a	7	.60	2	.81	5	1.35	762.32	4.38	24
americana	b	13	1.00	4	1.56	8	1.98	238.76	.78	24
Ulmus	a	6	.52	5	2.02	13	3.51	1602.22	9.20	40
americana	b	7	.54	1	.39	13	3.21	4461.07	14.31	44
U.	a	19	1.63	3	1.21	3	.81	2.36	.01	24
fulva	b	11	.86	3	1.17	5	1.23	78.54	.25	28
Viburnum	a	19	1.63	2	.81	2	.54	1.57	.01	12
prunifolium	b	17	1.32	3	1.17	3	.74	—	—	16
Vitis	a	10	.86	3	1.21	3	.81	2.36	.01	28
spp.	b	2	.16	—	—	—	—	—	—	4
Zanthoxylem	a	10	.86	—	—	—	—	—	—	8
americanum	b	4	.31	—	—	—	—	—	—	12