

PLANT SPECIES OF BEALL'S WOODS, WABASH CO., ILLINOIS

WILLIAM C. ASHBY and JAMES E. OZMENT
Botany Department, Southern Illinois University, Carbondale 62901

ABSTRACT — A total of 340 species were found on approximately 300 forested acres. Eight forest types were recognized, four on the upland and four on the floodplain periodically inundated by the Wabash River. White oak predominated on the upland. Several tree species important in the lower Mississippi River bottomlands were found on the floodplain. Trees 3 and 4 feet in diameter were relatively common, particularly on the floodplain.

Beall's Woods lie about eight miles south of Mt. Carmel, Illinois in approximately a half section of land on both sides of Coffee Creek and Sugar Creek at their confluence with each other and with the Wabash River. This area was acquired by the Illinois Department of Conservation in 1965. During the Wisconsin glacial period the Wabash Valley had been entrenched and subsequently filled with sediments (outwash, lacustrine flats, and loess). Flood stages of 30 feet on the Wabash, which reach approximately the 400-foot contour at Beall's Woods, cover about half of the nearly 300 forested acres. Only a small portion of the floodplain remains under water longer than the period of flood in the Wabash. Wells in the vicinity contribute oil which is carried by flood waters and has been deposited on tree trunks and on litter piles left by the waters.

Mr. Archie Esarey of nearby Rochester, Illinois, son and brother of tenants who farmed the property from 1912 for 30 years, stated that past use of the woods has included hogs (about 125 head), some cattle, hunters, and mushroom collectors. Walnut over 12-inches diameter breast height (DBH), large sweet gum and burr oak, yellow poplar (tulip tree), and "dead" trees were removed in former years. The Works Progress Administration cleaned out along the creek. Mr. Esarey felt that the woods were thicker now than in earlier times, when they could drive a team and wagon through to feed the hogs.

The vegetation and environment along the Wabash have been described by Lindsey, et al. (1961). The climate is continental, typical of southeastern Illinois. Soils are described in the Wabash County Soil Survey (1964). Soils recognized include Beaucoup silt loam, Allison silty clay loam, Wakeland silt loam, and Birds silt loam primarily on the floodplain. Limited sandstone bluffs or steep banks occur along portions of Coffee Creek. About a half-dozen ravines with banks up to 50 feet high and lengths of several hundred feet are locally entrenched into the upland, which lies between the 400- and the 450-

foot contours. Soils shown on the Soil Survey for the upland include extensions of those from the lower areas and Hickory loam, Marissa silt loam, Roby fine sandy loam, Iona silt loam, and Alford silt loam. The boundaries for these soils do not correspond to the vegetational units recognized later in the paper, which tend to be related more closely to topographic position. Detailed soil types for alluvial soils have been recognized in other areas not to correspond closely to vegetation types.

PROCEDURE

Preliminary trips were made to the forest in the summer and fall of 1962 with several foresters and botanists. A preliminary species list was prepared based on sight records and a few herbarium specimens of unusual species. Numerous diameter and a few height measurements showed clearly that the trees of this forest were indeed exceptional in size. These data were in agreement with records from timber cruises carried out in the Division of Forestry, Illinois Department of Conservation, by Richard Thom in 1951 and by H. F. Siemert in 1962.

Stereo photointerpretation of U. S. Department of Agriculture aerial photographs, 1952 series, by Malchus B. Baker, Jr., then a student in the Forestry Department, Southern Illinois University, revealed 13 areas with identifiable characteristics and reasonable internal homogeneity. Occasional visits were made by W. C. Ashby, and 20 visits were made by J. E. Ozment during the growing season of 1963, averaging one per week in April, May, and June, and then approximately one each two weeks up to October. The forested areas were systematically covered with attention to phenology, vegetation types, and species present. Herbarium specimens were collected, pressed, identified, and deposited in the herbarium of the Botany Department, Southern Illinois University, Carbondale. Point samples were taken with a wedge prism to give basal areas and species composition. Geographic localization of vegetation types was sketched on an enlarged portion of the

Keensburg Quadrangle, U. S. Geological Survey, which included Beall's Woods. Although there was a broad correspondence of areas delineated on the aerial photographs and the types observed in the ground survey, successive refinement of types resulted in a closer correspondence to topographic features than was initially sketched.

RESULTS

Moist higher ground had a flower display from April to May of yellow fumewort, violets, bloodroot, Dutchman's breeches, and toothwort. As the spring flood waters retreated in late April, first spring cress and then swamp buttercup were conspicuous flowering in the bottoms. In May the upland spring herbs disappeared, while a heavy herbaceous cover developed in the bottomland, characterized by single-species dominance of local areas. Aster species, and flowering butterweed (*Senecio*) were important, as was poison ivy. During June and July the creek would flood up several feet following rains. Some large trees on the floodplains were found uprooted during these periods. Down timber had also been observed on the upland in early spring. New herbs were observed flowering in September with progressive drying of the creek beds.

The complete listing of all species recorded is presented by growth form and by family in the species list (*Table 1*). In number of species, there were 60 trees, 15 shrubs, 22 vines, 5 ferns, and 238 herbs, or a total of 340 species on less than one-half a square mile. A number of tree species characteristic of the Mississippi River bottomlands further south but not usual for this latitude ($38^{\circ}22'$) in Illinois were

TABLE 1.—Species List of Vascular Plants Collected from Beall's Woods, Wabash County, Illinois 1962-1964.

TREES

Aceraceae

- Acer negundo* Boxelder
A. rubrum Red maple
A. saccharinum Silver maple
A. saccharum Sugar maple

Annonaceae

- Asimina triloba* Pawpaw

Cornaceae

- Cornus florida* Flowering dogwood

Corylaceae

- Betula nigra* River birch
*Carpinus caroliniana** Blue beech
 or Hornbeam
Ostrya virginiana Ironwood or hop-hornbeam

Ebenaceae

- Diospyros virginiana* Persimmon

Fagaceae

- Fagus grandifolia** Beech
Quercus alba White oak
Q. bicolor Swamp white oak
Q. falcata var. *pagodaefolia* Cherry-bark oak
Q. imbricaria Shingle oak
Q. lyrata Overcup oak
Q. macrocarpa Burr oak
Quercus michauxii Basket oak
Q. muhlenbergii Chinquapin oak
Q. palustris Pin oak
Q. rubra Red oak
Q. shumardii Shumard's red oak
Q. stellata Post oak
Q. velutina Black oak

Hamamelidaceae

- Liquidambar styraciflua* Sweetgum

Juglandaceae

- Carya cordiformis* Bitternut hickory
C. glabra Pignut hickory
C. illinoensis Pecan
C. laciniata Shellbark hickory
C. ovalis Small-fruited hickory
C. ovata Shagbark hickory
C. tomentosa Mockernut hickory
Juglans nigra Black walnut

Lauraceae

- Sassafras albidum* Sassafras

Leguminosae

- Cercis canadensis* Redbud
Gleditsia tricanthos Honey locust
Gymnocladus dioica Kentucky coffee tree

Magnoliaceae

- Liriodendron tulipifera* Tulip tree
 (Yellow poplar)

Moraceae

- Morus alba** White mulberry
M. rubra Red Mulberry

Nyssaceae

- Nyssa sylvatica* Black gum

Oleaceae

- Fraxinus americana* White ash
F. pennsylvanica Red ash
F. p. var. *subintegerrima* Green ash

Platanaceae

- Plantanus occidentalis* Sycamore

Rosaceae

- Crataegus crus-galli* Cockspur-thorn
C. mollis Hawthorn
Prunus americana var. *lanata* Wild plum
*P. persica** Peach
P. serotina Wild black cherry
Pyrus angustifolia Wild crab-apple

Salicaceae

- Populus deltoides* Cottonwood
Salix lucida Shining willow
S. nigra Black willow

Simaroubaceae

- Ailanthus altissima** Tree-of-heaven

Tiliaceae

- Tilia americana* Basswood

Ulmaceae

- Celtis laevigata* Sugarberry
C. occidentalis Hackberry
Ulmus americana American elm
U. rubra Slippery elm

SHRUBS

Anacardiaceae

- Rhus glabra* Smooth sumac
R. radicans Poison ivy—also listed as a vine

Aquifoliaceae

- Ilex decidua* Deciduous holly

Caprifoliaceae

- Sambucus canadensis* Elderberry
Symphoricarpos orbiculatus Coralberry

Celastraceae

- Euonymus atropurpureus* Wahoo

Cornaceae

- Cornus drummondii* Rough-leaved dogwood

Corylaceae

- Corylus americana* Hazelnut

Lauraceae

- Lindera benzoin* Spicebush

Rosaceae

- Rosa setigera* Climbing rose
Rubus allegheniensis Allegheny blackberry

*Almost or entirely restricted to soil above sandstone outcrops.

*Mostly introduced species occurring in a few disturbed areas—field edge, etc.

- R. alumnus*
 Rubiaceae
Cephalanthus occidentalis Button-
 bush
 Saxifragaceae
Hydrangea arborescens Wild hy-
 drangea
 Staphyleaceae
Staphylea trifolia Bladdernut

VINES

- Anacardiaceae
Rhus radicans Poison ivy
 Bignoniaceae
Bignonia capreolata Crossvine
Campsis radicans Trumpet creeper
 Caprifoliaceae
Lonicera japonica Japanese honey
 suckle
 Convolvulaceae
Cuscuta coryli Dodder
C. polygonorum
Ipomoea lacunosa Small-flowered
 morning glory
 Cucurbitaceae
Sicyos angulatus Bur cucumber
 Dioscoraceae
Dioscorea villosa Wild yam
 Liliaceae
Smilax lasioneura Carrion flower
S. pulverulenta
S. rotundifolia Common greenbrier
S. tamnoides var. *hispida* Bristly
 greenbrier
 Menispermaceae
Menispermum canadense Moon-
 seed
 Passifloraceae
Passiflora lutea Passion flower
 Polygonaceae
Polygonum convolvulus Black bind-
 weed
P. scandens Climbing false buck-
 wheat
 Ranunculaceae
Clematis virginiana Virgin's bower
 Vitaceae
Parthenocissus quinquefolia Virgin-
 ia creeper
Vitis cinerea Pigeon grape
V. riparia River-bank grape
V. vulpina Frost grape

FERNS AND FERN ALLIES

- Equisetaceae
Equisetum hyemale Tall scouring
 rush
 Ophioglossaceae
Botrychium virginianum Rattle-
 snake fern

- Polypodiaceae
Cystopteris fragilis Fragile fern
Dryopteris hexagonoptera Broad
 beech fern
Polystichum acrostichoides Christ-
 mas fern

HERBS

- Acanthaceae
Ruellia strepens Wild petunia
 Amaranthaceae
Amaranthus hybridus⁺ Pigweed
Iresine rhizomatosa Bloodleaf
 Amaryllidaceae
Hypoxis hirsuta⁺ Yellow star grass
 Araceae
Arisaema dracontium Green drag-
 on
A. triphyllum Jack-in-the-pulpit
 Araliaceae
Panax quinquefolius Ginseng
 Aristolochiaceae
Aristolochia serpentaria Virginia
 snakeroot
Asarum canadense var. *reflexum*
 Wild ginger
 Asclepiadaceae
Asclepias exaltata Poke milkweed
A. perennis
 Balsaminaceae
Impatiens capensis Spotted touch-
 me-not
I. pallida Pale touch-me-not
 Berberidaceae
Podophyllum peltatum Mayapple
 Boraginaceae
Hackelia virginiana Stickseed
 Campanulaceae
Campanula americana Tall bell-
 flower
Lobelia inflata Indian tobacco
Specularia perfoliata Venus's look-
 ing-glass
 Caryophyllaceae
Paronychia canadensis Forked
 chickweed
P. fastigiata
Silene stellata Starry campion
Stellaria longifolia Starwort
 Chenopodiaceae
Atriplex patula⁺
Chenopodium album⁺ Lamb's quar-
 ters
C. boscianum
 Commelinaceae
Commelina diffusa Dayflower
C. virginica
Tradescantia subaspera Spiderwort
 Compositae
Achillea millefolium⁺ Common yar-
 row

- Actinomeris alternifolia* Wingstem
Ambrosia artemisiifolia Common ragweed
A. trifida Giant ragweed
Arctium minus⁺ Common burdock
Artemisia annua⁺ Annual Wormwood
Aster ericoides
A. lateriflorus
A. ontarionis
A. pilosus
A. simplex
Bidens bipinnata Spanish needles
B. frondosa Beggar ticks
Bidens polylepis
B. vulgaris
Eclipta alba Yerba-de-tago
Elephantopus carolinianus Elephant's foot
Erigeron annuus Daisy fleabane
E. canadensis Horsetweed
E. philadelphicus
Eupatorium coelestinum Mistflower
E. purpureum Joe Pye weed
E. rugosum White snakeroot
E. serotinum Late boneset
Lactuca canadensis Common wild lettuce
L. floridana Blue wild lettuce
Prenanthes altissima Rattlesnake root
Rudbeckia laciniata Golden glow
R. subtomentosa Fragrant coneflower
R. triloba Brown-eyed Susan
Senecio aureus Golden ragwort
S. glabellus Butterweed
Solidago altissima Tall goldenrod
S. caesia Blue-stemmed goldenrod
S. gigantea Late goldenrod
S. ulmifolia Elm-leaved goldenrod
Taraxacum officinale⁺ Dandelion
Vernonia altissima. Ironweed
V. missurica
Xanthium italicum Cocklebur
- Crassulaceae
Sedum ternatum^{*} Three-leaved stonecrop
- Cruciferae
Arabis laevigata Smooth rockcress
Barbarea vulgaris⁺ Common wintercress
Cardamine bulbosa Spring cress
Dentaria laciniata Toothwort
Iodanthus pinnatifidus Purple rocket
- Cyperaceae
Carex abscondita
C. bushii
C. cephalophora
- C. cristatella*
C. grayii
C. hitchcockiana
C. jamesii
C. laxiflora
C. louisianica
C. muhlenbergii
C. muskingumensis
C. nigromarginata
C. normalis
C. oligocarpa
C. rosea
C. scoparia
C. shortiana
C. sparganioides
C. squarrosa
C. tetanica
C. umbellata
Eleocharis obtusa Spike rush
Scirpus atrovirens Bulrush
S. lineatus
- Euphorbiaceae
Acalypha rhomboidea Three-seeded mercury
A. virginica
Euphorbia humistrata
E. maculata Nodding spurge
E. supina Milk spurge
- Geraniaceae
Geranium carolinianum Carolina cranesbill
- Gramineae
Agrostis hyemalis Tickle grass
Andropogon virginicus Broomsedge
Bromus racemosus⁺
Cinna arundinacea Wood reedgrass
Danthonia spicata Poverty grass
Digitaria sanguinalis⁺ Crabgrass
Echinochloa crusgalli⁺ Barnyard grass
E. walteri
Elymus canadensis Nodding wild rye
E. virginicus
Festuca obtusa
Hordeum pusillum Small wild barley
Leersia virginica White grass
Muhlenbergia frondosa
Panicum capillare
P. dichotomiflorum
P. lanuginosum var. *fasciculatum*
P. nitidum
P. oligosanthes
Paspalum pubiflorum
Phleum pratense⁺ Timothy
Poa compressa⁺ Canada bluegrass
P. pratensis Kentucky bluegrass
P. sylvestris
Setaria viridis⁺ Green foxtail
Sphenopholis intermedia
S. nitida

Guttiferae

Ascyrum hypericoides St. Andrew's cross

Hypericum punctatum Spotted St. John's-wort

H. tubulosum var. *walteri*

Hydrophyllaceae

Hydrophyllum appendiculatum Waterleaf

Juncaceae

Juncus tenuis Rush

*Luzula bulbosa** Woodrush

Labiatae

Agastache nepetoides Horsemint

Blephilia hirsuta Wood mint

Hedeoma pulegioides Pennyroyal

Lycopus rubellus Water horehound

Prunella vulgaris Selfheal

Pycnanthemum flexuosum Mountain mint

Scutellaria lateriflora Skullcap

S. nervosa

S. ovata

Stachys tenifolia Common hedge-nettle

Teucrium canadense Wood sage

Leguminosae

Desmodium glabellum Tick trefoil

D. nudiflorum

D. pauciflorum

*Lespedeza hirta** Bush clover

*L. violacea**

*L. virginica**

Liliaceae

Allium canadense Wild onion

Erythronium albidum White trout lily

Polygonatum canaliculatum Solomon's seal

Smilacina racemosa False Solomon's seal

Trillium flexipes White trillium

T. recurvatum Resurved wakerobin

Lythraceae

Ammannia coccinea

Cuphea petiolata Waxweed

Rotala ramosior Tooth cup

Onagraceae

Circaea quadrisulcata Enchanter's nightshade

Oenothera biennis Evening primrose

Orchidaceae

Corallorhiza wisteriana Wister's coral-root orchid

Liparis lilifolia Twayblade orchid

Oxalidaceae

Oxalis europaea Common wood sorrel

O. stricta Yellow wood sorrel

O. violacea Violet wood sorrel

Papaveraceae

Corydalis flavula Yellow fumewort

Dicentra cucullaria Dutchman's breeches

Sanguinaria canadensis Bloodroot

Phrymaceae

Phryma leptostachya Lopseed

Phytolaccaceae

Phytolacca americana Pokeweed

Plantaginaceae

Plantago rugelii Common plantain

Polemoniaceae

Phlox divaricata Blue phlox

P. paniculata Panicked phlox

Polemonium reptans Jacob's ladder

Polygonaceae

Polygonum hydropiper Common smartweed

P. pennsylvanicum Smartweed

P. punctatum Water smartweed

Rumex altissimus Pale dock

*R. obtusifolius** Bitter dock

Tovara virginiana Virginia knotweed

Portulacaceae

Claytonia virginica Spring beauty

Primulaceae

*Anagallis arvensis** Scarlet pimpernel

Lysimachia lanceolata Narrow-leaved loosestrife

*L. nummularia** Moneywort

Samolus parviflorus Brookweed

Ranunculaceae

Delphinium tricorne Wild larkspur

Hydrastis canadensis Goldenseal

Myosurus minimus Mousetail

Ranunculus abortivus Kidney-leaf buttercup

R. recurvatus

R. septentrionalis Swamp buttercup

Thalictrum dioicum Early meadow-rue

Rosaceae

Agrimonia pubescens Agrimony

A. rostellata

Aruncus dioicus Goat's beard

Geum canadense White avens

G. vernum Spring avens

G. virginianum

Rubiaceae

Diodia teres Rough buttonweed

Galium aparine Goosegrass

G. circaezans Wild licorice

Galium concinnum Bedstraw

G. obtusum

G. triflorum Sweet-scented bedstraw

Houstonia purpurea

Spermacoce glabra Smooth buttonweed

Saururaceae

<i>Saururus cernuus</i> Lizard's tail	<i>Erigenia bulbosa</i> Harbinger of spring
Scrophulariaceae	<i>Osmorhiza claytoni</i> Sweet cicely
<i>Chelone obliqua</i> Turtlehead	<i>Sanicula canadensis</i> Black snake-root
<i>Gerardia flava</i> False foxglove	<i>S. gregaria</i>
<i>G. tenuifolia</i>	Urticaceae
<i>Gratiola neglecta</i> Hedge hyssop	<i>Boehmeria cylindrica</i> False nettle
<i>Mimulus alatus</i> Monkey flower	<i>Laportea canadensis</i> Wood nettle
<i>Penstemon digitalis</i> Beard tongue	<i>Parietaria pensylvanica</i> Pellitory
<i>Scrophularia marilandica</i> Figwort	<i>Pilea pumila</i> Clearweed
<i>Seymeria macrophylla</i> Mullein fox-glove	Verbenaceae
<i>Verbascum blattaria</i> ⁺ Moth mullein	<i>Verbena urticifolia</i> White vervain
<i>V. thapsus</i> ⁺ Common mullein	Violaceae
Solanaceae	<i>Viola kitaibeliana</i> var. <i>rafinesquii</i> ⁺
<i>Physalis pubescens</i> Groundcherry	Field pansy
<i>P. subglabrata</i>	<i>V. papilionacea</i> Blue violet
Umbelliferae	<i>V. pensylvanica</i> Smooth yellow violet
<i>Chaerophyllum tainturieri</i>	
<i>Cryptotaenia canadensis</i> Honewort	

found. These species included persimmon, overcup oak, basket oak, Shumard's red oak, cherrybark oak, sweet gum, and sugarberry. The spring-flowering herbs would not be unusually rich by comparison to areas in northern Indiana or southern Illinois. This may be related to heavy previous use of the woods by mushroom hunters and other visitors, and by livestock.

In *Figure 1* is shown the listing of vegetation types and their distribution related to the general topography of the area. White oak was the predominant tree on the upland. Trees over three feet DBH were not unusual. Associated black oaks attained equal sizes. Shagbark, pig-nut, and small-fruited hickories were the more usual species on the upland. Variants in the apparently moist zones of the relatively flat uplands were areas with tulip tree and with sugar maple. Previous cutting of the tulip tree seems a reasonable explanation for their scarcity when trees 2½ to 3 feet DBH were locally present. The scattered large sugar maples seemed unusually low in

number, considering the size attained by a few, to 40 inches DBH.

The slope to the west of the lower portion of the creek has a red oak-basswood type which is commonly found on relatively steep slopes above streams in northern and central Illinois. Basswood was reproducing vigorously with many head-high saplings present. This contrasts to the southern part of Illinois where basswood is virtually absent and a red oak-beech-black gum type may be found on such slopes. At their steepest the forested slopes rose at an angle of about 30 degrees. The lower part of the southernmost ravine is still steeper, severely eroded, and bare. Cattle trails were evident in the forest which lies above this ravine and south of the 450-foot contour, next to a cultivated field.

To the north of the red oak-basswood type ledges of layered sandstone bound the floodplain along the western margin of the midsection of Coffee Creek. The vegetation above the sandstone ledges is unique for the study area. Essentially none of the spring flowers mentioned above

were present. Moss and lichens, including *Cladonia*, were evident, growing among broomsedge, poverty grass, sedges, lespedezas, and false foxglove. Black oak, of smaller stature than in other parts of the upland, was important locally. Ironwood was present at the top of the ledges. A somewhat unusual ecological feature was that a few relatively small canopy beeches were found here, and beech was essen-

tially absent from other areas. Hornbeam had a similar distribution.

The vegetation on the areas lying below the 400-foot contour was divided into four additional forest types. That closest to the creek, occupying the floodplain at approximately the 380-foot contour, was characterized by large trees. Silver maple, pecan, and sycamore were conspicuous, with local basket oak. Scattered river birch and cotton-

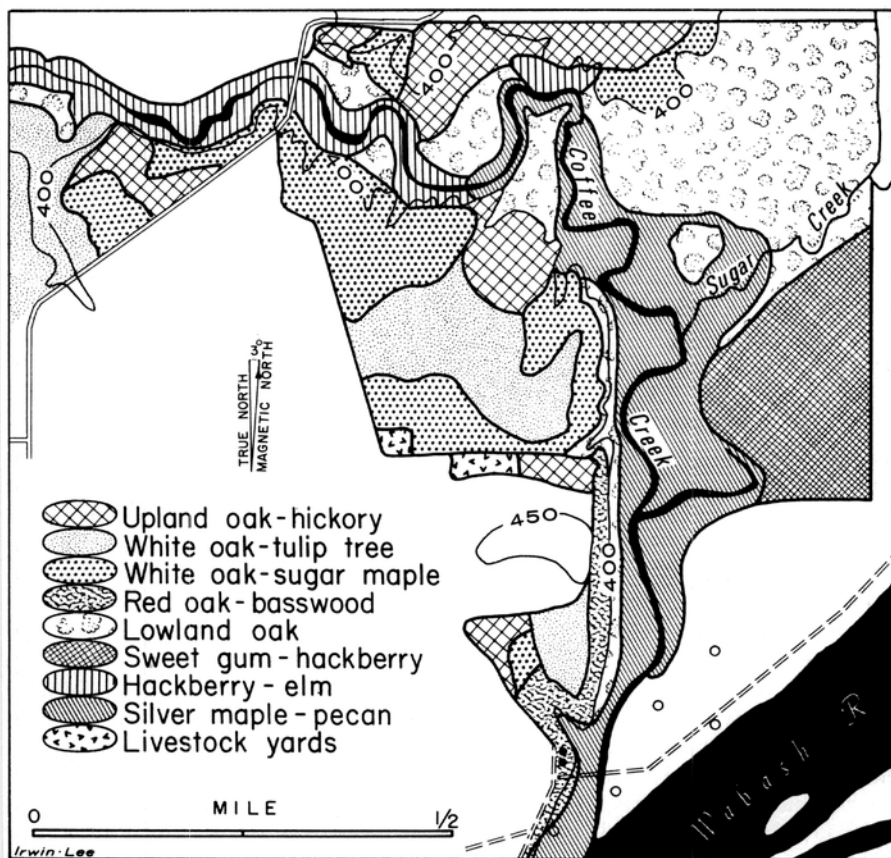


FIGURE 1.—Forest Type Map, Beall's Woods, Wabash County, Illinois. Vegetation types by James E. Ozment, 1963, drawn on Keensburg Quadrangle, U.S. Geological Survey. Prepared by Cartographic Laboratory, Southern Illinois University, Carbondale.

wood were found. In the southeastern area, lying only slightly higher in elevation, large trees, to four feet DBH, of sweet gum were important. Hackberry was relatively common in this area. The lowland oak type was important in several parts of the floodplain extending from roughly the 385-foot contour to about the 400-foot contour where it intergraded with the other oak types. The lower-lying areas had trees of the previously listed floodplain types with oil marks visible on the trunks more than head high. An approximate gradient of oak species in relation to decreasing amounts of flooding would be pin oak-burr and swamp white oak-cherrybark and Shumard's red oak. Individuals of pin, burr, and Shumard over four feet DBH, and of the others over three feet DBH were found or have been reported. Shellbark hickory is found locally in this type.

Adjacent to Coffee Creek above the 380-foot contour in the narrower valley of its upper reaches was a hackberry-elm type. All types to the west of the road and bridge, both upland and lowland, were much less grand in size of tree and appeared to be more disturbed than the main body of the forest.

Lindsey (1962) reported 31 tree species on the floodplain with a stand density of 114 trees per acre and a stand basal area of 199 square feet per acre. The equivalent values for the upland forest were 31 species with 115 trees per acre and 152 square feet basal area. He also listed the largest individuals encountered for several species in his sample units and tabulated the size classes

of the several species. The sizes determined in the present study generally agreed with those of Lindsey. Distinctly larger individuals found were sycamore, 65 inches DBH and pin oak 52 inches DBH. A Haga altimeter reading of this oak gave a height of 115 feet. Large trees of additional species were honey locust, 55 inches; Kentucky coffee tree, 29 inches; tulip tree, 38 inches (not a highly unusual size for this species in southern Illinois); cherrybark oak, 34 inches; shingle oak, 32 inches; overcup oak, 46 inches; and red oak, 47 inches DBH.

The several forest types mapped are based on estimates of floristic composition of tree species, ecological structure of the communities, topographic (habitat) relationships, and to a slight extent physiognomy. They are subjective segregates which have been described to represent the nature and variation of the present forest cover subject and not subject to the several consequences of flooding in the areas adjacent to the lower Wabash River. Sharp boundary lines are not evident. A continuum analysis of floristic composition and a gradient analysis of environmental factors would seem appropriate to the areas. The forces making for stability and for change in the forest composition have yet to be delineated. Windthrow was evident in the present study. The relatively small size of the remnant stand and the change of ecological relationships through predator control, earlier livestock, and other human activities suggest that the forest may be altered in some respects over time. The favorable combination of climate, soil, and highly

adapted tree species should sustain a forest of exceptional vigor and size for the predictable future.

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species in the adjacent state-owned cultivated fields.

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