

An ecological survey of Berkey woods: A remnant of forest primeval in Kosciusko county, Indiana

J. E. Potzger
Butler University

Ray C. Friesner
Butler University

Follow this and additional works at: <http://digitalcommons.butler.edu/botanical>

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.

Recommended Citation

Potzger, J. E. and Friesner, Ray C. (1943) "An ecological survey of Berkey woods: A remnant of forest primeval in Kosciusko county, Indiana," *Butler University Botanical Studies*: Vol. 6 , Article 2.

Available at: <http://digitalcommons.butler.edu/botanical/vol6/iss1/2>

Butler University
Botanical Studies
(1929-1964)

Edited by

Ray C. Friesner

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, Daudenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

Requests for use of materials, especially figures and tables for use in ecology text books, from the *Butler University Botanical Studies* continue to be granted. For more information, visit www.butler.edu/herbarium.

AN ECOLOGICAL SURVEY OF BERKEY WOODS, A REMNANT OF FOREST PRIMEVAL IN KOS- CIUSKO COUNTY, INDIANA

By J. E. POTZGER AND RAY C. FRIESNER

In July 1942, we published results of a detailed study of Cox Woods, a remnant of forest primeval in Orange county, located in southern Indiana (9). In the present study we place on record quantitatively a relatively undisturbed stand of forest in the northern part of Indiana. The Berkey Woods is located along the Tippecanoe river, 3.5 miles northwest of Warsaw, and in it is found a giant *Juercus macrocarpa* which Deam (3) calls the "biggest tree in Indiana." It is an excellently preserved specimen of bur oak which inspires by its towering height and immense diameter of trunk. The Warsaw, Indiana, Chamber of Commerce published the following description of this veteran oak: height 124 feet, circumference 23.5 feet, diameter 7.5 feet, distance to first limb 61 feet. Our own circumference measurements on November 30, 1942, were 21 feet and 10 inches, 4.5 feet above the base.

The once renowned Eastern deciduous forest, expressed exceptionally well in Indiana, has now vanished as a forest primeval except for a few isolated smaller tracts. Special effort is made by our department of botany to study every comparatively little disturbed stand of this great forest as a permanent record of the sociological factors which operated. We are of the opinion that forest studies are of greater significance if a quantitative report forms the basis of description. Only thus can comparisons be made with other stands, and in this way only can botanists of the future reconstruct the forest primeval.

Tharp (11) describes the northwestern quarter of the state in which the Berkey Woods is located as a slightly uneven plain with a few prominent ridges. Much of the section is "somewhat undulating" and rises only a few feet above the wide flats near Leesburg, Kosciusko county. The fertile loam soil of the area also promises good returns for agriculture.

METHODS

Fifty 100-square-meter quadrats were involved in the quantitative study. A stout cord divided by loops into four ten-meter sections, rolled on a large reel, was used to mark off the quadrats. The loops fitted easily over wooden stakes driven into the ground and thus facilitated a comparatively rapid tabulation of the fifty quadrats. One person laid out the quadrats, another called the species and measured DBH. of stems one inch or above, and a third person tabulated the results. All trees one inch or over in diameter were measured with wooden calipers. DBH. measurements as well as number of stems in the quadrat were recorded. All young trees less than one inch DBH. but at least one meter in height were also counted. It is our opinion that young trees of this size record more accurately the status of reproduction than seedlings, which may not survive the first season.

RESULTS

Thirty woody species constitute the major part of the vegetation complex (table I). These can be divided roughly into 18 species of tall trees, 3 of small trees, 3 of tall shrubs, and 6 of small shrubs. A striking feature is the absence of lianas. The crown cover is controlled primarily by *Acer saccharum* and *Fagus grandifolia* as density, frequency, and basal area well reflect (table I). However, so many other species participate in the arboreal layer that the stand can hardly be called beech-maple. For that reason we favor the mixed mesophytic forest concept of Miss Braun (2). We consider this to be the typical climax for Indiana (9) in the most mesophytic habitat sites. The F. I. of the second layer trees (*Ostrya*, 54% and *Carpinus*, 20%) show that this layer is only weakly expressed. While the representation of shrubby species is high, coverage of the stratum is low. Only *Asimina triloba* with a F. I. of 56% and density of 400 stems makes any decided claim on high coverage. Both *Acer saccharum* and *Fagus grandifolia* show excellent reproduction (table I). The Berkey Woods is outstanding by the rather impressive number of very large trees. Just to name the DBH. in inches of a few of these: *Liriodendron* 46, 48, 49; *Fraxinus quadrangulata* 31; *Ulmus thomasi* 48, 49, 44, 36; *Quercus macrocarpa* 32, 33 in addition to the one previously described as the largest tree in Indiana.

DISCUSSION

Papers on forest study—even those designated as ecological surveys, are primarily of two types, viz. (1) descriptive: based on super-

ficial peripheral observations; and (2) diagnostic: based on quantitative and qualitative field data. The first type deals with generalities and can hardly be used in a comparable manner with studies in other localities, hence can never lead to a solution in the understanding of vegetation. Plato says, "If arithmetic, mensuration and weighing be taken from any art that which remains will not be much." This is certainly true of an ecological analysis of the complex Eastern deciduous forest. As we have stressed in previous studies, mere observational studies of a forest is inaccurate in detail. A few large trees may catch the eye, and the observer receives the impression that these species constitute the most important part of the vegetation complex, when in reality they may play only a minor role. Merging phenomena can be appreciated adequately only if quantitative data are available. This is, no doubt, the reason why botanists, in experimental fields where quantitative data back conclusions, frequently feel that the work of the ecologist is vague. It would be of tremendous value to an understanding of forest primeval, before civilized man disturbed it so extensively, if we had quantitative data on at least a few larger tracts. We would no doubt have a better picture of the sociology and the environment which controlled it.

According to Tharp (11) the soil occupied by the Berkey Woods is of a fertile loam type with fine water-holding capacity which carries good moisture conditions through prolonged rainless periods. Very favorable mesophytic habitat conditions are evidently necessary to enable the ultimate climax mixed mesophytic forest to establish and maintain itself in Indiana. Apparently it finds expression in any part of the state where the above-mentioned habitat conditions prevail. In southern Indiana it is found on north-facing slopes (8) and in northern Indiana on the better loam soils.

The number of tree species entering into the forest complex is similar to that of Cox Woods (9), but shrub species are more abundant. *Juglans nigra* and *Liriodendron tulipifera* occupy a less prominent place in the Berkey stand than in the Cox Woods. This may be due to selective cutting. Two large black walnut stumps observed, one 16.5 feet in circumference 3 feet above the base, the other 14 feet, 3 inches, indicate that at least some of the more valuable timber trees were cut. The numerous stems in the small size classes (table I) also reflect some disturbance by man. As Auten (1) and Potzger (7) have found, a mature forest supports less than 300 stems per acre and the Berkey Woods has a considerably higher number. All important

components of the crown cover show excellent reproduction, even *Fagus* has a much greater representation in the young stem group than in many stands of central southern Indiana as reported by Potzger and Friesner (8).

Special attention should be drawn to the important place which *Ulmus thomasi* takes in the large size-classes, and therefore in control of the crown cover. Bog pollen studies clearly indicate that *Ulmus* is a persistent invader of the forests in post-Pleistocene times but seldom shows aggressive tendencies (4, 5, 6, 10). Its winged seeds facilitate invasion, and its physiological requirements must permit a wide range of temperature suitable for ecdysis. *Ulmus thomasi* as a rule is a common floodplain species in most Indiana forests. Its abundance in the Berkey Woods associated there with *Acer saccharum* and *Fagus* indicates high soil moisture but not lacking aeration, at least not during the growing season. While *Asimina triloba* occupies a similar position in both Cox and Berkey woods its abundance and frequency are lower in the northern stand. *Fagus* and *Acer saccharum* are without doubt the most important species in the mixed mesophytic forest in Indiana, which is also indicated by the frequent reference to this type as beech-maple. Abundance and frequency figures of table I characterize them, too, as most aggressive in control of the crown cover. One is always impressed with the prolific reproduction of *Acer saccharum* in mesic habitats over its entire range. Table I so graphically pictures the association complex which represents the ultimate climatic climax forest in Indiana under most favorable soil moisture conditions that lengthy discussions are hardly required. A detailed comparison of several stands of forest primeval (mixed mesophytic) still existing in Indiana was given in the study on Cox Woods by Potzger, Friesner and Keller (9).

SUMMARY AND CONCLUSIONS

1. The paper presents an ecological study of Berkey Woods in Kosciusko county, Indiana. It is based on fifty 100-square-meter quadrat tabulations.
2. Special attention was given the sociological factors frequency, density, basal area and expression of various strata in the woody species.
3. Eighteen species of tall trees participate in the crown cover, four in the small tree stratum and eight in the shrub layer.
4. The most important species in the crown cover are *Acer*

saccharum (F. I. 98; 246 stems one inch or above DBH.; basal area 11,411.87 sq. in.), *Fagus grandifolia* (F. I. 78; 89 stems one inch or over DBH.; basal area 6,985.279 sq. in.), *Ulmus thomasi* (F. I. 56; 56 stems one inch or above DBH.; basal area 9,723.82 sq. in.).

5. *Acer saccharum*, *Fagus grandifolia* and *Ulmus thomasi*, species with highest F. I., show excellent reproduction.

6. The Berkey Woods is a typical mixed mesophytic forest. This is the ultimate climax in Indiana under optimum mesophytic habitat conditions.

ACKNOWLEDGMENT

We are indebted to Mr. Scott McCoy, Assistant Curator of the Herbarium, and to Messrs. Matthew Harmon, Robert Kent and Dayton Swickard, advanced students in the Botany Department, for assistance in the survey work.

LITERATURE CITED

1. AUTEN, JOHN T. Notes on old-growth forests in Ohio, Indiana and Illinois. U. S. D. A. Forest Service, Central States For. Exp. Sta. Tech. Note 49. 1941.
2. BRAUN, E. LUCY. Deciduous forest climaxes. *Ecol.* 19:515-522. 1938.
3. DEAM, CHARLES C. Trees of Indiana. 4th ed. Indiana Dept. of Conservation. 1931.
4. HAMP, FRANK A. A fossil pollen study of two northern Indiana bogs. *Butler Univ. Bot. Stud.* 4:217-225. 1940.
5. MOSS, BYRON W. A comparative pollen analysis of two bogs within boundaries of late Wisconsin glaciation in Indiana. *Butler Univ. Bot. Stud.* 4:207-216. 1940.
6. OTTO, JAMES H. Forest succession of the southern limits of early Wisconsin glaciation as indicated by a pollen spectrum from Bacon Swamp, Marion county, Indiana. *Butler Univ. Bot. Stud.* 4:93-116. 1938.
7. POTZGER, J. E. The phytosociology of the forest primeval in central northern Wisconsin and upper Michigan (Ms.).
8. ——— AND RAY C. FRIESNER. What is climax in central Indiana? A five-mile quadrat study. *Butler Univ. Bot. Stud.* 4:181-195. 1940.
9. ——— AND C. O. KELLER. Phytosociology of the Cox Woods: A remnant of forest primeval in Orange county, Indiana. *Butler Univ. Bot. Stud.* 5:190-221. 1942.
10. ——— AND IRA T. WILSON. Post-Pleistocene forest migration as indicated by sediments from three deep inland lakes. *Amer. Midl. Nat.* 25:270-289. 1941.
11. THARP, W. E., ET AL. Soil survey of Kosciusko county, Indiana. 1927.

TABLE I
Results of fifty 100-square-meter quadrat study in Berkey Woods.

| Species | Below 1 in. | 1-2 | 3-5 | 6-10 | 11-15 | 16-20 | 21-30 | Above 30 | Total Stems | | Total Basal Area in Sq. In. |
|-----------------------------|----------------|-----|-----|------|-------|-------|-------|-------------|----------------|-------|-----------------------------------|
| | | | | | | | | | Above 1 in. | F. I. | |
| <i>Acer rubrum</i> | 2 | | 1 | | | | | | 1 | 4 | 7.0686 |
| <i>A. saccharum</i> | 250 | 133 | 39 | 31 | 24 | 13 | 6 | | 246 | 98 | 11,411.8720 |
| <i>Aesculus glabra</i> | 2 | 2 | 1 | 2 | | | | | 5 | 12 | 126.4494 |
| <i>Asimina triloba</i> | 288 | 99 | 3 | | | | | | 102 | 56 | 158.6608 |
| <i>Carpinus caroliniana</i> | 5 | 21 | | | | | | | 21 | 20 | 22.7766 |
| <i>Carya cordiformis</i> | 13 | 1 | | | 1 | | | | 2 | 18 | 101.3166 |
| <i>Celtis occidentalis</i> | 18 | 6 | 1 | | | | | | 7 | 22 | 14.1372 |
| <i>Cornus alternifolia</i> | 1 | | | | | | | | | 2 | |
| <i>Corylus americana</i> | 2 | | | | | | | | | 2 | |
| <i>Crataegus sp?</i> | 1 | | | | | | | | | 2 | |
| <i>Dirca palustris</i> | 26 | 3 | | | | | | | 3 | 30 | |
| <i>Fagus grandifolia</i> | 34 | 65 | 3 | 1 | 4 | 7 | 9 | | 89 | 78 | 6,985.2792 |
| <i>Fraxinus americana</i> | 7 | 3 | 2 | 1 | | 4 | 3 | | 13 | 24 | 2,710.4154 |
| <i>F. lanceolata</i> | 1 | 1 | | | | | | | 1 | 4 | .7854 |
| <i>F. quadrangulata</i> | | 1 | | 1 | | | | 1 | 3 | 6 | 805.8204 |
| <i>Juglans nigra</i> | | | | | | 1 | | | 1 | 2 | 283.5294 |

TABLE I—(Continued)

Results of fifty 100-square-meter quadrat study in Berkeley Woods.

| Species | Below 1 in. | 1-2 | 3-5 | 6-10 | 11-15 | 16-20 | 21-30 | Above 30 | Total Stems | | Total Basal Area in Sq. In. |
|--|----------------|-----|-----|------|-------|-------|-------|-------------|----------------|-------|-----------------------------------|
| | | | | | | | | | Above 1 in. | F. I. | |
| <i>Lindera benzoin</i> | 1 | | | | | | | | 2 | | |
| <i>Liriodendron tulipifera</i> | 1 | 3 | 1 | 3 | 2 | | 3 | 3 | 12 | 16 | 6,032.6514 |
| <i>Ostrya virginiana</i> | 60 | 30 | 1 | | | | | | 31 | 54 | 140.5866 |
| <i>Prunus serotina</i> | 2 | 1 | 1 | 1 | | | | | 3 | 8 | 51.1510 |
| <i>Quercus borealis</i> var. <i>maxima</i> | | | | | | 1 | | | 2 | 4 | 661.3068 |
| <i>Q. macrocarpa</i> | | 1 | | | | | 2 | 2 | 2 | 2 | 1,659.5502 |
| <i>Ribes</i> sp.? | 1 | | | | | | | | | 2 | |
| <i>Sambucus canadensis</i> | 8 | | | | | | | | | 2 | |
| <i>Tilia americana</i> | 15 | 10 | 1 | | 2 | 1 | 2 | | 16 | 14 | 1,551.9504 |
| <i>Ulmus americana</i> | | 1 | | 1 | | | | | 2 | 4 | 66.7590 |
| <i>U. fulva</i> | 83 | 8 | 7 | 1 | 1 | | | | 17 | 32 | 330.6534 |
| <i>U. thomasi</i> | 30 | 31 | 14 | 3 | 8 | 2 | 1 | 5 | 64 | 56 | 9,723.8228 |
| <i>Viburnum acerifolium</i> | 1 | | | | | | | | | 2 | |
| <i>Zanthoxylum americanum</i> | 1 | | | | | | | | 1 | 2 | |