

ECOLOGY

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ABSTRACTS

Analysis of Possible Successional Trends within the Tree Stratum in Old-growth Beech-maple Dominated Forests.¹ M. T. JACKSON, Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809.—Twenty-one old-growth forest stands located in Indiana, Ohio and Michigan were sampled by taking 40, 1/40-hectare rectangular plots in each stand. In addition to the usual species attributes of density, frequency, basal area and importance values, the species were grouped into five moisture adaptation categories which range from xerophytic to hydrophytic. Analysis of changes in collective importance values by species-moisture category for canopy trees (>12 inches diameter breast height) *versus* sub-canopy trees (4-12 inches dbh) revealed that species shifts are occurring in several stands. Eight stands (Heuston, Toumey, Manlove, Officer, Hoot, Meltzer, Ogden and Haven Hill Woods) showed negligible changes. Six stands (Allee, Cox, Weaver, Logansport, Russ and Pine Hills Woods) appear to be increasing in wet mesic and mesic species, with corresponding declines in dry mesic and xeric trees. Seven stands (Warren, Bendix, Price Memorial, Versailles, Timberlane, Kado-Lato and Big Walnut Woods) exhibited an opposite trend with increasing values for dry mesic and xeric species, with corresponding declines in wet mesic and mesic species.

Greater importance values were recorded for American beech (*Fagus grandifolia* Ehrh.) than for sugar maple (*Acer saccharum* Marsh.) in the canopy stratum in 17 of the 21 stands. The four stands (Kado-Lato, Toumey, Price Memorial and Allee) where sugar maple had the greatest importance values were likely all used as maple sugar camps in the past, thus selection for sugar maple probably occurred. Conversely, sugar maple had higher importance values in the sub-canopy stratum than did American beech in 20 of 21 stands (Timberlane in Ohio, being the lone exception). These shifts in importance from canopy to sub-canopy strata are not proof that sugar maple is replacing beech as the stands mature. Differential survival rates between the two species maintain high levels of beech domination in old-growth stands. In fact, beech in the canopy stratum exceeded 35 per cent importance value in 15 of the 21 stands and exceeded 50 per cent importance value in four stands.

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The Groundlayer of the Beech-Maple Association: A Community Structure Analysis.¹ JAMES B. LEVENSON,² Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809.—The groundlayer stratum was sampled by 40, 1/4000-hectare rectangular plots in each of 21 old-growth beech-maple forests in Indiana, Ohio, and Michigan during the summer of 1972. Density, frequency, abundance, constancy, commonness, importance value, and species association were compiled for all vascular plants less than 0.5 m tall within each stand and for the overall association. The groundlayer was a constantly varying assemblage containing a total of 174 species for all stands. Sugar maple (*Acer saccharum* Marsh.) and woodbine (*Parthenocissus quinquefolia* (L.) Blanch.) were dominant within the overall association, but were influenced by the inclusion and deletion of subordinate species among the 21 individual stands.

A community ordination of the 21 stands was constructed. The ordination was linear and controlled by the degree of domination by sugar maple and woodbine. A general inverse relationship between those two species suggested control by available light. Actual placement of each stand along the line was largely determined by a parallel moisture gradient.

A New Method for Extracting Tree Roots from Soil. BYRON HOLLETT,³ Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809.—A new method was developed to extract tree root material from soil samples (each sample was 2.5 centimeters in diameter by 7.5 to 15.0 centimeters long) the length depending on the depth from which the sample was taken. Also, specimens were taken from the root systems of tree seedlings which had been extracted.

Fiberglass screen cylinders (each 2.5 centimeters in diameter by 15.0 centimeters long with one end screened over) were securely fitted into 250 milliliter Ehrlenmeyer flasks. Each screen cylinder, containing a soil sample, was placed in a flask half filled with an aqueous solution of trisodium phosphate (trade name, Calgonite) which acts as a soil dispersing agent. The flasks were shaken at a low to moderate speed on an electric shaker for approximately 24 hours. The cylinders were then removed and washed under tap water to remove any remaining soil particles from the root material.

Root specimens were obtained from the tree seedlings by submerging the entire root system in a warm aqueous solution of Calgonite for 15-20 minutes, meanwhile agitating the trees by hand. The root systems were then washed under tap water to remove any remaining soil particles. Root sections were then cut with a scalpel.

These methods efficiently provided relatively soil-free root specimens from both individual samples and entire root masses.

¹ A research grant from the Indiana Academy of Science for field expenses is gratefully acknowledged.

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Site Preferences and Growth Responses of Kentucky Coffeetree, *Gymnocladus dioicus* (L.) K. Koch, Near the Center of its Range. MANSON LESLIE MCCLAIN,¹ Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809.—Vegetation associates, growth data, and soil samples were obtained within 0.1-acre circular plots centered around coffeetrees at 141 sites located in and around Vigo County, Indiana. Attributes tables were constructed and the soils were analyzed for pH, texture, and concentration of potassium, calcium, and magnesium.

Hackberry was the most prominent associated species followed by black walnut, American elm, and sugar maple. The coffeetree occurred on slope, terrace, upland, floodplain, and depressional topography. The coffeetree exhibited a preference for the lighter textured soils and was distributed bimodally with respect to pH, with occurrences generally around pH 6.0 and 8.0. Nutrient concentrations were higher in the topsoil than in the subsoil.

The coffeetree reproduces both sexually and vegetatively (by root suckers). The latter occurs more frequently and with greater growth rates especially in the more disturbed situations. Running water is probably the most effective dispersal mechanism followed by wind and human activity.

Bacterial and Chemical Analyses of Cardinal Creek Flowing through Ball State University, from May to December, 1972. PATRICIA A. EDDY, Department of Biology, Ball State University, Muncie, Indiana 47306.—Detailed bacterial and chemical studies were conducted on Cardinal Creek, flowing through the Ball State University campus from May to December, 1972. Samples were collected from drain pipes flowing into the stream and also from the center of the stream between drain pipes.

Results indicate that human waste materials are entering Cardinal Creek at the sampling site located behind the Ball State trailer courts. Ratios of fecal coliforms to fecal streptococci at this site were above 4.0 in 44% of the samples, thus indicating human waste contamination.

The presence of pathogens is another clue to the quality of surface water. *Salmonella* and *Shigella* are associated with gastrointestinal diseases that may be spread by ingestion of water contaminated with these bacteria. Both *Salmonella* and *Shigella* were isolated on several occasions from the drain pipe behind the trailer courts. *Salmonella paratyphi* (found on December 28) is evidence that human wastes are entering the stream.

Chemical data, collected on December 28, indicate a heavy load of organic matter is entering Cardinal Creek at the Ball State trailer court drain pipe. Of all the sites sampled on this date, the highest values for nitrogen and phosphorus and the lowest values for oxygen were found at the trailer court location. Measures should be taken to correct the situation.

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The Limitation of Oxygen Demand Tests for Water Pollution Control. ROBERT H. L. HOWE, Eli Lilly and Company Tippecanoe Laboratories, Lafayette, Indiana 47902.—The limitation of biochemical oxygen demand, dichromate chemical oxygen demand and other oxygen-demand tests for water pollution control were discussed. Suggestions for improvement were presented.

Effect of Diquat upon the Root and Mycorrhiza System of *Liriodendron tulipifera* L. JAMES M. SPROAT, Department of Biology, Ball State University, Muncie, Indiana 47306.—The effect of an herbicide (Diquat) upon the root and mycorrhiza system of the tuliptree (*Liriodendron tulipifera* L.) was determined. The herbicide was applied under normal field conditions and concentrations by spraying the tuliptree foliage. The trees were as similar in size, age, location and soil conditions as field conditions permitted. The aerial portions of the trees were removed at pre-determined time periods to prevent any further translocation. The root systems were then removed and analyzed for herbicide content. The herbicide concentration within the root system was determined by subjecting root (and mycorrhiza) samples (taken at three time intervals) to extraction and gas chromatography analysis.

Assessment of Characteristics of Strip-mined Areas of Indiana. ROGER M. HOFFER,¹ L. A. BARTOLUCCI,² and J. S. BERKEBILE,² Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana 47906.—Due to pending legislation in Congress dealing with strip-mining procedures, detailed information is needed concerning the areal extent and condition of lands affected by strip-mining. Further information is required for a Department of Interior study dealing with assessment of the extent and quality of surface waters in strip-mined areas for fisheries potential. Small scale color infrared imagery (1:120,000) was used to estimate the areas of water bodies located in strip-mined areas of Indiana and to correlate spectral characteristics of the water with various aspects of water quality. The need for additional information prompted a computer-aided classification of multispectral scanner data gathered by aircraft over strip-mined land in Greene, Sullivan, Knox, and Daviess Counties. The correlation of spectral classes of water with pH levels was attempted. Acreage estimates of surface water, agricultural, and forest covers have been made. The results suggest a potential method for rapidly assessing many qualitative and quantitative characteristics of strip-mined land.

NOTE

An Ecological Analysis of the Shrub Stratum in the Beech-Maple Forest Type.³ HENRY M. DONSELMAN,⁴ Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809.—The tree, shrub, and

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ground layer were sampled by 40, 1/400-hectare rectangular plots in each of 21 old-growth beech-maple forests in Indiana, Ohio, and Michigan during the summer of 1972. Only stands in which beech and hard maple comprised a total of at least 50 per cent of the canopy stratum were selected. Sites with a recent history of grazing, burning, or timbering were not used.

Density, frequency, distribution, and species associations were compiled for each species in each stand and for the entire study area. A three-dimensional ordination was constructed, based on the importance values of the species (1).

The following conclusions relate to the shrub layer of the Beech-Maple Association:

- 1) A single plant community was not present in the Beech-Maple Association, rather, several communities approach a continuum which depends on climatic, edaphic, and geographic factors.
- 2) Sugar maple (*Acer saccharum* Marsh.) reproduction and spicebush (*Lindera benzoin* L. Blume.) were the most important component species of the shrub layer.
- 3) The importance of American beech (*Fagus grandifolia* Ehrh.) was attributed to the even distribution and high frequency of the species in each stand and throughout the Association.
- 4) The importance of sugar maple and beech in the shrub stratum was generally higher in northern stands and lower in southern stands, substantiating the theory that the Beech-Maple Association is best developed on youthful topography.
- 5) Eleven combinations of 8 woody species were found to dominate the 21 stands.
- 6) Only two species, sugar maple and American beech, were sampled in all 21 stands.
- 7) Sugar maple, due to its high frequency, significantly associated with the most species on both the intrastand and interstand level.
- 8) Beech and maple associated positively in 20 of the 21 stands.
- 9) Unusually high numbers of negative species associations were found for bitternut hickory (*Carya cordiformis* (Wang.) K. Koch.), spicebush, pawpaw (*Asimina triloba* (L.) Dunal.) and hop-hornbean (*Ostrya virginiana* (Mill.) K. Koch.) on the interstand level.
- 10) The number of woody species in the shrub stratum was influenced by the amount of past disturbance and number of microhabitats in a stand.
- 11) Work with the ground layer (2) and the tree stratum (Jackson, unpubl. data) indicate that the ground layer is largely controlled by micro-environments, the shrub layer by both the micro-environment and regional environment, and the tree stratum by the regional environment.
- 12) Stands in which the regional climate is modified have a mixing of northern or southern species with the species common in that area.

Literature Cited

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